

Vector-Borne Disease Section

2011 Annual Report



Infectious Diseases Branch
Division of Communicable Disease Control
Center for Infectious Diseases

California Department of Public Health



2011

ANNUAL REPORT

VECTOR-BORNE DISEASE SECTION

INFECTIOUS DISEASES BRANCH

DIVISION OF COMMUNICABLE DISEASE CONTROL

CENTER FOR INFECTIOUS DISEASES

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH



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Preface

I am pleased to present to you the 2011 Annual Report for the Vector-Borne Disease Section (VBDS) of the California Department of Public Health (CDPH). VBDS staff conducted surveillance, prevention, and control of existing and emerging vector-borne diseases throughout California in 2011.

West Nile virus (WNV) activity increased in 2011 relative to 2010, with 158 human cases (9 fatal) reported statewide. Activity was detected in 36 counties, with the highest number of cases reported from Los Angeles County. In addition to concerns over WNV transmission in Los Angeles County, the exotic Asian tiger mosquito, *Aedes albopictus*, was detected in September. This mosquito is a vicious day-biter and potential vector of several viruses, including dengue. CDPH worked collaboratively with the affected local vector control agencies to assess and respond to this invasive species, which by year's end, was found in an 18-square-mile area of central Los Angeles County.

Confirmed human cases of six tick-borne diseases were reported in California in 2011, including Lyme disease, Rocky Mountain spotted fever, tick-borne relapsing fever, tularemia, and spotted fever group (SFG) *Rickettsia* 364D. Spotted fever group *Rickettsia* 364D was first implicated as a causative agent of human disease in 2008 when one case was identified. In the summer of 2011, five more cases were identified in residents of Lake, Contra Costa, and Santa Clara counties. The likely vector of this disease agent is the Pacific Coast tick, *Dermacentor occidentalis*; ticks infected with SFG *Rickettsia* 364D have been found in seven counties. Tick-borne disease prevention education in 2011 focused on reducing occupational exposure to tick bites. VBDS also conducted a tick-bite prevention Public Service Announcement contest and posted the winning videos on our website.

Plague activity was detected in rodents and carnivores from five counties in California, including in a domestic cat from Plumas County; there were no human cases. Hantavirus was detected in eight of 15 counties where rodents were tested for antibodies to Sin Nombre virus; no human case was reported. VBDS continued to provide extensive consultation and training to staff and management of the United States Forest Service and the National Park Service employees to reduce the risk of vector-borne disease exposure to park staff and visitors.

VBDS staff worked extensively with the Mosquito and Vector Control Association of California to evaluate numerous regulatory issues affecting mosquito control in California and in particular, implementation of the National Pollution Discharge Elimination System (NPDES) permit.

Many of you are our collaborators and colleagues and I hope that you find the information contained in this annual report to be of value as we collectively strive to promote and protect the health of all Californians.

Vicki L. Kramer, Ph.D., Chief
Vector-Borne Disease Section

Acknowledgements

The Vector-Borne Disease Section works with numerous local, state, and federal agencies, private and commercial organizations, and members of the medical community in its efforts to monitor, prevent, and control vector-borne diseases in California. Some key collaborators in 2011 are listed here.

Rodent-borne Disease

U.S. Department of Agriculture (USDA); U.S. Forest Service (USFS); U.S. Department of Interior National Park Service (NPS); Special Pathogens Branch, U.S. Centers for Disease Control and Prevention (CDC); Mono County Health and Human Services (HHS); Nevada County Environmental Health Department (EHD); Alameda County Vector Control Services District (VCSD); Coachella Valley Mosquito and Vector Control District (MVCD); Orange County Vector Control District (VCD); Riverside County Vector Control Program (VCP); San Bernardino County VCP; San Diego County VCP; Santa Clara County VCD; Santa Cruz County MVCD; West Valley MVCD; Viral and Rickettsial Diseases Laboratory Branch (VRDL), California Department of Public Health (CDPH)

Flea-borne Disease

Animal and Plant Health Inspection Service, Wildlife Services; NPS; El Dorado County Environmental Management Department; Fresno County Department of Agriculture; Inyo County Environmental Health Services (EHS); Kern County Department of Public Health (DPH) and EHS; Los Angeles County Agricultural Commissioner/Weights and Measures; Los Angeles County DPH, Environmental Health, Vector Management; Mono County HHS; Nevada County Public Health Department (PHD) and EHD; Placer County HHS; Riverside County VCP; Sacramento County HHS; San Bernardino County VCP; Santa Clara County VCD; Tulare County HHS; West Valley MVCD; School of Veterinary Medicine, University of California, Davis (UCD); Microbial Diseases Laboratory Branch, CDPH

Tick-borne Disease

United States Army Center for Health Promotion and Preventative Medicine-West; NPS; Rickettsial Zoonoses Branch, Division of Global Migration and Quarantine, and Division of Vector-Borne Infectious Diseases, CDC; Rocky Mountain Laboratories, National Institutes of Health; Arizona Department of Health Services; Coconino County (Arizona) Health Department; Washington State Department of Health; Alameda County VCSD; Calaveras County EHD; Coachella Valley MVCD; Contra Costa County MVCD; Imperial County PHD; Lake County VCD; Marin County HHS; Marin-Sonoma County MVCD; Napa County MAD; Riverside County VCP; San Benito County HHS; San Joaquin County MVCD; San Luis Obispo PHD; San Mateo MVCD; Santa Cruz County MVCD; Sacramento-Yolo County MVCD; Shasta County MVCD; VRDL, and California Office of Binational Border Health, CDPH

Mosquito-borne Disease

California Animal Health and Food Safety Laboratory; California Department of Food and Agriculture (CDFA); Mosquito and Vector Control Association of California; participating local health departments, physicians and veterinarians, and local mosquito and vector control agencies; Center for Vectorborne Diseases, UCD; VRDL and Veterinary Public Health Section, CDPH

Other Vectors and Public Health Pests

CDFA; Coachella Valley MVCD; Los Angeles County DPH; Orange County VCD; San Gabriel Valley MVCD; San Francisco DPH; San Francisco Housing and Homeless Programs; Alameda VCD; CDC

Reports and Public Information Materials

DEET Education Program, Judi Anderson, Susan Little, Ryan Nau for sponsorship and support of the Tick-bite Prevention Public Service Announcement Video contest

Annual Report Technical Assistance

Claudia Erickson, MS, CHES, Veterinary Public Health Section, CDPH

Vector-Borne Disease Section

Sacramento: Vicki Kramer, PhD, Chief, Anne, Kjemtrup, DVM, MPVM, PhD, Jonathan Kwan, MS, Tim Howard, MS, Jesse Laxton, Melissa Williams, Claudia Erickson, MS, CHES. Northern Region: Mark Novak, PhD, Lawrence Bronson, James Tucker, MS, Michael Niemela, MS, Joshua Ogawa¹, PhD. Southern Region: Renjie Hu, PhD, Marco Metzger, PhD, Inger Vilcins, PhD, MPH, Joseph Burns¹. Coastal Region: Kerry Padgett, PhD, Tina Feiszli, MSPH, Daniel Salkeld, PhD, Denise Bonilla¹, MS, Ervic Aquino², John Chen², Leslie Foss², MS, Jaynia Anderson², Margaret Kerrigan², Robert Payne³, Rachel Bouttenot³ MS, Mary-Joyce Pakingan³.

¹U.S. Forest Service Project, ²West Nile Virus Contract Project, ³Laboratory Project

Program Overview

The mission of the California Department of Public Health (CDPH) Vector-Borne Disease Section (VBDS) is to protect the health and well-being of Californians from arthropod- and vertebrate-transmitted diseases and injurious pests. (Authorizing statutes: Health and Safety Code Sections 116108-116120, 116102, et. seq., and 116180; Government Code Section 12582). VBDS provides leadership, information, and consultation on vector-borne diseases to the general public and agencies engaged in the prevention and control of vector-borne diseases. VBDS staff, located in four regional offices and headquartered in Sacramento, provide the following services:

- Develop and implement statewide vector-borne disease surveillance, prevention, and control programs
- Design and conduct scientific investigations to further knowledge of vector-borne diseases in California
- Coordinate preparedness activities for detection and response to introduced vectors and vector-borne diseases, such as West Nile virus
- Conduct emergency vector control when disease outbreaks occur
- Advise local agencies on public health issues related to vector-borne diseases
- Advise local agencies on regulatory issues pertaining to mosquito and vector control
- Oversee local vector control agency activities through a Cooperative Agreement
- Oversee the Vector Control Technician Certification and Continuing Education programs
- Provide information, training, and educational materials to governmental agencies and the public
- Provide assistance in coordinating issues related to the management of bed bugs, Africanized honey bees, and red imported fire ants
- Advise local agencies, schools, and the public on head lice management
- Maintain the San Francisco Bay Area U.S. Army Corps of Engineers general permit, which allows local vector control agencies to conduct abatement activities
- Oversee Special Local Need permits on restricted use of public health pesticides

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Rodent-borne Disease



Hantavirus cardiopulmonary syndrome is the most important rodent-borne disease in California. Since the disease was first identified in 1993, the Vector-Borne Disease Section has collaborated with county, state, and federal public health agencies to identify and investigate human cases of disease, to survey and study Sin Nombre virus infection in wild rodents, and to prepare and promote preventive information for the general public.

Human disease surveillance

No cases of hantavirus cardiopulmonary syndrome (HCPS) were diagnosed in California residents in 2011.

Rodent surveillance

In 2011, 1,708 rodents of the genera *Microtus*, *Neotoma*, *Peromyscus*, and *Reithrodontomys* were collected and tested for serum antibodies to Sin Nombre virus (SNV) (Table 1). Of 1,369 *Peromyscus* spp. tested, 61 (4.5%) had serologic evidence of infection with SNV. Seroprevalence was highest in *Peromyscus eremicus* at 10.7% and followed by *P. maniculatus* at 5.5% (Table 1). At least one seroreactive *Peromyscus* sp. was detected in eight of 15 California counties in which *Peromyscus* spp. were sampled in 2011 (Table 2). The unusually high seroprevalence in *P. eremicus*, the cactus mouse, was driven by surveillance conducted by the Vector-Borne Disease Section (VBDS) at sites in Death Valley National Park, Inyo County, described below. Antibody detected by the assay represent reaction to SNV but in some species may indicate reaction to other SNV-like viruses. For example, *Reithrodontomys megalotis* and *Microtus californicus* specimens have demonstrated evidence of infection with SNV-like hantaviruses (El Moro Canyon and Isla Vista, respectively), but these strain variations have not been shown to be pathogenic to humans.

