

# **Lyme disease And Tick Vectors In Alameda County**



## WHAT ARE TICKS?

Ticks are blood-sucking parasites of mammals, birds, and reptiles. In the class of Arachnids, they are in the same sub group of mites. Both of them have eight legs as nymphs and adults (larvae and insects are six-legged). Ticks are divided into two families: the hard tick (*Ixodidae*) and the soft tick (*Argasidae*). Both ticks can transmit diseases and cause illness in humans.

In California the America Dog Tick (*Dermacentor variabilis*), Pacific Coast Tick (*Dermacentor occidentalis*) and Western Black-legged Tick (*Ixodes pacificus*) are the three most common ticks and are all hard ticks. They are the vectors of *Tick-borne Relapsing Fever*, *Rocky Mountain Spotted Fever*, *Tularemia*, *Anaplasmosis*, *Ehrlichiosis*, *Babesiosis*, *Bartonella*, and *Lyme disease*. In addition, people and domestic animals can develop *Tick Paralysis* following a tick bite.



*Ixodes pacificus*  
Image From ACVCSD

*Ixodes pacificus*  
(Western Black-legged Tick)  
the only known vector of Lyme  
disease in California.



*Dermacentor variabilis*  
Image From ACVCSD

*Dermacentor variabilis*  
(American Dog Tick) is a  
known vector of Rocky Mountain  
Spotted Fever, Tularemia  
and Relapsing Fever



*Dermacentor occidentalis*  
Image From ACVCSD

*Dermacentor occidentalis*  
(Pacific Coast Tick) is a known  
vector of Rocky Mountain  
Spotted Fever, Relapsing  
Fever and Tularemia.

### Three "Hard" Ticks Commonly Found in Alameda County

## TICK-BORNE DISEASES DETECTED IN CALIFORNIA

- ☐ Lyme disease (*Borrelia burgdorferi*)
- ☐ Rocky Mountain Spotted Fever (*Rickettsia rickettsii*)
- ☐ Anaplasmosis (*Anaplasma phagocytophilum*)
- ☐ Ehrlichiosis (*Ehrlichia chaffeensis*)
- ☐ Babesiosis (*Babesia duncani*)
- ☐ Bartonella (*Bartonella spp.*)
- ☐ Colorado Tick Fever (Colorado tick fever virus)
- ☐ Tularemia (*Francisella tularensis*)
- ☐ Relapsing Fever (*Borrelia hermsii*)
- ☐ Tick Paralysis (toxin)



## LYME DISEASE

Lyme disease is the most reported vector-borne disease in the United States (see table on page 10). In 2009, the Center for Disease Control and Prevention (CDC) reported 29,959 cases of Lyme disease – a far greater number than the 720 reported West Nile virus (WNV) cases, the second highest. For this reason, this pamphlet will focus on Lyme disease and Western Black-legged Tick (*Ixodes pacificus*), the vector in California and Alameda County.

Lyme disease is a potentially debilitating infection transmitted to humans and other animals by *Ixodes* ticks. The disease is caused by a spirochete, *Borrelia burgdorferi*, a corkscrew-shaped bacterium. Of the 48 tick species found in California, the Western Black-legged Tick (*Ixodes pacificus*) is the only known tick thought to be responsible for transmitting the spirochete to people. On average, only about 1 to 2% of the adult *I. pacificus* ticks and 2-15% of the nymphs are infected in California. However, in one woodland site in Mendocino County, 41% of the nymphs were found to contain Lyme disease spirochetes. In Alameda County, our surveillance has shown a 3.4% average infection rate in adult ticks—with a range of 1-7.7%, and a 5.9% infection rate in nymphal ticks—with a range of 1.7-11%.

