Vector-borne Disease Report, Napa County 2003-2015
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Napa County Human Case History
Vector-borne Disease

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Arenavirus	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Hantavirus	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lyme Disease	**0**	**1**	**1**	**0**	**3**	**2**	**3**	**0**	**0**	**3**	**1**	**2**	**3**
Tularemia	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**
Colorado Tick Fever	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Malaria	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Dengue Fever	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**0**
West Nile Virus	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1***
Saint Louis Encephalitis	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Western Equine Encephalitis	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Includes confirmed and probable cases *asymptomatic blood donor

Vector-borne Disease Surveillance Summary
Napa County 2004-2015

Mosquito-borne Disease

The Napa Mosquito Abatement District conducts comprehensive mosquito-borne disease surveillance on an annual basis. This surveillance includes testing for West Nile Virus (WNV), Saint Louis Encephalitis (SLE), and Western Equine Encephalitis (WEE). Various mechanisms are used in order to detect these viruses that include sentinel chicken serological, mosquito, and dead bird testing. Surveillance for mosquito-borne disease typically begins in May, continues through the peak mosquito season, and ends in October. The following chart are summarizes the surveillance data from 2004 through 2015; there has not been any detection of SLE or WEE during this period.

WNV Positives 2004-2015

	Human	Bird	Squirrel	Chicken Pos/tested	Mosquito pools Pos/tested	Total mosquitoes tested	Horses
2004	0	6	0	0/834	0	0	0
2005	0	43	1	2/695 AC/C	0	0	0
2006	1 Cal	8	0	0/420	0/11	394	0

2007	1 Napa	2	0	0/390	0/109	4359	0
2008	0	1	0	0/390	0/117	5099	0
2009	0	0	0	3/390 SH	0/37	1273	0
2010	1 Napa	0	0	0/390	0/45	1334	0
2011**	0	0	0	N/A	0/237	10554	0
2012**	0	1	0	N/A	1/139 C	3257	0
2013**	1	2	0	N/A	0/141	2401	0
2014	0	12	0	0/130	0/117	3108	N/A
2015**	1* Cal	7	0	N/A	0/214	4543	N/A

*asymptomatic blood donor case ** no sentinel chicken sera tested, Cal=Calistoga, AC=American Canyon, C=Carneros, SH=Saint Helena

The District also participates in the dead bird reporting program conducted by the California Department of Public Health. This information used to be analyzed using a predictive model, Dynamic Continuous – Area Space Time System (DYCAST) in an effort to predict human disease risk in a given area. The use of DYCAST has been discontinued; however, dead birds are still reported to the dead bird hotline in the same manner.

Napa County Dead Bird Reporting 2004-2015

	Reported	**Tested**	**Positive**
2004	37	19	6
2005	472	133	43
2006	237	46	8
2007	140	12	2
2008	89	4	1
2009	92	6	0
2010	23	1	0
2011	28	1	0
2012	82	9	1
2013	60	4	2
2014	115	12	12
2015	77	10	7