Table 1. Results of testing for antibodies reactive to Sin Nombre virus antigen in California rodents, 2002 - 2011

Species	Common name	2011			2002-2011		
		No. collected	No. reactive	Percent	No. collected	No. reactive	Percent
<i>Neotoma</i> spp.	woodrats	49	1	2.0	1,053	35	3.3
<i>Peromyscus boylii</i>	brush mouse	29	0	0.0	2,336	91	3.9
<i>Peromyscus californicus</i>	parasitic mouse	166	0	0.0	1,437	21	1.5
<i>Peromyscus crinitus</i>	canyon mouse	9	0	0.0	292	10	3.4
<i>Peromyscus eremicus</i>	cactus mouse	252	27	10.7	2,867	128	4.5
<i>Peromyscus maniculatus</i>	deer mouse	565	31	5.5	7,490	1,072	14.3
<i>Peromyscus truei</i>	piñon mouse	61	0	0.0	381	9	2.4
<i>Peromyscus fraterculus</i> ^a	northern Baja mouse	287	3	1.0	287	3	1.0
<i>Peromyscus</i> sp.	unspecified <i>Peromyscus</i>	0	0	0.0	61	3	4.9
<i>Reithrodontomys megalotis</i>	western harvest mouse	248	19	7.7	859	73	8.5
<i>Microtus</i> spp.	voles	42	16	38.1	281	32	11.4

^a *P. fraterculus* recently elevated to full species level in San Diego County

Sin Nombre virus has been detected in rodents from 33 of 41 counties in the last ten years, with prevalence ranging from 0.5% to 38.5% (Table 2). Despite widespread detection of both deer mice and SNV, HCPS remains rare. People become infected with SNV by breathing microscopic particles of droppings or urine from an infected deer mouse. Information on how to avoid rodents, their droppings, and nesting material can be found at <http://www.cdph.ca.gov/HealthInfo/discond/Pages/HantavirusPulmonarySyndrome.aspx>.

Enhanced surveillance

As part of a National Park Service cooperative agreement with VBDS, and in follow up to unusually high SNV seroprevalence in rodents at Scotty's Castle in Death Valley National Park (DEVA) detected in 2010, VBDS performed rodent surveillance at Scotty's Castle in the spring and fall of 2011. Blood from rodents was tested by both enzyme immunoassay for antibodies and by polymerase chain reaction (PCR) for virus detection and characterization. Twenty-seven of 69 (39.1%) cactus mice (*P. eremicus*), one of four (25%) deer mice (*P. maniculatus*), zero of four canyon mice (*P. crinitus*) and one of nine (11%) desert woodrats (*Neotoma lepida*) tested positive for SNV antibody. Of the 28 cactus mice tested by PCR, 15 (54%) were positive for SNV virus; nine of these were also seropositive. One of the four deer mice was PCR positive for SNV virus (but seronegative); none of the canyon mice were PCR positive. The SNV virus detected was molecularly characterized as the Convict Creek strain.

In addition, trapping was performed at two high-elevation (>2000 m) campgrounds at DEVA, yielding two of two (100%) deer mice with serologic reactivity to SNV and two of five (40%) piñon mice (*P. truei*) positive for SNV by PCR.

Cactus mice (*Peromyscus eremicus*) were the dominant species at Scotty's Castle which likely contributed to the high seroprevalence to SNV ($\geq 30\%$) detected in this species. Deer mice (*P. maniculatus*) are recognized as the principal reservoir and vector for SNV in California, though the epidemiology of SNV might vary slightly at local ecological levels.

Table 2. Results of serologic testing for hantavirus (Sin Nombre) infection in *Peromyscus maniculatus* in California 2002 - 2011

County	2011			2002-2011		
	No. collected	No. reactive	Percent	No. collected	No. reactive	Percent
Alameda	4	0	0	202	1	0.5
Alpine				76	26	34.2
Amador						
Butte				13	5	38.5
Calaveras				5	1	20.0
Colusa						
Contra Costa				20	2	10.0
Del Norte						
El Dorado				825	230	27.9
Fresno				68	1	1.5
Glenn	5	0	0.0	5	0	0.0
Humboldt						
Imperial						
Inyo	3	1	33.3	33	7	21.2
Kern	6	1	16.6	6	1	16.6
Kings						
Lake						
Lassen				821	128	15.6
Los Angeles				30	7	23.3
Madera				42	10	23.8
Marin				18	1	5.6
Mariposa				5	1	20.0
Mendocino						
Merced						
Modoc	14	6	61.4	27	6	22.2
Mono				684	198	28.9
Monterey				39	7	17.9
Napa	2	0	0	45	8	17.8
Nevada				23	7	30.4
Orange	46	1	2.2	1,365	97	7.1
Placer						
Plumas	4	1	25.0	99	25	25.3
Riverside	68	0	0	1,350	166	12.3
Sacramento						
San Benito				5	0	0
San Bernardino	15	0	0.0	439	41	9.3
San Diego	361	19	5.3	822	40	4.9
San Francisco				13	0	0
San Joaquin						
San Luis Obispo				42	6	14.3
San Mateo				64	5	7.8
Santa Barbara				58	12	20.7
Santa Clara	1	0	0.0	10	0	0.0
Santa Cruz	6	0	0.0	14	0	0.0
Shasta	19	1	5.3	35	4	11.4
Sierra	11	1	9.1	69	10	14.5
Siskiyou				53	8	15.1
Solano						
Sonoma						
Stanislaus						
Sutter				7	0	0
Tehama						
Trinity						
Tulare				4	0	0.0
Tuolumne				48	8	16.7
Ventura				6	2	33.3
Yolo				1	0	0
Yuba						
Douglas, NV				5	1	20.0
California	565	31	5.5	7,496	1,072	14.3

2

Flea-borne Disease



Plague and typhus fever are the principal flea-borne diseases under surveillance in California. The California Department of Public Health collaborates with local, state, and federal agencies to conduct a statewide plague surveillance program. The Vector-Borne Disease Section collects, collates, and analyzes information on suspect and confirmed plague activity among humans, domestic pets, and wild animals throughout California to evaluate the potential risk of plague to the public and, where necessary, implement preventive and control actions.

Human disease

Typhus

Typhus is a bacterial illness transmitted by fleas from wild rats or opossums. Typhus is endemic in parts of Los Angeles and more recently, Orange County. Fifty-one cases of typhus fever were reported to the California Department of Public Health in 2011 (as of April 2012); 28 of these met criteria for a confirmed case, 16 were probable, and 7 were suspect. The case-patients were residents of Los Angeles (39) and Orange (12) Counties. This is an increase in the number of reported cases compared to 2009 (15), and 2010 (41). The increase may be due to increase awareness of the disease by health practitioners and the general public due to follow-up activities conducted by local agencies. These agencies and CDPH continue to investigate reasons for the increase.

Persons living in areas endemic for typhus should avoid contact with opossums and maintain proper flea control on outdoor pets.

Plague

No cases of plague in humans were reported in 2011.

Domestic pets

In July, a domestic cat from Plumas County presented to a local veterinary clinic with fever, cervical edema/cellulitis, and a fluctuant submandibular abscess. Plague was suspected and an aspirate of the abscess tested positive by direct fluorescent antibody assay and polymerase chain reaction for *Yersinia pestis* two days later at the local regional laboratory. The cat was placed in isolation at the clinic, treated with appropriate antibiotics, and recovered. Though the cat had no signs of pneumonic involvement, the veterinarian, veterinary staff, and cat's owners were advised to contact their health care providers for antibiotic prophylaxis.

No additional domestic pets were tested for plague in 2011.

Plague in domestic felines is not uncommon in the Sierra Nevada Counties, and in particular, the Truckee area of Nevada County. Plague infection has been detected in 5 of 14 domestic cats tested from this region since 2001.

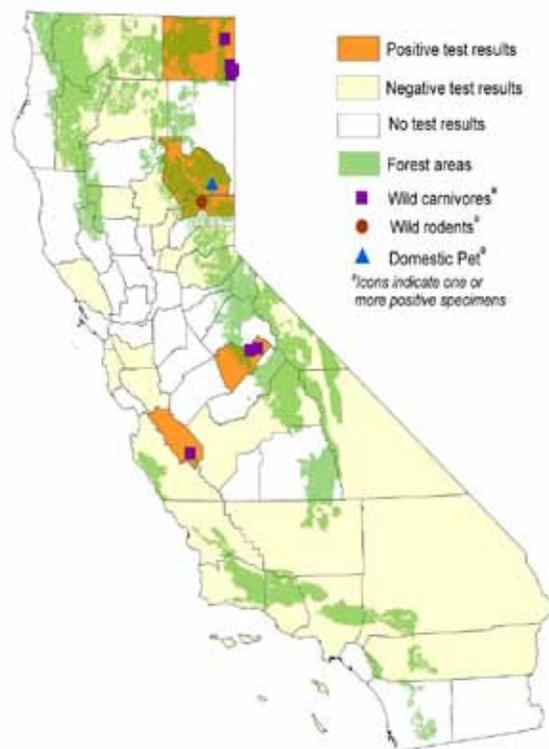


Figure 1. Map of California counties where mammals were found to have evidence of *Yersinia pestis* infection, 2011

Wild animals

The Vector-Borne Disease Section (VBDS) plague surveillance program received 726 test results in 2011 for 397 rodents and 329 wild carnivores from 28 counties (Figure 1, Table 3).

Squirrels tested for plague antibodies included: 149 California ground squirrels from six counties, 31 golden-mantled ground squirrels from five counties, 2 Belding's ground squirrels, 2 Douglas' squirrels and 10 eastern gray squirrels. Chipmunk species tested for plague antibodies included: 97 yellow-pine chipmunks from six counties, 16 Merriam's chipmunk from three counties, 19 lodgepole chipmunks from three counties, 22 shadow chipmunks and 2 Sonoma chipmunks. Also sampled were 33 mice, 13 woodrats, and a kangaroo rat. All of the shadow chipmunks were sampled from Pack Saddle, Berger Creek and Diablo campgrounds within the Tahoe National Forest, Sierra County in late July. One chipmunk from this area tested positive for plague antibodies (1:8,192). No other indicators of plague activity were noted from this location and all other rodents tested in 2011 were plague antibody negative.