**Reported Lyme disease Cases by County of Residence, California 1998-2009**

County	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Alameda	6	3	4	3	5	1	0	5	3	2	6	1
Contra Costa	2	1	1	5	3	4	0	4	1	0	1	0
Marin	8	4	3	1	4	4	0	1	7	2	2	3
Mendocino	16	8	7	4	11	6	2	0	0	5	11	7
Napa	0	2	2	3	3	0	1	1	0	3	0	2
San Francisco	7	1	2	3	3	3	1	7	5	5	4	1
San Mateo	4	4	2	4	4	5	1	4	2	0	2	11
Santa Clara	6	2	2	2	6	4	0	2	9	2	0	2
Santa Cruz	2	2	5	9	1	8	3	0	6	5	2	5
Sonoma	15	14	8	6	4	9	2	9	8	8	10	10

(Modified excerpt of our local Counties from the California Department of Public Health Vector-Borne Disease Section Annual Report 2008 and 2009 )

## HOW DO TICKS BECOME INFECTED WITH DISEASE?

The pathogens that cause tick-borne diseases, such as *Lyme disease* are maintained in reservoir hosts, on which the larvae, nymphs and adult ticks feed. The larval, nymphal or adult ticks pick up the disease organisms when they feed on the blood of infected animals then drop off for molting, or egg deposition. If the tick is infected, the pathogen multiplies and passes on to the next stage. In California, the

nymphal Western Black-legged Tick (*Ixodes pacificus*) commonly feeds on cold blooded lizards. The lizard blood contains a protein that destroys Lyme spirochetes in the midgut of feeding nymphs. As such, an infected nymph can become a non-infected adult after feeding on the lizard. This is the reason why the prevalence of infection with Lyme spirochetes in the nymphal Western Black-legged Tick (*Ixodes pacificus*) (average 2-15%) usually exceeds adult tick infection (average 1-2%) in California. "*Ixodes pacificus* is the primary tick that feeds on humans in California and has the ability to transmit a variety of infectious diseases and thus is a major public health concern."

## **WESTERN BLACK-LEGGED TICKS (*Ixodes pacificus*)**

All ticks have four life stages (egg, larva, nymph and adult), except for the egg, all the other three stages need to feed on the blood of a vertebrate to develop into the next stage, or egg production, in the case of the adult female. Each female tick can produce thousands of eggs after a blood meal. The six-legged larval tick is very tiny (1/25 inch or 1 mm), sometimes compared to a poppy seed in size. They are light beige in color and very difficult to spot without a magnifier. The eight-legged nymphs are less than 1/16 inch (1.5875 mm) long. Both larvae and nymphs are prevalent in the leaf litter, tree trunks and wood logs. The adult female is about 1/8 inch (3.175 mm) long and has a dark brown head/thorax and reddish brown body with black legs. The male is smaller and entirely brownish-black. The females and males have eight legs attached to a hard and flattened body.

## **RISK AREAS FOR LYME DISEASE IN CALIFORNIA**

The Western Black-legged tick has been found in 56 of the 58 counties in California. It is common in the humid coastal areas and on the western slope of the Sierra Nevada mountain range. Ticks prefer cool, moist areas and can be found on grasses and low shrubs in both suburban and rural areas. Adult ticks climb to the tip of vegetation along trails and wait for a host to brush against them. They are most active from fall through early spring. Nymphs are found in low moist vegetation such as leaf litter and on logs. They are active primarily in the spring and summer months. In some areas in Alameda County, the nymphs were found through late October. Nymphs pose a greater risk of transmitting Lyme disease to humans in California, because nymphal ticks have higher infection rate and they are so tiny, very difficult to see and usually do not hurt when they bite. Most Lyme patients were infected by the nymphal ticks who did not recall the exposure to tick bites, and most likely delayed the medical treatments in the early disease stage until symptoms developed at a much later time.

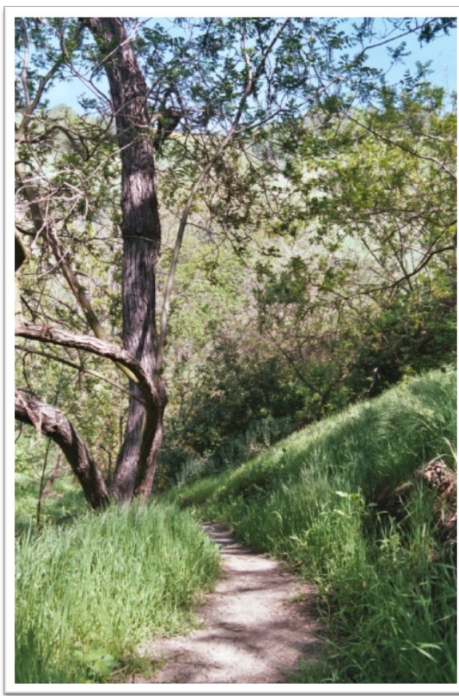
## **RISK AREAS FOR LYME DISEASE IN ALAMEDA COUNTY**

The American Dog Tick, Pacific Coast tick and Western Black-legged tick; these are