Introduced mosquitoes *Aedes aegypti* and *Aedes albopictus*

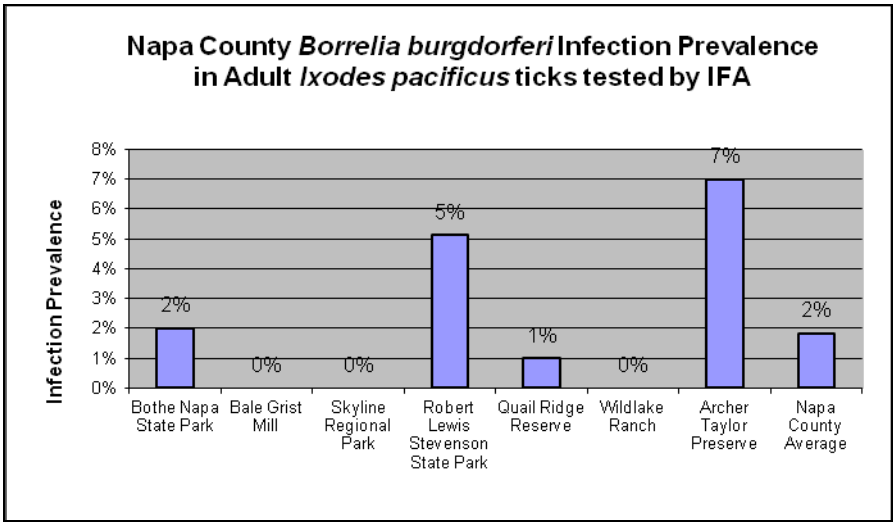
California is now home to two newly introduced mosquito species, initially detected in southern California and the central valley; these species have now been detected in 12 counties throughout the state. Although most of the distribution is in Southern California, the District began conducting preemptive surveillance for these two container breeding mosquitoes in 2015. The surveillance consists of "Ovicup" placement, which are specific egg laying containers that would be attractive to these invasive species. Ovicups are placed throughout the county in areas where we think these mosquitoes may be initially detected. These species are responsible for the transmission of dengue fever, yellow fever, chikungunya, and Zika virus that is so prominent in the news lately.

Tick-borne Disease

Borrelia burgdorferi

The Napa Mosquito Abatement District routinely conducts surveillance for *Ixodes pacificus*, the Western black-legged tick; these ticks are periodically tested for the presence of *Borrelia burgdorferi*, the causative agent of Lyme disease. The surveillance involves collection of ticks from areas where the public is at greater risk of exposure such as State and County parks, along popular hiking trails. During the early years of surveillance, ticks were tested using an Immunoflourescent assay (IFA), this test detects the actual bacterium that resides in the tick midgut. Ticks are now tested using the polymerase chain reaction (PCR) which detects the DNA of the bacteria, a method that is much more sensitive and specific than the IFA. The PCR test has been conducted in Dr. Janet Foley's lab at UC Davis and more commonly at the California Department of Public Health lab in Richmond.

The following chart indicates *Borrelia burgdorferi* infection prevalence amongst adult Western black-legged ticks collected in Napa County and tested by IFA.



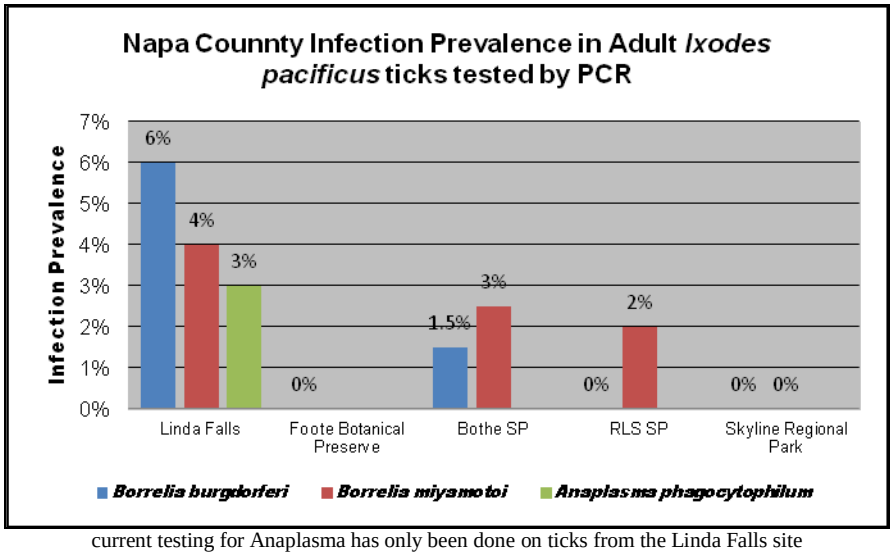
Anaplasma phagocytophilum

A single tick collected at the Linda Falls site in Angwin that was tested at Dr. Janey Foley's lab and was found positive for *Borrelia burgdorferi* was also co-infected with *Anaplasma phagocytophilum*, the causative agent of Anaplasmosis. Testing for this organism has only been done once on a small collection of ticks tested at Dr. Foleys lab. Anaplasmosis is another tick-borne disease with rather non-specific flu like symptoms that occur 1-2 weeks after the bite of an infected Western black-legged tick; it is not as common in California as Lyme disease and is treated with antibiotics.