The carnivores tested for plague antibodies included: 254 coyotes from 17 counties, 31 black bears from five counties, 12 raccoons from three counties, 11 mountain lions from six counties, 5 bobcats from three counties, 14 striped skunks from two counties, 1 gray fox and 1 badger. Plague antibodies were detected in two black bears from Yosemite National Park, Mariposa County (1:64, 1:128), four coyotes from Modoc County (1:32, 1:32, 1:32 and 1:512) and a coyote from San Benito County (1:64).

These results do not include data collected from plague surveillance programs of Los Angeles and San Diego Counties who conduct their own testing.

Table 3. VBDS plague surveillance results for 2011. (All specimens are sera unless otherwise indicated.)					
County Location	No. rodents tested	No. carnivores tested	Positive specimens		
			Species	Result	Month
Butte		2			
El Dorado	14				
Fresno		9			
Glenn	2				
Inyo	1				
Kern	18	78			
Los Angeles		22			
Mariposa		14			
Yosemite National Park: Yosemite Valley			Black Bear	1:64	May
Yosemite National Park: Yosemite Valley			Black Bear	1:128	September
Mendocino		31			
Modoc	11	35			
Eagleville: 5 miles east			Coyote	1:32	January
Lake City: 5 miles northeast			Coyote	1:32	January
Eagleville: 4 miles northeast			Coyote	1:32	October
Eagleville: 4 miles southeast			Coyote	1:512	October
Mono	24				
Monterey		10			
Placer	4				
Plumas	46	18			
Beckwourth: Grizzly Rd., 4 miles north			Domestic Cat	POS	July
Riverside	84				
San Benito		61			
Hernandez Reservoir			Coyote	1:64	November
San Bernardino	107				
San Luis Obispo		12			
San Mateo	12				
Santa Barbara		8			
Santa Clara	8				
Shasta		6			
Sierra	66	2			
Tahoe NF, Pack Saddle Campground			Chipmunk, S	1:8192	July
Siskiyou		14			
Sonoma		1			
Trinity		1			
Ventura		2			
Yuba		3			
Total	397	329			

Abbreviations

Species Chipmunk, S: Shadow Chipmunk (Tamias senex)
 Location NF: National Forest
 Result POS: Positive

3



Tick-borne Disease

At least seven tick-borne diseases have been documented in California. The goal of the Vector-Borne Disease Section is to reduce human morbidity from tick-borne diseases in California through ongoing surveillance of the disease-causing agents and vectors, investigation of human cases when necessary, management of tick populations as appropriate, and timely dissemination of findings and prevention messages to public health and vector control agencies, medical personnel, and the general public.

Human disease surveillance

Anaplasmosis

Three infections with *Anaplasma phagocytophilum* were reported to the California Department of Public Health (CDPH). They met the national surveillance case definition for confirmed (1), probable (1), and suspect (1) cases. The confirmed case-patient was a Sacramento resident with history of tick bite exposure in Rhode Island, an endemic area for *A. phagocytophilum*.

Lyme disease

A total of 94 cases of Lyme disease were reported to CDPH in 2011 (as of April 2012); 74 met the surveillance case definition criteria for a confirmed case, 6 were probable and 14 were suspect. Confirmed case-patients were residents of 23 counties (Table 4). The most case-patients (10) were reported from Santa Clara County. Of 39 case-patients reporting travel history within the incubation period, 29 (74%) were exposed outside California. The most frequently reported locations of likely exposure were Massachusetts and Connecticut.

The median age of confirmed Lyme disease case-patients was 37 years (range, 2 to 83 years); 44 (60%) were

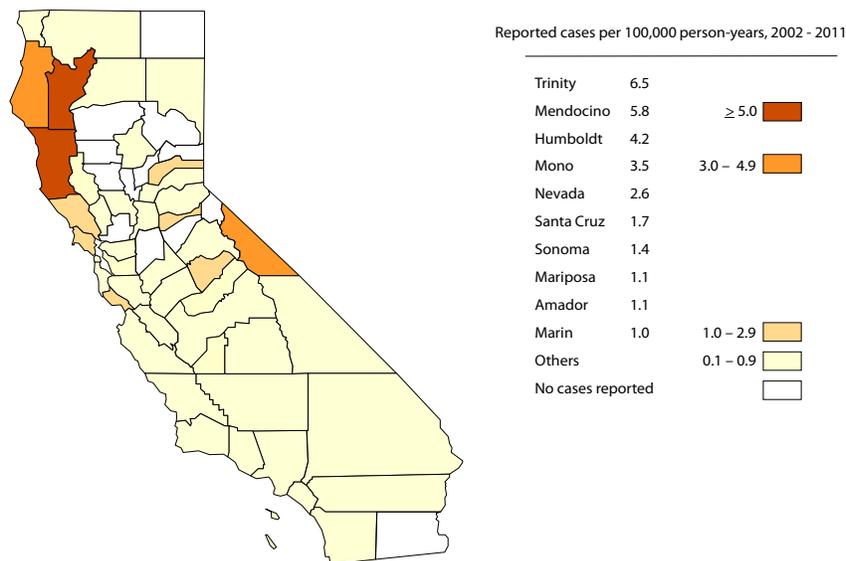


Figure 2. Incidence of Lyme disease, California, 2002 - 2011

Table 4: Reported confirmed Lyme disease cases by county of residence, California, 2002 - 2011

County	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Incidence per 100,000 person- years
Alameda	5	1	0	5	3	2	6	1	1	2	0.17
Alpine	0	0	0	0	0	0	0	0	0	0	0.00
Amador	0	0	0	0	1	2	0	0	1	0	1.05
Butte	3	2	2	0	1	0	2	1	0	0	0.50
Calaveras	0	0	0	0	0	0	0	0	0	0	0.00
Colusa	0	0	0	0	0	0	0	0	0	0	0.00
Contra Costa	3	4	0	4	1	0	1	0	0	1	0.13
Del Norte	2	0	0	0	0	0	0	0	0	0	0.70
El Dorado	0	0	3	3	3	2	2	2	1	0	0.88
Fresno	0	0	0	0	1	0	2	0	1	0	0.04
Glenn	0	0	0	0	0	0	0	0	0	0	0.00
Humboldt	4	5	7	11	5	7	6	4	6	2	4.23
Imperial	0	0	0	0	0	0	0	0	0	0	0.00
Inyo	0	0	0	0	1	0	0	0	0	0	0.54
Kern	2	1	0	2	1	2	5	1	2	0	0.19
Kings	0	0	0	0	0	0	0	1	0	0	0.07
Lake	0	1	1	1	0	1	0	0	0	0	0.62
Lassen	2	0	0	0	0	0	0	0	0	0	0.57
Los Angeles	6	7	2	8	11	9	8	3	5	7	0.07
Madera	0	0	0	0	0	0	0	0	0	1	0.07
Marin	4	4	0	3	7	2	2	1	2	1	1.03
Mariposa	1	0	1	0	0	0	0	0	0	0	1.10
Mendocino	11	6	2	1	0	5	11	6	6	3	5.81
Merced	0	0	0	0	0	0	0	0	0	1	0.04
Modoc	0	0	0	0	0	0	0	0	0	0	0.00
Mono	0	3	1	0	0	0	0	0	1	0	3.52
Monterey	5	1	1	0	0	0	0	0	1	1	0.22
Napa	3	0	1	1	0	3	0	1	0	1	0.73
Nevada	3	4	1	3	2	3	2	1	3	5	2.73
Orange	3	2	0	1	2	1	1	0	5	5	0.07
Placer	3	0	2	2	3	0	1	2	0	1	0.40
Plumas	0	0	0	0	0	0	0	0	0	0	0.00
Riverside	1	2	1	4	0	0	1	4	0	4	0.08
Sacramento	1	4	2	6	3	2	0	1	0	1	0.14
San Benito	1	0	0	0	0	0	0	0	0	0	0.18
San Bernardino	0	2	0	0	0	0	1	0	0	2	0.02
San Diego	7	2	4	8	9	5	3	8	6	8	0.19
San Francisco	3	3	1	7	5	5	4	1	1	1	0.38
San Joaquin	0	0	0	0	0	0	0	0	0	0	0.00
San Luis Obispo	0	0	0	1	0	0	1	0	0	0	0.07
San Mateo	4	5	1	4	2	0	2	1	3	0	0.31
Santa Barbara	2	2	2	0	0	2	2	0	1	3	0.33
Santa Clara	6	4	0	2	9	2	0	2	5	10	0.22
Santa Cruz	1	8	3	0	6	5	2	4	7	8	1.68
Shasta	1	0	2	2	0	0	0	0	1	1	0.39
Sierra	0	0	0	0	0	0	0	0	0	0	0.00
Siskiyou	1	0	0	0	0	0	0	0	0	0	0.22
Solano	0	0	0	0	0	0	0	0	0	0	0.00
Sonoma	4	9	2	9	8	8	10	9	5	5	1.43
Stanislaus	0	0	0	1	0	0	1	1	0	0	0.06
Sutter	0	0	0	0	0	0	0	0	0	0	0.00
Tehama	0	0	0	0	0	0	0	0	0	0	0.00
Trinity	1	1	3	3	0	1	0	0	0	0	6.53
Tulare	0	2	0	0	0	1	0	0	0	0	0.07
Tuolumne	1	0	0	1	1	0	0	0	0	0	0.54
Ventura	1	1	2	1	0	5	2	0	0	0	0.15
Yolo	2	0	1	0	1	1	0	0	0	0	0.25
Yuba	0	0	0	0	0	0	0	0	0	0	0.00
California	97	86	48	94	86	76	78	55	64	74	0.20

male. Of 52 case-patients for which race was reported, 48 were white, 2 were Asian-Pacific Islander, and 1 each was American Indian or mixed race. Erythema migrans (EM) was identified in 45 (60%) case-patients, 35 (78%) of whom had onset of EM noted between May and September.