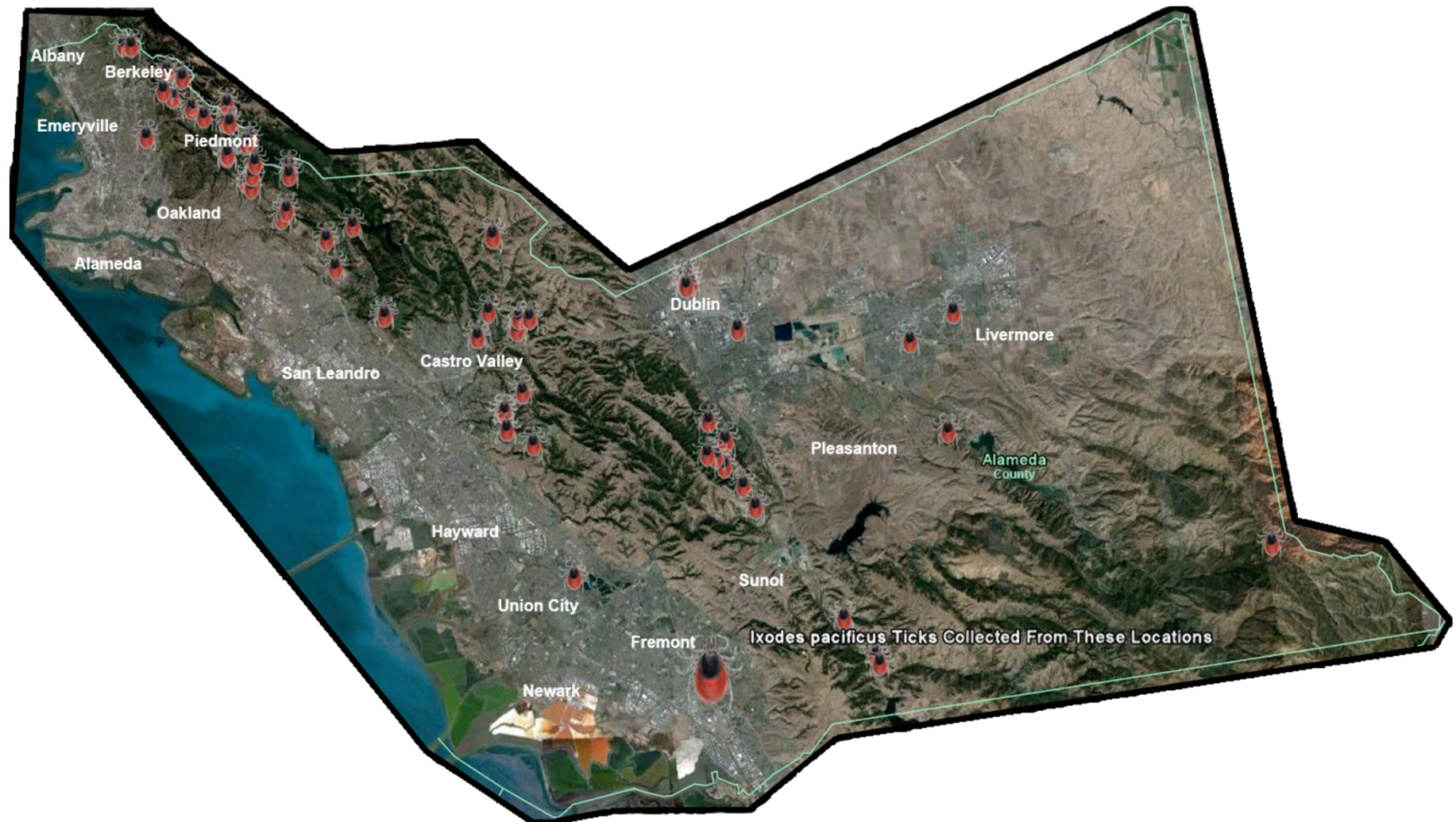
the three ticks commonly encountered in Alameda County. Each species has preferred ecological settings, and are abundant at different times of the year. Alameda County Vector Control Services District conducts tick surveillance all year-round to study tick habitat and the diseases that they are vectoring. Our data has shown that the Western Black-legged ticks (*Ixodes pacificus*) are commonly found in wooded areas associated with oaks, madrone, and redwood, especially along the hills in the western part of the county. This hilly area contains parks and recreation areas with wooded parkland that provides outdoor recreation to our local population and visitors. Almost any grassy area or leaf litter next to an oak tree, madrone or redwood will present high risk of encountering a tick for people running, jogging or walking dogs.