Borrelia miyamotoi

This tick-borne pathogen has recently been found to cause human illness in the United States. The tick vector in California is also the Western black-legged tick and symptoms are very similar to Lyme disease including joint and muscle pain. Treatment with the same antibiotics is thought to be effective. The pathogen has been detected in the ticks collected from a few areas within Napa County and is being found to have even higher infection prevalence than the closely related Lyme disease bacterium in some instances. Our surveillance and testing for this pathogen is fairly new and the District intends to focus increased attention on its detection now that we are aware of its disease causing potential and testing has become available.

The following chart indicates *Borrelia burgdorferi. Borrelia miyamotoi and Anaplasma phogocytopilum* infection prevalence amongst adult Western black-legged ticks collected in Napa County and tested by PCR.



current testing for Anaplasma has only been done on ticks from the Linda Falls site

Tularemia

American Canyon Human Case History

A 48 year-old male resident of American Canyon presented to John Muir Medical Center, Walnut Creek, on July 12, 2010, with chief complaint of left eye pain. The patient stated that he first noted onset of redness and pain on July 9. He reported a slight decrease in visual acuity but denied photophobia (light sensitivity). He also reported fever and night sweats for two nights prior to his visit.

A conjunctival swab obtained on July 12 was submitted to the hospital lab for microbiologic evaluation. On July 17, the lab reported identification of the culture as probable *Francisella tularensis* and forwarded the isolate to the Contra Costa Public Health Lab. On July 20 the PHL confirmed *F. tularensis* by PCR.

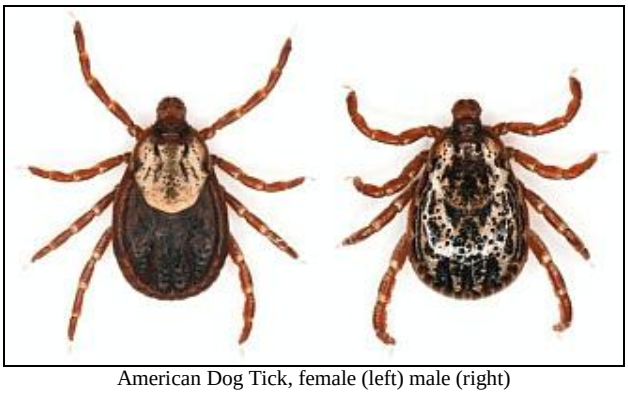
The patient reported no travel outside the U.S. in the preceding six months. The patient stated that he frequently walked his dogs around the "wetlands" near his home. He also reported

noting a tick bite on his arm approximately 10 days prior to onset of illness and another tick bite on his abdomen approximately 3 days prior to onset. The patient reported frequently noting ticks on his dogs as well.

Tick Vector Surveillance Response

The California Department of Public Health and Napa County Mosquito Abatement District conducted surveillance for the probable vector tick along Wetlands Edge on either side of the American Canyon Corporate yard. A total of 97 *Dermacentor variabilis*, the American Dog Tick, and 23 *Rhipicephalus sanguineus*, the Brown Dog Tick, were collected using standard tick flagging methods along the Wetlands Edge marsh area adjacent to the sidewalk where residents frequently walk their dogs.

The ticks were pooled and submitted to Dr. Peterson's lab at the Centers for Disease Control where they were tested for the presence of *Francisella tularensis*. Three pools of the American Dog Tick were found to be positive for *F. tularensis* (minimum infection rate = 3.1%) none of the Brown Dog Tick pools were found to be positive.