Spotted fever group *Rickettsia*

Three cases of Rocky Mountain spotted fever (RMSF) were reported to CDPH in 2011. One met the national surveillance case definition for a confirmed case, the other two were probable (1) and suspect (1) cases. The confirmed case-patient was a Los Angeles County resident who presented in April with fever, headache, myalgia and an eschar on the abdomen where the a tick-bite was reported one week previously. Recent tick exposure history was reported near and in Topanga State Park. The probable case-patient was a Monterey County resident who presented in May with fever, headache, myalgia and an undescribed rash: no history of tick-bite was reported.

Five cases of spotted fever group *Rickettsia* (SFG) confirmed as type 364D were reported to CDPH in 2011. Confirmation was by polymerase chain reaction (PCR) and sequencing performed by the CDPH-Viral and Rickettsial Disease Laboratory (VRDL) of cutaneous ulcers (eschars). All but one case-patients were pediatric patients (≤ 17 -years-old); three were female. Case-patients were residents of Lake (3), Contra Costa (1), and Santa Clara (1) Counties. In addition to the eschar, patients presented with headache (4), lymphadenopathy (4), myalgia (3) and fever (3). Presumed exposure in all case-patients was near their home. Two case-patients reported a tick bite.

Tick-borne relapsing fever

One confirmed and two probable cases of tick-borne relapsing fever (TBRF) were reported to CDPH in 2011. Case-patient ages ranged from two to 34 years and two were male. The confirmed and one of the probable case-patients were visitors to a rustic cabin in Alpine County. The other probable case-patient had visited a ski hut in Yosemite National Park two weeks prior to onset of illness. VBDS investigated both likely exposure locations.

Tularemia

Six cases of tularemia were reported to the CDPH in 2011; four of these met the national surveillance case definition for a confirmed case. Transmission via tick bite was suspected for one case-patient. A male resident of Sacramento County reported receiving a tick bite to his neck while camping in Yuba County, approximately two weeks prior to onset of illness. The removed tick was retained and later identified by VBDS as *Dermacentor variabilis*. *Francisella tularensis* was detected in the tick by PCR at the CDC.

Tick surveillance

Borrelia spirochetes

In 2011, local, state, and federal agencies collected 7,956 western black-legged ticks (*Ixodes pacificus*) in 26 counties; collection and testing data were collated by VBDS. Of the collected ticks, 4,220 *I. pacificus* from 26 counties were tested by direct fluorescent antibody assay (DFA), PCR, or real-time PCR (RT-PCR) for *Borrelia* spirochetes; VBDS tested 2,601 of the ticks. Testing results are summarized in Table 5.

Tick-borne relapsing fever

In 2011, VBDS staff conducted tick surveillance for TBRF in Alpine and Mariposa Counties, at potential exposure locations for reported probable and confirmed cases. Investigation at a remote ski hut in Yosemite National Park (Mariposa County) yielded one male *Ornithodoros hermsi* soft tick which tested negative for *Borrelia hermsii* (bacterial agent of TBRF), DNA at the University of Nevada, Department of Animal Biotechnology. Follow-up at the cabin in Alpine County revealed one male and two female *O. hermsi* soft ticks. These tested negative for *B. hermsii* at the University of California, Irvine, Department of Microbiology and Molecular Genetics.

Tularemia

In 2011, VBDS and Napa County Mosquito Abatement District, conducted surveillance for *Francisella tularensis* in ticks collected from areas where human case-patients with suggested tick-bite exposure had been historically reported; ticks were tested by PCR at the San Diego County Environmental Health Department. All of the 182 collected *D. variabilis* ticks tested negative.

As follow-up to the one 2011 reported tularemia case-patient with tick-bite exposure, VBDS conducted surveillance for *D. occidentalis* and *D. variabilis* in Yuba and Nevada Counties at the campground where the patient was exposed. Two *D. occidentalis* nymphs, 17 pools of 91 *D. occidentalis* adults, and 1 *D. variabilis* adult all tested negative by PCR at CDC.

Spotted fever group *Rickettsia*

Ticks collected by VBDS and Los Angeles County West Vector Control District at exposure sites of the RMSF patient tested negative by CDC.

VBDS, Lake County MVCD, Contra Costa MVCD, and Santa Clara MVCD conducted tick surveillance for SFG *Rickettsia* 364D at patient exposure sites. All ticks were tested by PCR at VRDL, CDPH.

In Contra Costa County, 8 *D. occidentalis* nymphs, 5 *D. occidentalis* larvae, 16 *I. pacificus* nymphs, 4 *I. pacificus* larvae, and 3 *Haemaphysalis leporispalustris* larvae were all negative for SFG *Rickettsia* 364D.

In Lake County, 182 *D. albipictus* larvae, 26 *D. occidentalis* larvae and 30 *D. occidentalis* nymphs were collected. Two *D. occidentalis* nymphs tested positive for SFG *Rickettsia* 364D. This is the first PCR detection of SFG *Rickettsia* 364D from *D. occidentalis* nymphs.

In Santa Clara County, 363 *D. albipictus* larvae, 1 *D. occidentalis* larvae, 3 *H. leporispalustris* larvae, and 7 *I. pacificus* larvae were all negative for SFG *Rickettsia* 364D.

In Sonoma County, 36 *D. albipictus* larvae, 8 *D. occidentalis* larvae, 5 *H. leporispalustris* larvae, and 1 *D. occidentalis* nymph all tested negative for SFG *Rickettsia* 364D.

Table 5. Results of *Ixodes pacificus* ticks tested for evidence of *Borrelia* spirochetes, California, 2011^a

County Location	No. Ticks Tested		No. Ticks Positive		Laboratory
	Adults	Nymphs	Adults (% pos)	Nymphs (% pos)	
Amador					
Indian Grinding Rock SP	45	23	2 (4.4)	2 (8.7)	CDPH, VBDS
Butte					
Loafer Creek SP	0	153		9 (5.9)	CDPH, VBDS
Calaveras					
New Melones Lake	30	8	1 (3.3)	0	CDPH, VBDS
Vallecito	14	4	0	0	CDPH, VBDS
Contra Costa					
Tilden RP	0	4		0	CDPH, VBDS
El Dorado					
Fleming Meadow, El Dorado NF	0	4		0	CDPH, VBDS
Folsom Lake SRA	194	17	8 (4.1)	2 (11.7)	CDPH, VBDS
Marshall Gold Discovery SP	28	0	1 (3.6)		CDPH, VBDS
Glenn					
Camp Ellendale, Mendocino NF	11	0	0		CDPH, VBDS
Humboldt					
Pearch Creek CG, Six Rivers NF	10	0	0		CDPH, VBDS
Lake					
Clear Lake SP	0	135		6 (4.4)	CDPH, VBDS
Los Angeles					
Pacific Palisades	0	1	0	0	CDPH, VBDS
Topanga SP	5	2	0	0	CDPH, VBDS
Marin					
China Camp SP	251	96	7 (2.7)	5 (5.2)	CDPH, VBDS
China Camp SP	26	21	0 ^d	1 (4.8) ^d	M/S MVCD
Marin Municipal Water District	723	19	19 (2.6) ^d	2 (10.5) ^d	M/S MVCD
Mount Tamalpais SP	89	0	2 (2.3) ^d		M/S MVCD
Olompali SP	21	86	0 ^d	2 (2.3) ^d	M/S MVCD
Mariposa					
Wawona CG, Yosemite NP	10	0	0		CDPH, VBDS
Napa					
Foote Botanical Preserve	20	0	0		Napa MAD
Linda Falls	30	0	2 (6.7) ^b		Napa MAD
Quail Ridge Preserve	0	55		1 (1.8)	CDPH, VBDS
Nevada					
Englebright Reservoir	5	5	0	1 (20.0)	CDPH, VBDS
South Yuba River SP	0	112		11 (9.8)	CDPH, VBDS
Orange					
Crystal Cove SP ^c	40	67	0	13 (14.4)	CDPH, VBDS
Placer					
Auburn SRA	10	37	1 (10.0)	1 (2.7)	CDPH, VBDS
Auburn SRA	114	7 ^a	9 (7.9) ^b	0 ^b	Placer MVCD
Folsom SRA	2		0 ^b		Placer MVCD
Green Valley Trail, Tahoe NF	5		0 ^b		Placer MVCD
Sugar Pine Trail, Tahoe NF	3		0 ^b		Placer MVCD
Hidden Falls RP	24		0 ^b		Placer MVCD
Horseshoe Bar Preserve	23		0 ^b		Placer MVCD
Long Ravine CG, Rollins Lake Reservoir	3		0 ^b		Placer MVCD
Meadow Vista Staging Area, Placer County Park	1		0 ^b		Placer MVCD
Placer Nature Center	13		2 (9.5) ^b		Placer MVCD
Sacramento					
Mississippi Bar SRA	0	29		6 (20.7)	CDPH, VBDS
Willow Creek SRA	0	8		0	CDPH, VBDS
San Mateo					
El Corte de Madera OSP	4	1	0	0	CDPH, VBDS
Jasper Ridge	18	37	1 (5.6)	1 (2.7)	CDPH, VBDS
Windy Hill OSP	158	1	1 (0.63)	0	CDPH, VBDS
Wunderlich County Park	144	0	0		San Mateo MVCD
Santa Clara					
Henry Coe SP	0	45		15 (33.3)	CDPH, VBDS
Monte Bello OSP	104	64	1 (0.96)	4 (6.3)	CDPH, VBDS
Stanford University	0	7		0	CDPH, VBDS
Santa Cruz					
Monte Toyon	19	0	0		CDPH, VBDS
Forest of Nisene Marks SP	63	11	0	0	CDPH, VBDS
Wildler Ranch SP	138	189	5 (3.6)	18 (9.5)	CDPH, VBDS
Shasta					
Pollard Gulch CG, Shasta Trinity NF	19	3	0	0	
Sierra					
Canyon Creek Trail, Tahoe NF	7	0	0		CDPH, VBDS
Siskiyou					
Tree of Heaven CG, Klamath NF	3	0	0		CDPH, VBDS
Beaver Creek CG, Klamath NF	13	0	1 (7.7)		CDPH, VBDS
Sonoma					
Annadel SP	27	12	0 ^d	1 (8.3) ^d	M/S MVCD
Jack London SP	7	166	0 ^d	0 ^d	M/S MVCD
Sugarloaf Ridge SP	0	60		4 (6.7) ^d	M/S MVCD
Stanislaus					
Patterson	46	0	0		CDPH, VBDS
Trinity					
Stoney Creek PA, Shasta Trinity NF	17	0	0		CDPH, VBDS
Stoney Creek CG, Shasta Trinity NF	39	0	0		CDPH, VBDS
Yuba					
Bullard's Bar, Tahoe NF	81	0	1 (1.2)		CDPH, VBDS
Camptonville	15	0	0		CDPH, VBDS
Daugherty Hill Wildlife Area	0	25		0	CDPH, VBDS
Englebright Reservoir	0	1		0	CDPH, VBDS
Oregon Creek, Tahoe NF	10	0	0		CDPH, VBDS
Total	2682	1538	64 (2.4)	105 (6.8)	

^a All tested by direct fluorescent antibody test (DFA) to genus only unless otherwise noted. All ticks are *Ixodes pacificus* except where otherwise noted.