In recent years, the housing developments have expanded to wooded and remote areas, allowing wildlife access to our backyards and adjacent open area. The ticks feed on the deer, small animals and birds and then the replete female will drop off into some convenient shrubbery or a backyard and deposit her thousands of eggs. Deer, small animals, birds often serve as a “vehicle” to transport the ticks from afar and disburse the potentially disease carrying vectors along the trails, parks or backyards. Most people may not be aware of the tiny riders these animals carry and the diseases that can infect family members and pets.



Bottom left image depicts “leaf-litter” area where nymphal ticks may abound. Bottom right is the typical trail where “questing” adult ticks are found in the grasses along the sides of the trail. (Images ACVCSD)

***Here are the areas that the Western Black-Legged Tick (*Ixodes pacificus*) has been found in Alameda County***



**The markers on the map above indicate areas where we have collected *Ixodes pacificus* ticks.**

\*This is by no means an all inclusive distribution map of *Ixodes pacificus* ticks—rather a work in progress that will be updated as verifiable data is collected. (Map by Google Earth)



## ***WHAT PREVENTATIVE MEASURES CAN AN INDIVIDUAL TAKE AGAINST LYME DISEASE (TICKS)?***

The best prevention against Lyme disease is to avoid being bitten by ticks. Ticks prefer bushy areas with high grass and a lot of leaf litter. Whenever possible, persons should avoid entering areas that are likely to be infested with ticks. Individuals who venture into these areas should be aware of the hazard associated with tick bites and make it a habit to regularly check their bodies for ticks. Other personal protective measures should include:

- Wear light colored clothing so ticks can be seen and removed before they become attached to your skin.
- Wear long pants and long-sleeved clothing.
- Tuck pants into socks or boots, and shirt into pants.
- Use approved repellents. Be sure to follow the manufacturer's instructions carefully!
- Choose wide trails and walk in the center. Avoid bushy and grassy areas as well as off-the-trail hikes.
- Inspect yourself and others (including pets) thoroughly for ticks at least once an hour while walking in suspected tick infested areas, and for the next couple days after an excursion.

**Products containing DEET** (N,N-Diethyl-meta-toluamide) are the only skin-use repellents approved by the FDA to repel ticks. Products containing 20%-30% DEET are the most effective. Also consider the application life of skin based repellents. Some may only be effective for a few hours, and with perspiration, may necessitate reapplication. Some of the micro-encapsulated formulas have the longest effective duration. Always follow the product label.

There are repellants specifically formulated to be used on fabric and clothing that **are not** for use on the skin. These products contain the active ingredient **permethrin**, that can be very effective when applied properly to clothing, tents, sleeping bags, footwear and other garments. Following the label carefully can safely provide prolonged protection from biting ticks that attempt to climb on your outerwear, or camp gear!