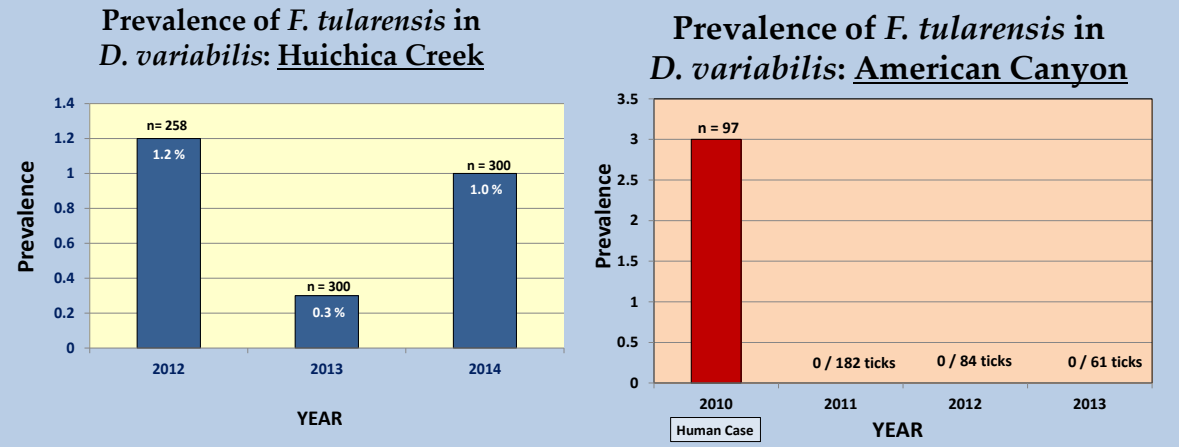


American Dog Tick, female (left) male (right)
http://www.ento.okstate.edu/ddd/images/americandogtick.jpg