^b Tested by polymerase chain reaction (PCR) specific for *Borrelia burgdorferi*, agent of Lyme disease

^c Ticks tested from this site included multiple species of *Ixodes* ticks.

^d Tested by Real-Time Polymerase Chain Reaction (RT-PCR) specific for *Borrelia burgdorferi*

Abbreviations:

Location: NF, National Forest OSP, Open Space Preserve SP, State Park
 NP, National Park PA, Picnic Area SRA, State Recreation Area
 Laboratory: CDPH, VBDS, California Department of Public Health, Vector-Borne Disease Section
 MAD, Mosquito Abatement District
 M/S MVCD, Marin/Sonoma Mosquito & Vector Control District
 MVCD, Mosquito and Vector Control District

Borrelia spirochetes are detected in ticks by DFA, PCR, or RT-PCR assays. DFA is a generic test that detects all *Borrelia* species; PCR and RT-PCR are specific tests that identify *B. burgdorferi* (the agent of Lyme disease), *B. miyamotoi*, and *B. bissettii* (latter two of unknown human pathogenicity). All test results are shown here to demonstrate prevalence and geographic distribution of all *Borrelia* species detected in *Ixodes pacificus* ticks in 2011..

4

Mosquito-borne Disease



Mosquito-borne diseases under surveillance in California include the endemic arboviral diseases caused by West Nile virus, western equine encephalomyelitis virus, and St. Louis encephalitis virus, as well as the travel-associated diseases caused by *Plasmodium* spp. (malaria) and dengue virus. Endemic arbovirus surveillance is performed under the California Arbovirus Surveillance program, a cooperative effort of multiple state and local entities.

Human disease surveillance

West Nile virus

Serological diagnosis of human infection with West Nile virus (WNV) and other arboviruses was performed at the Viral and Rickettsial Disease Laboratory (VRDL) and 26 local county public health laboratories. Local laboratories tested for WNV using an IgM or IgG immunofluorescent assay (IFA) and/or an IgM enzyme immunoassay (EIA). Specimens with inconclusive results were forwarded to VRDL for confirmation or further testing with a plaque reduction neutralization test (PRNT). Additional WNV infections were identified through testing performed at blood donation centers.

A total of 158 symptomatic and 18 asymptomatic infections with WNV were identified in 2011, a 35% increase compared to 2009 and 2010 (Tables 6,11). Of the 158 clinical cases, 47 (30%) were classified as West Nile fever and 111 (70%) were West Nile neuroinvasive disease (i.e. encephalitis, meningitis, or acute flaccid paralysis). Case-patients were residents of 24 counties and 98 (62%) were male. Incidence was highest (4.1 cases per 100,000 persons) in Yuba County (Figure 3). The median ages for West Nile fever and neuroinvasive case-patients were 53 years (range, 22 to 79 years) and 59 years (range, 14 to 87 years), respectively. The median age of the nine WNV-associated fatalities was 58 years (range, 37 to 87 years). Dates of symptom onset ranged from June 27 – October 31, 2011.

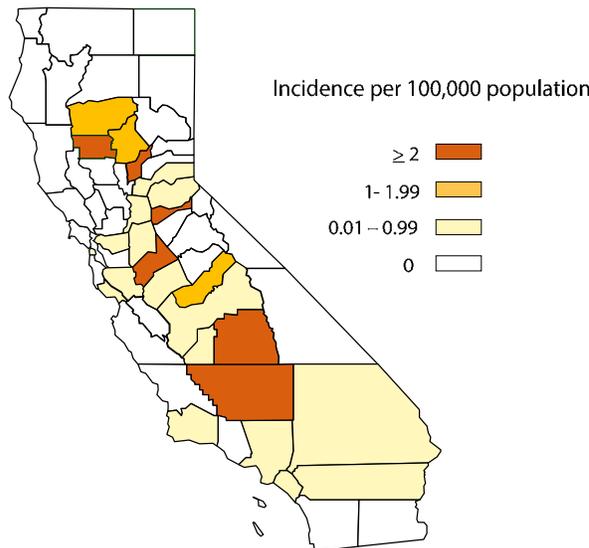


Figure 3. Incidence of human cases of West Nile virus, California 2011

Table 6. Reported WNV human cases by county of residence, California, 2007-2011

County	2007	2008	2009	2010	2011	Incidence per 100,000 person-years
Alameda	0	1	0	1	0	0.03
Alpine	0	0	0	0	0	0.00
Amador	0	0	0	0	1	0.53
Butte	16	6	2	1	3	2.53
Calaveras	0	1	0	0	0	0.44
Colusa	2	1	0	0	0	2.78
Contra Costa	3	4	5	4	3	0.36
Del Norte	0	0	0	0	0	0.00
El Dorado	0	1	1	0	1	0.33
Fresno	17	3	13	23	9	1.38
Glenn	7	1	0	2	1	7.78
Humboldt	0	0	0	0	0	0.00
Imperial	3	0	0	0	0	0.34
Inyo	0	0	0	0	0	0.00
Kern	140	2	18	15	18	4.56
Kings	7	2	3	1	1	1.83
Lake	0	0	0	0	0	0.00
Lassen	0	0	0	0	0	0.00
Los Angeles	36	156	20	4	58	0.56
Madera	2	0	1	7	2	1.58
Marin	0	0	0	0	0	0.00
Mariposa	0	0	0	0	0	0.00
Mendocino	2	0	0	0	0	0.45
Merced	4	1	4	1	1	0.85
Modoc	0	0	0	0	0	0.00
Mono	0	0	0	0	0	0.00
Monterey	0	0	1	0	0	0.05
Napa	1	0	0	0	0	0.15
Nevada	0	0	0	0	0	0.00
Orange	9	71	4	1	10	0.63
Placer	4	6	0	3	1	0.79
Plumas	0	0	0	0	0	0.00
Riverside	17	62	3	0	7	0.80
Sacramento	25	13	0	12	4	0.76
San Benito	0	0	0	0	0	0.00
San Bernardino	4	36	2	5	4	0.50
San Diego	15	35	4	0	0	0.35
San Francisco	0	0	0	1	0	0.02
San Joaquin	10	12	10	6	5	1.24
San Luis Obispo	0	0	0	0	0	0.00
San Mateo	0	0	0	0	0	0.00
Santa Barbara	0	1	0	0	1	0.09
Santa Clara	4	1	0	0	1	0.07
Santa Cruz	0	0	0	0	1	0.08
Shasta	9	1	0	0	0	1.12
Sierra	0	0	0	0	0	0.00
Siskiyou	0	0	0	0	0	0.00
Solano	1	1	0	0	0	0.10
Sonoma	1	0	0	0	0	0.04
Stanislaus	21	17	14	12	11	2.90
Sutter	3	0	0	0	0	0.63
Tehama	4	4	0	0	1	2.81
Trinity	0	0	0	0	0	0.00
Tulare	10	5	4	12	11	1.88
Tuolumne	0	0	0	0	0	0.00
Ventura	1	0	0	0	0	0.02
Yolo	2	1	2	0	0	0.50
Yuba	0	0	1	0	3	1.10
Total WNV disease	380	445	112	111	158	0.64
Asymptomatic Infections ^a	29	53	17	20	18	
Total WNV infections	409	498	129	131	176	0.72

^a WNV infections detected through blood bank screening; no associated illness reported

Other Arboviruses

No cases of western equine encephalomyelitis (WEEV) or St. Louis encephalitis (SLEV) were identified in California residents in 2011.

Malaria

One hundred twenty-six confirmed cases of malaria were reported to CDPH in 2011. Case-patients were residents of 25 California counties and 67 (53%) were male. The median age was 34 years (range, 5 to 87 years). Of 109 cases for which the *Plasmodium* species was determined, 52 were *P. falciparum*, 46 *P. vivax*, 4 *P. malariae*, 2 *P. ovale*, 4 co-infections of *P. vivax/malariae* and 1 co-infection of *P. vivax/ovale*. One hundred twenty five case-patients reported compatible travel history within past three years including travel to Africa (64), Asia (51), Central America (5), South America (2), the Caribbean (1), and Africa/Asia (2). India was the most commonly reported country of travel (33 or 26% of case-patients). Exposure for one case patient could not be identified (lost to follow up), however demographics suggested recent immigration from endemic country as most probable exposure.

Dengue

Twenty-seven cases of dengue reported to CDPH in 2011 met the case definition for a probable case of dengue fever. No cases of dengue hemorrhagic fever or dengue shock syndrome were reported. Case-patients were residents of 15 California counties and 14 (52%) were male. The median age was 38 years (range, 2 to 76 years). All case-patients reported travel to dengue-endemic areas including Asia (17), the Caribbean (7), North America (2), and Central America (1); countries of travel most frequently reported were the Philippines (8), India (5), and the United States (Puerto Rico) (5).

Mosquito surveillance

A total of 926,746 mosquitoes (32,877 pools) collected in 38 counties were tested at University of California, Center for Vectorborne Diseases (CVEC) or at one of seven local agencies by a real-time (TaqMan) reverse transcriptase-polymerase chain reaction (qRT-PCR) for SLEV, WEEV, and/or WNV viral RNA (Table 7). Four local agencies also tested an additional 8,979 mosquitoes (352 pools) for WNV using a commercial rapid assay-RAMP® (Rapid Analyte Measurement Platform, Response Biomedical Corp).