**Tick identification and testing.** Place the tick in a zip-lock bag along with a moistened napkin, tissue, or cotton ball. Contact Alameda County Vector Control Services District (ACVCSD), to have the tick identified. If it is a Western Black-legged

## HOW SHOULD A TICK BE REMOVED?



***Grasp the embedded tick with fine-tipped tweezers (never with bare hands) as close to your skin as possible (Fig.1). With a steady motion, pull the tick's body away from the skin. Do not jerk or twist the tick as you extract it.***

Fig. 1



***Grasping the tick higher up on its body can increase the risk of "squeezing" tick body fluids into bite site (Fig. 2). Do not apply alcohol, fingernail polish, heat from a lit match, or petroleum jelly to the tick to try and get it to back out. These methods are not effective and can increase the chances of the tick transmitting disease.***

Fig. 2

tick, there are several laboratories that can test the tick, (normally for a fee) to determine if it harbors the Lyme disease spirochete. ACVCSD can help facilitate the testing. Tick testing may help your physician evaluate if you were exposed to the Lyme disease pathogen. No matter what the testing result, you should monitor yourself for the signs and symptoms of Lyme disease after being bitten by a tick.

One of the classic clinical markers of Lyme disease infection is the *erythema migrans* (EM) rash. In California, on average, only 60% (range 44-71%\*) of confirmed reported cases were diagnosed with this rash, that manifests in various forms. You may also experience symptoms of fatigue, chills, fever, headache, and muscle and joint aches, as well as swollen lymph nodes. In some cases, these may be the only symptoms of infection. **Consult your doctor if you have any of these symptoms!**

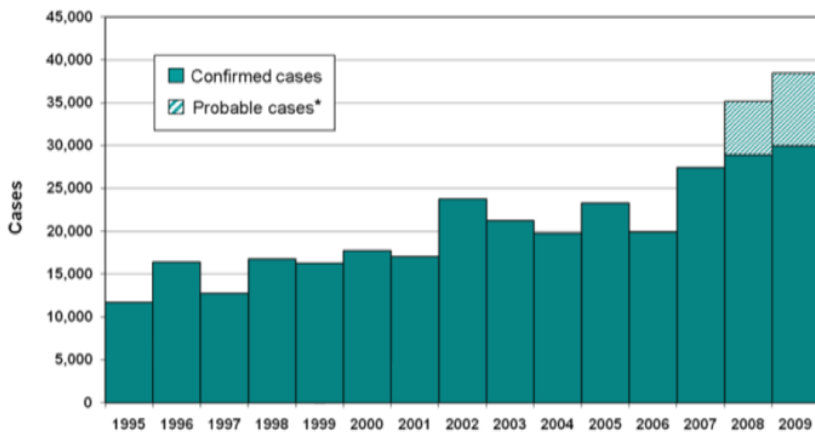
\* California Department of Public Health Vector-borne Disease Section, Statistics from Annual Reports 2002-2009



***Erythema Migrans (EM) Lesion Variations***

*Images CDC*

## Reported Cases of Lyme Disease by Year, United States, 1995-2009



\*National Surveillance case definition revised in 2008 to include probable cases; details at [http://www.cdc.gov/ncphi/diss/nndss/casedef/lyme\\_disease\\_2008.htm](http://www.cdc.gov/ncphi/diss/nndss/casedef/lyme_disease_2008.htm)