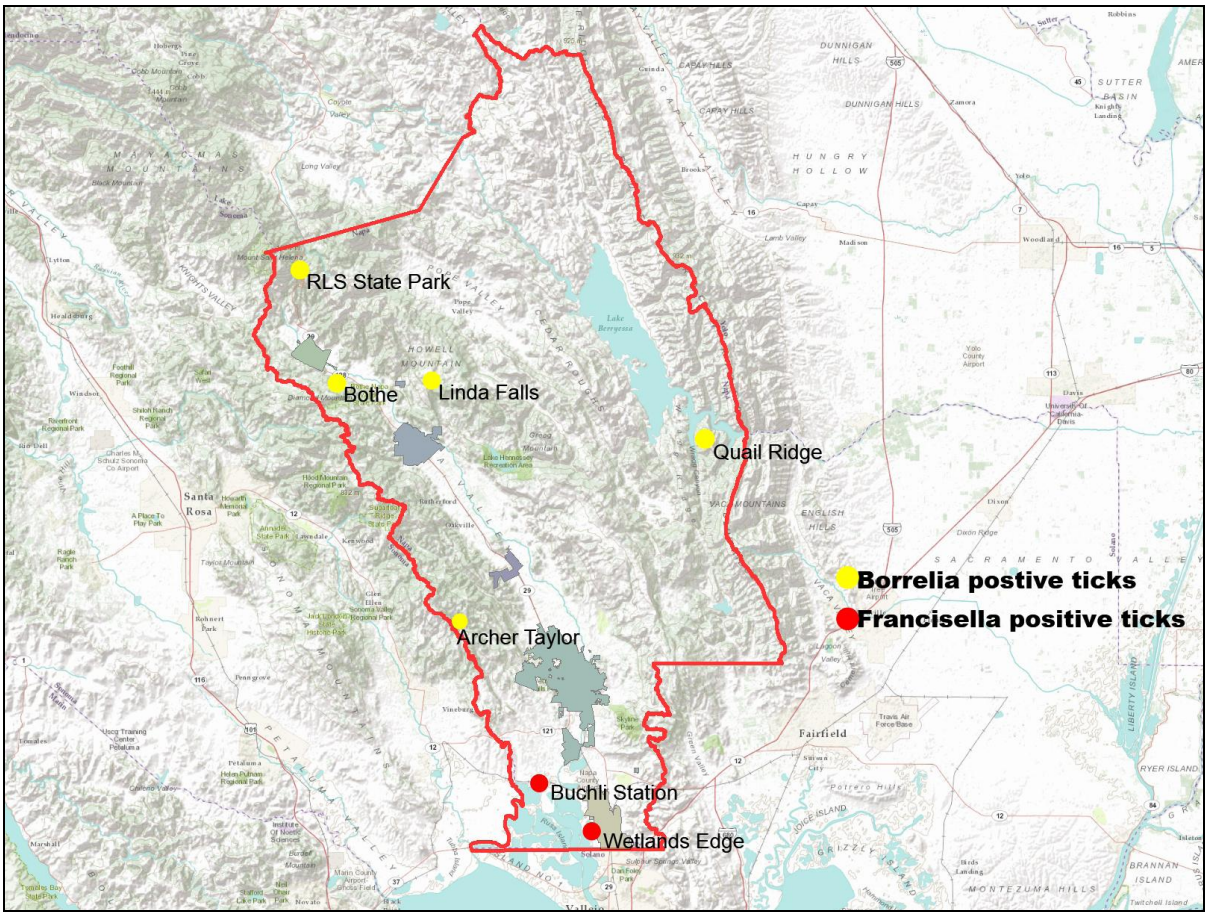
Continued Surveillance

The District and CDPH, have continued to collect and test ticks from the Wetlands Edge site in American Canyon and in 2012 added a second location where the habitat was very similar to the Wetlands Edge site in the hopes of gaining better understanding of the occurrence of *F. tularensis* in Napa County. The second location is at the Huichica Creek unit of the California Department of Fish and Wildlife in the Carneros area of Napa County.

To date, we have detected *F. tularensis* positive ticks only once at the American Canyon site during the initial response to the human case, positive ticks have been detected at the Huichica Creek site for four consecutive years. 2015 test results are still being analyzed however tentative results indicate that 3% of ticks tested positive from Huichica Creek and that no ticks tested positive from American Canyon.



The following map indicates approximate locations within Napa County where either *Borrelia* sp. or *Franciscella tularensis* positive ticks have been found:



Rodent-borne Disease

Hantavirus

The District, in cooperation with the California Department of Public Health (CDPH) conducts periodic surveillance of other vector-borne diseases in Napa County by trapping wild rodents and testing serological samples. Rodent sera has been tested for the presence of Hantavirus (Sin Nombre) antibody in 8 locations within the County, the following table is a list of all sites where Hantavirus surveillance has been conducted and positive animals found.

Napa County Hantavirus (Sin Nombre) Surveillance 2004-2015

Surveillance Location	**Positive Animals**
CDFG Huichica Creek Unit-Cabral's Dairy	8 *Peromiscus maniculatus*, 1 *Microtus californicus*
CDFG Headquarters, Yountville	No positive animals
Napa State Hospital	No positive animals
Napa Sea Ranch, Carneros	No positive animals
Mount St. Helena	No positive animals
Quail Ridge Reserve	1 *Peromiscus truei*
Bothe-Napa State Park	No positive animals
CDFW Huichica Creek Unit-Buchli Station	1 *Peromiscus maniculatus*, 1 *Microtus californicus*

Other Vertebrate Testing

In addition to the above Hantavirus surveillance, the District has also worked in collaboration with CDPH on surveillance for tularemia and plague in mammals collected at Mt. Saint Helena, all specimens were negative. Serological samples have also been submitted by Wildlife Animal Damage control trappers from the following animals in Napa County for plague testing, all negative: Racoon, Saint Helena; Two Mountain Lions, Saint Helena; Coyote, Napa; Mountain Lion, Pope Valley; Coyote, Pope Valley. In addition to the above, ten feral pigs from Napa have been tested for tularemia, all negative.