Table 7. Results of PCR testing of mosquitoes for West Nile (WNV) virus, California 2011

County	No. mosquitoes tested ^a	No. mosquito pools tested	WNV positive pools ^a	WNV Minimum Infection Rate, by PCR only ^b
Alameda	8,396	202	0	0.00
Alpine	0			
Amador	0			
Butte	6,030	124	1	0.17
Calaveras	0			
Colusa	0			
Contra Costa	10,538	309	2	0.19
Del Norte	0			
El Dorado	0			
Fresno	39,627	1,010	122	3.08
Glenn	1,100	22	0	0.00
Humboldt	0			
Imperial	1,494	34	3	2.01
Inyo	1,862	44	2	1.07
Kern	108,709	3,141	389	3.58
Kings	31,431	836	63	2.00
Lake	13,194	372	3	0.23
Lassen	0			
Los Angeles	145,732	3,952	465	3.19
Madera	1,364	47	5	3.67
Marin	4,051	450	0	0.00
Mariposa	0			
Mendocino	0			
Merced	9,844	285	11	1.12
Modoc	0			
Mono	0			
Monterey	400	8	0	0.00
Napa	10,554	237	0	0.00
Nevada	0			
Orange	40,170	1,412	91	2.27
Placer	36,605	1,937	48	1.31
Plumas	32	3	0	0.00
Riverside	152,091	4,061	56	0.37
Sacramento	70,076	5,236	381	5.44
San Benito	0			
San Bernardino	61,294	2,083	150	2.45
San Diego	906	45	1	1.10
San Francisco	387	11	0	0.00
San Joaquin	24,763	1,295	51	2.06
San Luis Obispo	1,820	42	0	0.00
San Mateo	0			
Santa Barbara	22,301	486	0	0.00
Santa Clara	4,557	381	16	3.51
Santa Cruz	0			
Shasta	12,023	389	1	0.08
Sierra	6	1	0	0.00
Siskiyou	0			
Solano	967	22	0	0.00
Sonoma	18,729	1,326	2	0.11
Stanislaus	37,404	1,079	89	2.38
Sutter	10,662	275	26	2.44
Tehama	0			
Tulare	15,835	479	82	5.18
Tuolumne	0			
Ventura	2,115	47	0	0.00
Yolo	18,421	1,149	7	0.38
Yuba	1,256	45	1	0.80
Total	926,746	32,877	2,068	2.23

^a Tested by University of California at Davis Center for Vectorborne Diseases or local mosquito/vector control agency.

^b Minimum Infection Rate = (No. pools positive/No. mosquitoes tested) X 1000

West Nile virus was detected in 2,087 mosquito pools from 26 counties; 2,068 were positive by RT-PCR and 19 were positive by RAMP only (Table 11). Statewide, the minimum infection rate (MIR) - defined as 1,000 times the number of infected mosquito pools divided by the number of mosquitoes tested - of WNV in all mosquitoes tested was 2.2; the MIR was highest (5.4) in Sacramento County (Figure 4). Since 2003, the MIR of WNV in California has ranged from a low of 0.08 (2003) to a high of 2.2 (2011). West Nile virus was identified from six *Culex* species (*Cx. erythrothorax*, *Cx. pipiens*, *Cx. quinquefasciatus*, *Cx. stigmatosoma*, *Cx. tarsalis*, *Cx. thriambus*) (Figure 4, Table 8), and two other species (*Anopheles freeborni*, *Culiseta incidens*) (Table 8). The first RT-PCR confirmed detection of WNV in mosquitoes in 2011 was from a *Cx. tarsalis* pool collected in Riverside County on February 15. The last detection of WNV in mosquitoes was from a *Cx. quinquefasciatus* pool collected in San Bernardino County on November 30. No mosquito pools were positive for SLEV or WEEV in 2011.

Chicken serosurveillance

In 2011, 40 local mosquito and vector control agencies in 34 counties maintained 204 sentinel chicken flocks (Table 9). Blood samples were collected from chickens every other week and tested for antibodies to SLEV, WNV, and WEEV by an EIA at the VBDS CDPH laboratory. Positive samples were confirmed at the VBDS laboratory by IFA and western blot, or by PRNT as needed.

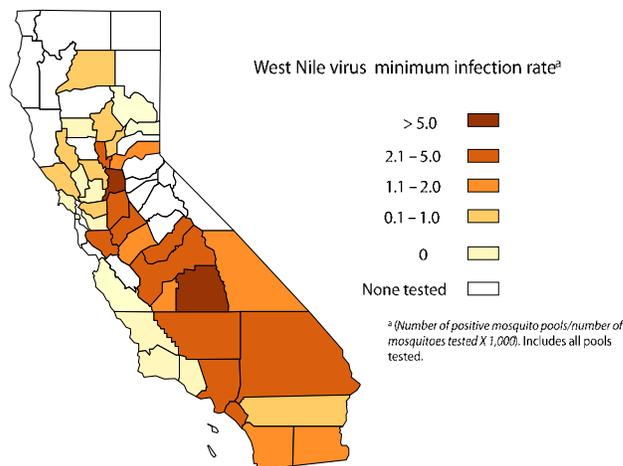


Figure 4. West Nile Virus minimum infection rate of mosquitoes, California 2011

Table 8. Results of mosquito testing by species for West Nile virus (WNV), California 2011

Mosquito Species	No. Pools Tested	No. Mosquitoes	WNV +	Minimum Infection
				Rate ^a
Culex species				
<i>Cx erythrothorax</i>	2638	101,013	6	0.06
<i>Cx pipiens</i>	7,115	122,515	400	3.26
<i>Cx quinquefasciatus</i>	9,455	311,174	1,099	3.53
<i>Cx restuans</i>	14	542	0	0.00
<i>Cx stigmatosoma</i>	939	11,443	40	3.50
<i>Cx tarsalis</i>	11,949	353,272	531	1.50
<i>Cx thriambus</i>	90	233	1	4.29
<i>unknown</i>	3	25	0	0.00
All Culex	32,203	900,217	2,077	2.31
Anopheles species				
<i>An franciscanus</i>	6	96	0	0.00
<i>An freeborni</i>	55	1,952	1	0.51
<i>An hermsi</i>	56	1,712	0	0.00
<i>An. Occidentalis</i>	1	18	0	0.00
All Anopheles	118	3,778	1	0.26
Aedes species				
<i>Ae dorsalis</i>	1	13	0	0.00
<i>Ae increpitus</i>	1	38	0	0.00
<i>Ae melaninom</i>	51	2,112	0	0.00
<i>Ae nigromaculis</i>	5	143	0	0.00
<i>Ae sierrensis</i>	1	14	0	0.00
<i>Ae squamiger</i>	5	160	0	0.00
<i>Ae. taeniorhyncus</i>	2	49	0	0.00
<i>Ae vexans</i>	27	1,099	0	0.00
<i>Ae washinoi</i>	51	2,372	0	0.00
All Aedes	144	6,000	0	0.00
Other species				
<i>Culiseta incidens</i>	495	13,982	2	0.14
<i>Culiseta inornata</i>	42	804	0	0.00
<i>Culiseta particeps</i>	42	1,770	0	0.00
<i>Coquilletidia peturbans</i>	9	374	0	0.00
<i>Unknown</i>	176	8,800	7	0.80
All other	764	25,730	9	0.35

^a Minimum Infection Rate = (No. pools positive/No. mosquitoes tested) X 1000

Out of 22,941 chicken blood samples that were tested, 391 seroconversions to WNV were detected among 72 flocks in 15 counties (Table 9). Statewide, 23.3% of sentinel chickens seroconverted to WNV. Since 2003, the percentage of WNV seroconversions in chickens has ranged from a low of 3.2% (2003) to a high of 30.4% (2005). In 2011, the first WNV seroconversions were detected in Kern County on July 7, and the last seroconversions were detected in Merced County on November 22. No sentinel chickens were positive for SLEV or WEEV in 2011.

Dead bird and tree squirrel surveillance

In 2011, the WNV hotline and website received 10,118 dead bird reports from the public in 56 counties (Table 10, Figure 5). Dead bird carcasses were tested either at CVEC by RT-PCR, or at one of 25 local agencies by RT-PCR, RAMP or VecTest (Medical Analysis Systems, Inc., Camarillo, CA). In 2010, CVEC began differentiating between acute (recent within

Table 9. Results of testing sentinel chickens for West Nile (WNV) virus, California 2011

County	No. flocks	No. chickens ^a	No. WNV positive flocks	WNV positive sera
Alameda	2	14	0	0
Alpine	0			
Amador	0			
Butte	7	77	4	20
Calaveras	1	10	0	0
Colusa	1	10	0	0
Contra Costa	5	50	0	0
Del Norte	0			
El Dorado	0			
Fresno	0			
Glenn	1	11	1	5
Humboldt	0			
Imperial	1	10	1	3
Inyo	0			
Kern	15	174	13	140
Kings	0			
Lake	2	12	0	0
Lassen	0			
Los Angeles	47	323	19	86
Madera	0			
Marin	1	6	0	0
Mariposa	0			
Mendocino	0			
Merced	7	42	4	15
Modoc	0			
Mono	0			
Monterey	2	20	0	0
Napa	0			
Nevada	2	20	0	0
Orange	0			
Placer	8	48	2	6
Plumas	0			
Riverside	22	188	9	40
Sacramento	9	69	2	7
San Benito	1	10	0	0
San Bernardino	18	120	9	42
San Diego	2	20	0	0
San Francisco	0			
San Joaquin	0			
San Luis Obispo	0			
San Mateo	1	10	0	0
Santa Barbara	5	48	0	0
Santa Clara	7	49	0	0
Santa Cruz	2	20	0	0
Shasta	7	62	0	0
Sierra	0			
Siskiyou	0			
Solano	3	36	1	1
Sonoma	4	24	0	0
Stanislaus	2	16	2	7
Sutter	4	40	3	8
Tehama	3	30	0	0
Tulare	1	10	1	7
Tuolumne	0			
Ventura	5	49	0	0
Yolo	4	28	0	0
Yuba	2	20	1	4
Total	204	1,676	72	391

^a Reflects planned standard number of chickens per flock. Actual number may vary due to mortality or replacement of seroconverted chickens.

current surveillance season) and chronic (exposed at an undeterminable time in the past) infections in WNV positive dead birds. These changes were based on research conducted by CVEC and improved testing methods. Of the 2,356 carcasses deemed suitable for testing, WNV was detected in 818 (35%) carcasses from 34 counties; 688 were reported as acute infections from 26 counties, and 130 were reported as chronic infections from 28 counties (Tables 10,11, Figure 5). Since 2003, the prevalence of WNV positive dead birds has ranged from a low of 5% (2003) to a high of 56% (2004). Of the acute infections, 591 were confirmed positive by RT-PCR, 54 by RAMP, and 43 by VecTest. In 2011, the first WNV positive dead bird was an American Crow reported from Sacramento County on February 17, and the last WNV positive dead bird was an American Crow reported from Orange County on December 29.