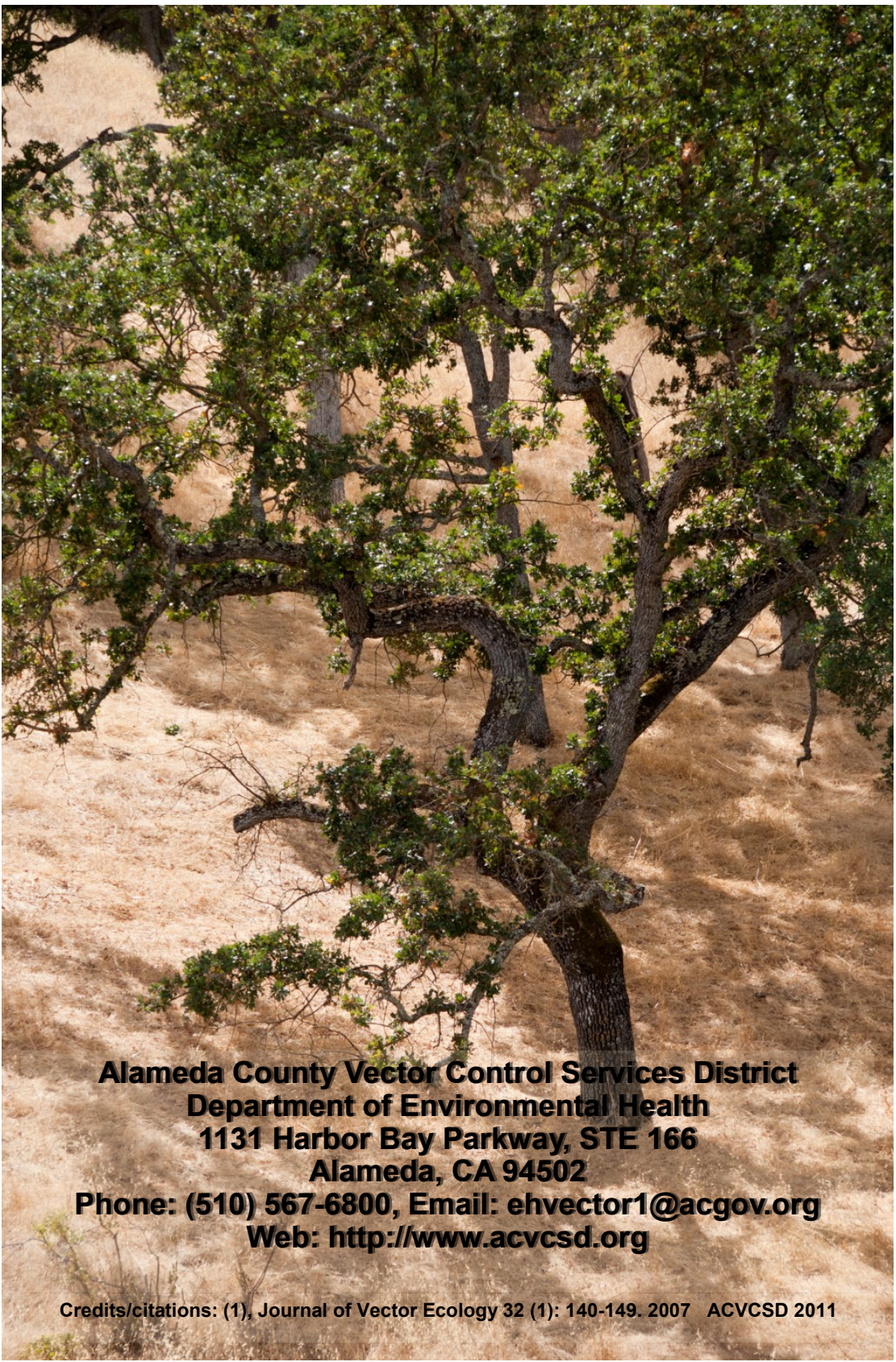
Lyme disease is the most reported vector-borne disease in the U.S.:1995-2009= 303,189 cases.

## Lyme Disease Cases in the United States 1999-2009 (Data: CDC)

Lyme disease*	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pennsylvania	2781	2343	2806	3989	5730	3985	4287	3242	3994	3818	4950
New Jersey	1919	2459	2020	2349	2887	2698	3363	2432	3134	3214	4598
New York	4402	4329	4083	5535	5399	5100	5565	4460	4165	5741	4134
Massachusetts	787	1158	1164	1807	1532	1532	2336	1432	2988	3960	4019
Connecticut	3215	3773	3597	4631	1403	1348	1810	1788	3058	2738	2751
Wisconsin	490	631	597	1090	740	1144	1459	1466	1814	1493	1952
Maryland	899	688	608	738	691	891	1235	1248	2576	1746	1466
Minnesota	283	465	461	867	474	1023	917	914	1238	1046	1063
New Hampshire	27	84	129	261	190	226	265	617	896	1211	996
Delaware	167	167	152	194	212	339	646	482	715	772	984
California	139	96	95	97	86	48	95	85	75	74	117
US Total <sup>†</sup>	16,273	17,730	17,029	23,763	21,273	19,804	23,305	19,931	27,444	28,921	29,959

\*The Lyme disease cases cited for the top-ten states only. <sup>†</sup> Total reported Lyme disease cases nearly doubled in last 11 years.





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