In 2011, 328 dead squirrels were reported through the WNV hotline; 112 carcasses were tested and WNV RNA was detected by RT-PCR in 24 (21%) carcasses from six counties (Table 11). These included 20 fox squirrels (*Sciurus niger*) and 4 eastern gray squirrels (*S. carolinensis*)

Horses

Serum or brain tissue specimens from 143 horses displaying neurological signs were tested for arboviruses at the California Animal Health & Food Safety Laboratory. West Nile virus infection was detected in 15 horses from 7 counties (Table 11). Four of the horses died or were euthanized as a result of their infection.

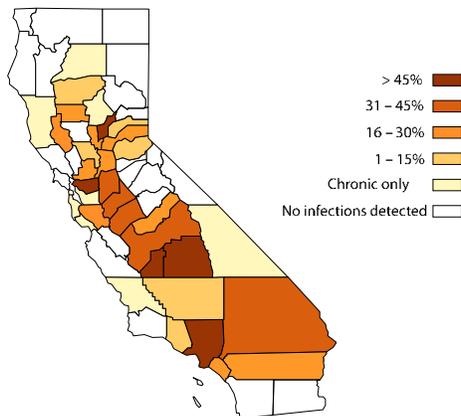


Figure 5. Prevalence of acute West Nile virus infection in dead birds, California, 2011

Table 10. Dead birds reported, tested^a, and positive for West Nile virus, California 2011

County	Reported	Tested	Positive-acute (%)	Positive-chronic (%)
Alameda	260	48	0	1 (2.1)
Alpine	0	0	0	0
Amador	18	0	0	0
Butte	222	50	0	5 (10)
Calaveras	20	1	0	0
Colusa	17	5	0	0
Contra Costa	1057	74	38 (51.4)	5 (6.8)
Del Norte	1	0	0	0
El Dorado	124	29	2 (6.9)	1 (3.4)
Fresno	334	49	15 (30.6)	3 (6.1)
Glenn	23	12	2 (16.7)	1 (8.3)
Humboldt	17	5	0	0
Imperial	1	0	0	0
Inyo	24	1	0	1 (1.0)
Kern	263	52	4 (7.7)	3 (5.8)
Kings	56	18	9 (50)	1 (5.6)
Lake	20	5	1 (20)	0
Lassen	13	1	0	0
Los Angeles	1,776	410	227 (55.4)	30 (7.3)
Madera	63	11	3 (27.3)	3 (27.3)
Marin	60	0	0	0
Mariposa	4	0	0	0
Mendocino	15	3	0	1 (33.3)
Merced	178	23	9 (39.1)	2 (8.7)
Modoc	1	1	0	0
Mono	7	1	0	0
Monterey	42	9	0	0
Napa	27	1	0	0
Nevada	57	16	1 (6.3)	1 (6.3)
Orange	193	198	50 (25.3)	1 (0.5)
Placer	215	37	10 (27)	8 (21.6)
Plumas	13	0	0	0
Riverside	208	30	7 (23.3)	3 (10)
Sacramento	1,216	441	134 (30.4)	29 (6.6)
San Benito	15	4	0	0
San Bernardino	379	107	33 (30.8)	5 (4.7)
San Diego	189	103	0	0
San Francisco	35	1	0	0
San Joaquin	366	63	27 (42.9)	10 (15.9)
San Luis Obispo	85	15	0	1 (6.7)
San Mateo	174	21	0	1 (4.8)
Santa Barbara	73	11	0	0
Santa Clara	675	185	35 (18.9)	0
Santa Cruz	72	4	0	1 25
Shasta	70	41	0	2 (4.9)
Sierra	0	0	0	0
Siskiyou	3	0	0	0
Solano	143	6	1 (16.7)	1 (16.7)
Sonoma	120	0	0	0
Stanislaus	370	65	24 (36.9)	3 (4.6)
Sutter	33	8	2 (25)	0
Tehama	50	9	1 (11.1)	0
Trinity	3	0	0	0
Tulare	315	76	42 (55.3)	4 (5.3)
Tuolumne	14	3	0	0
Ventura	178	35	1 (2.9)	3 (8.2)
Yolo	173	67	9 (13.4)	0
Yuba	38	1	1 (100)	0
Totals	10,118	2,356	688 (29.2)	130 (5.5)

^a Tested by University of California at Davis Center for Vectorborne Diseases or local mosquito/vector control agency

Table 11. Infections with West Nile virus in California, 2011

County	Humans ^a	Horses	Dead Birds	Mosquito Pools	Sentinel Chickens	Dead Squirrels
Alameda	0	0	0	0	0	1
Alpine	0	0	0	0	0	0
Amador	1	0	0	0	0	0
Butte	4	0	0	1	20	0
Calaveras	0	0	0	0	0	0
Colusa	0	0	0	0	0	0
Contra Costa	3	0	38	7	0	0
Del Norte	0	0	0	0	0	0
El Dorado	1	0	2	0	0	0
Fresno	12	5	15	123	0	0
Glenn	1	0	2	0	5	0
Humboldt	0	0	0	0	0	0
Imperial	0	0	0	3	3	0
Inyo	0	0	0	2	0	0
Kern	18	1	4	389	140	0
Kings	2	0	9	63	0	0
Lake	0	0	1	3	0	0
Lassen	0	0	0	0	0	0
Los Angeles	63	1	227	467	86	15
Madera	2	0	3	5	0	0
Marin	0	0	0	0	0	0
Mariposa	0	0	0	0	0	0
Mendocino	0	0	0	0	0	0
Merced	1	3	9	11	15	0
Modoc	0	0	0	0	0	0
Mono	0	0	0	0	0	0
Monterey	0	0	0	0	0	0
Napa	0	0	0	0	0	0
Nevada	0	0	1	0	0	0
Orange	10	0	50	91	0	1
Placer	1	2	10	48	6	0
Plumas	0	0	0	0	0	0
Riverside	10	0	7	56	40	0
Sacramento	4	0	134	381	7	3
San Benito	0	0	0	0	0	0
San Bernardino	6	0	33	150	42	0
San Diego	0	0	0	1	0	0
San Francisco	0	0	0	0	0	0
San Joaquin	6	0	27	51	0	0
San Luis Obispo	0	0	0	0	0	0
San Mateo	0	0	0	0	0	0
Santa Barbara	1	0	0	0	0	0
Santa Clara	1	0	35	16	0	1
Santa Cruz	1	0	0	0	0	0
Shasta	0	0	0	1	0	0
Sierra	0	0	0	0	0	0
Siskiyou	0	0	0	0	0	0
Solano	0	0	1	0	1	0
Sonoma	0	0	0	2	0	0
Stanislaus	11	0	24	100	7	0
Sutter	0	0	2	26	8	0
Tehama	1	0	1	0	0	0
Trinity	0	0	0	0	0	0
Tulare	13	1	42	82	7	0
Tuolumne	0	0	0	0	0	0
Ventura	0	0	1	0	0	0
Yolo	0	2	9	7	0	3
Yuba	3	0	1	1	4	0
State Totals	176	15	688	2,087	391	24

^aIncludes asymptomatic infections detected through blood bank screening

The statewide WNV minimum infection rate in mosquitoes was higher in 2011 than in any other year since surveillance began for WNV in California in 2000.

5

Other Vectors and Public Health Pests



The Vector-Borne Disease Section provides assistance to and coordination between local and state agencies for the management of other vectors and public health pests including Africanized honey bees, red imported fire ants, scorpions, lice, bed bugs, and scabies mites. The Vector-Borne Disease Section may also perform active surveillance, special projects, and intervention for these pests when necessary.

Red imported fire ants

The Vector-Borne Disease Section (VBDS) continues to provide consultation and serve as liaison to the California Department of Food and Agriculture (CDFA), county agriculture departments, and local vector control agencies that conduct surveillance and control programs for red imported fire ants (RIFA). In southern California, CDFA continues to monitor limited RIFA infestations in San Bernardino, western Riverside, and San Diego Counties. Enforcement of RIFA quarantine regulations remain a high priority within the statewide CDFA RIFA program.

The Coachella Valley Mosquito and Vector Control District reported that over 22,000 acres were treated for RIFA infestation within their district in 2011. Treatments were conducted in 14 communities on residential, country club, golf course, and public land sites. Sixty-seven square miles in the Coachella Valley (Riverside County) remain under CDFA quarantine guidelines. The Orange County Vector Control District Fire Ant Program conducted or contracted out over 4,900 treatments involving 2,513 large area sites and over 22,000 residential sites. Large area sites are defined as all other properties other than single family or agriculture sites. Agricultural sites continue to follow CDFA quarantine compliance procedures. Additionally, over 43,000 acres and 24,000 residential properties were surveyed for RIFA activity during 2011. Both the Coachella Valley and Orange County RIFA programs continue to evaluate the effectiveness of registered fire ant control products as well as potential bio-control agents that may be effective in the control of RIFA.

Lice, bed bugs, and scabies

VBDS continued a cooperative project on urban public health pests and associated diseases with San Francisco Project Homeless Connect and the U.S. Centers for Disease Control and Prevention (CDC), Fort Collins, CO. In 2011, VBDS set up a booth at three San Francisco Project Homeless Connect events to educate homeless clients and their providers about urban public health pests, offer head, body, and pubic louse checks, and provide consultation on bed bug and scabies complaints. Eighty clients received consultations at the booth. One hundred thirty-one body lice were collected from seven clients, and three head lice were collected from four clients. Consultation was offered to 18 people with bed bug bites or complaints. Clients with lice were offered free insecticidal lotions through the pharmacy division of the event. Clean donated clothing was provided to infested clients.

VBDS developed "What you need to know about bed bugs" wallet cards to help with the inspection of hotel rooms for bed bugs by both providing tips on bed bug biology and inspection and by physically using the card to dislodge potential bugs from behind the wall-mounted headboard of the bed.

Chagas disease (American trypanosomiasis)

Following a presentation by VBDS to USFS personnel on Chagas disease (caused by the protozoal parasite, *Trypanosoma cruzi*), VBDS was contacted to investigate a report of a large number of western

conenose bugs (*Triatoma protracta*, a vector of Chagas disease), near and around residences in Calaveras County. These residences were located approximately 40 miles north of where the only locally-acquired case of Chagas disease has been documented in California in 1982. Seventeen western conenose bugs were forwarded to CDC for *T. cruzi* testing; 13 (76%) tested positive. Additionally, 27 live western conenose bugs were subsequently collected by VBDS from one of the Calaveras County properties and provided to CDC to start and maintain a colony for disease and vector studies from a known California location.

One locally-acquired case of Chagas disease in California occurred near Lake Don Pedro, Tuolumne County in 1982. Western conenose bugs (*Triatoma protracta*) infected with *Trypanosoma cruzi* were found near the case-patient's home; evidence of trypanosomes was found in local squirrels and dogs. Antibody to *Trypanosoma cruzi* was detected in six of 237 (2.5 %) people living near the case-patient, in 12 of 1,706 (0.7 %) of individuals living in a community 20 miles northeast of the case-patient's home, but in only 1 of 637 (0.2 %) blood donors from the San Francisco Bay area. (American Journal of Public Health, 1985. 75 [4]: 366-369.)

6

U.S. Forest Service Cost-Share Agreement



In 1992, the Vector-Borne Disease Section entered into a Challenge Cost-Share Agreement with the Pacific Southwest Region of the United States Department of Agriculture Forest Service to maintain cooperative surveillance and control of vector-borne diseases within the National Forests. This report highlights some of the vector-borne disease monitoring, risk assessment, risk reduction, and education of personnel, concessionaires, and the public that the Vector-Borne Disease Section and local collaborators conducted at the 18 National Forests in California in 2011.

Angeles National Forest

Seventeen carnivores from lands adjacent to the Forest were tested for antibodies to *Yersinia pestis*, the causative agent of plague; none was positive. In addition, none of 235 California ground squirrels (*Otospermophilus beecheyi*) tested for plague by the Los Angeles County Department of Public Health Vector Control and Management Program, was positive for serum antibodies to *Y. pestis*. The Los Angeles County Agricultural Commissioner's Office conducted general flea control at 57 Forest recreational sites.

VBDS biologists met with the Santa Clara/Mojave Rivers District Ranger and staff to examine methods to avoid campground closures due to vector-borne disease transmission risk. VBDS continues to assist Table Mountain Campground concessionaire with options for ground squirrel population suppression. Staff visited Big Pine Visitor Center and discussed vector-borne diseases in the area and supplied educational brochures on plague, hantavirus, and West Nile virus for Forest users.

Cleveland National Forest

Routine monitoring for tick and rodent-borne diseases and plague was conducted by VBDS in collaboration with San Diego County Department of Environmental Health, Vector Surveillance and Control Program, at select locations throughout the Forest. Nineteen *Dermacentor occidentalis* ticks collected from Palomar Divide Truck Trail tested negative for evidence of tularemia. Hantavirus rodent surveillance conducted at the El Cariso Fire Station and a nearby office yielded no Sin Nombre (SNV) virus (causative agent of hantavirus cardiopulmonary syndrome) positive samples; however, County Environmental Health surveillance activities in sylvatic areas near the Forest continue to show hantavirus seroreactive mice. None of the 47 rodents from USFS lands tested was positive for antibodies to *Y. pestis*. Upon request, VBDS staff provided the Forest Safety Officer with information regarding Valley Fever (coccidioidomycosis) infections.

Eldorado National Forest

None of four nymphal *Ixodes pacificus* ticks tested from Fleming Meadow was positive for *Borrelia* spirochetes. VBDS staff visited numerous recreational sites, campgrounds and Forest facilities and provided educational materials on vector-borne disease prevention and control to staff, concessionaires, and visitors to the Forest. Trailheads and campground bulletin boards were posted with plague caution signs and concessionaires were reminded of the important role they play in monitoring for plague epizootics on USFS recreational lands. VBDS shot film footage at facilities on the Forest for use in future safety and disease prevention videos.

Today, most TBRF infections occur above 4,000 feet in the Lake Tahoe and eastern Sierra Nevada regions, and are most often associated with homes and structures that harbor sylvatic rodent nests. In the 1930s, the San Bernardino Mountains were the most common human exposure site for tick-borne relapsing fever (TBRF). Soft ticks (*Ornithodoros hermsi*) collected from the Big Bear Lake area were used in infection experiments to help researchers identify the bacterial agent (*Borrelia hermsii*) that causes TBRF.

Inyo National Forest

VBDS staff continued to monitor for evidence of new rodent plague infections near a localized plague epizootic discovered near Mammoth Lakes in 2009. None of the 24 rodents tested from Twin Lakes and New Shady Rest Campgrounds was positive for antibodies to *Y. pestis*. Biologists conducted visual plague assessments and spoke with concessionaires regarding hantavirus and plague at campgrounds in Reds Meadow and Mammoth Lakes areas, as well as Four Jeffrey Campground. VBDS checked several camping areas for the presence of ticks. Safety and disease prevention talks were given to Forest personnel at the Mammoth Lakes and Mt. Whitney Ranger Districts and the Forest Supervisor's Office. Educational brochures on the most common vector-borne diseases encountered in California were supplied to the Forest Safety Officer.

Klamath National Forest

VBDS staff collected 30 adult *Ixodes pacificus* and 117 adult *Dermacentor* spp. ticks from Beaver Creek and Tree of Heaven Campgrounds. One of 16 (6.3%) *I. pacificus* ticks tested was positive by direct fluorescent antibody (DFA) for *Borrelia* species. None of 13 carnivores tested from lands adjacent to the Forest was positive for *Y. pestis*. Staff also discussed future safety training opportunities and provided the Forest Safety Officer with vector-borne disease prevention and safety brochures and information.

Lake Tahoe Basin Management Unit

Plague and hantavirus rodent surveillance was conducted at Tallac Historical Site. None of the 24 rodents tested was positive for serum antibodies to *Y. pestis*. One of 11 (9%) deer mice (*Peromyscus maniculatus*) tested positive for serum antibody to SNV. Biologists discussed vector-borne disease safety with concessionaires at Meeks Bay Campground and posted plague caution signage to ensure public awareness. Staff also shot video footage for use in vector-borne disease prevention occupational health training videos.

Lassen National Forest

Educational materials on vector-borne disease prevention and control were provided to the supervising concessionaire for Hat Creek Ranger District campgrounds, with adequate supplies for distribution to campground concessionaires. VBDS biologists also distributed educational materials and discussed vector-borne disease issues with staff at Eagle Lake Ranger District.

Los Padres National Forest

VBDS staff conducted a visual plague risk assessment at Kirk Campground and estimated risk to be low due to very low density of ground squirrels. None of 17 carnivores from lands adjacent to the Forest tested positive for antibodies to *Y. pestis*.

Mendocino National Forest

Adult tick surveillance conducted at Camp Ellendale yielded 28 *I. pacificus* and 23 *D. occidentalis* adult ticks. Eleven adult *I. pacificus* tested negative by DFA for *Borrelia* spirochetes. No ticks were collected during surveillance activities at Middle Fork Campground; however, staff noted ground squirrel numbers were above

preferred densities. Biologists conducted a hantavirus risk assessment at Alder Springs Fire Station and found low risk based on facility condition, surrounding habitat, and high hantavirus prevention awareness among Station personnel. None of 11 *Peromyscus* mice tested positive for serum antibodies to SNV. None of the four carnivores from lands adjacent to the Forest tested positive for antibodies to *Y. pestis*. Vector-borne disease prevention and safety brochures were distributed to Grindstone Ranger District personnel.

Modoc National Forest

VBDS staff conducted plague and rodent-borne disease surveillance at campgrounds on the Big Valley and Warner Mountain Ranger Districts. Two of 40 (5%) carnivores sampled from lands adjacent to the Forest were positive for plague antibodies. A visual risk assessment at Lower Rush Creek Campground determined plague risk to be low, and none of nine rodents sampled for plague at Patterson Campground and Guard Station and Stough Reservoir Campground was positive for antibodies to *Y. pestis*. Serum antibody to SNV was detected in five of 11 (45.5%) deer mice and one of three (33.3%) deer mice at Patterson and Stough Reservoir campgrounds, respectively. Trapping results were discussed with District staff. Biologists also discussed vector-borne disease risks and provided Blue Lake Campground's host with safety and disease prevention brochures.

Plumas National Forest

Biologists conducted vector-borne disease risk assessments and direct surveillance at several locations. Black Mountain Fire Lookout was evaluated for hantavirus risk to visitors and overnight users. Verbal recommendations to District Recreation staff emphasized need for more extensive rodent exclusion measures around the base of the lookout. A plague positive cat from a residence close to USFS lands prompted direct surveillance at Crocker and Grizzly Campgrounds. None of the 61 rodents tested was positive for antibodies to *Y. pestis*. In addition, none of 17 other carnivores sampled for plague was positive for *Y. pestis*. However, one of four (25%) deer mice was positive for serum antibody to SNV. Biologists also posted a plague caution sign at Strawberry Campground.

San Bernardino National Forest

In collaboration with staff from the Riverside County Department of Environmental Health Vector Control Program and San Bernardino County Mosquito and Vector Control Program, VBDS Biologists conducted routine risk assessments and surveillance for ticks, plague, and rodent-borne diseases at numerous locations throughout the year. None of the 140 rodents tested was positive for serum antibodies to *Y. pestis*. None of 15 mice tested was positive for serum antibodies to SNV. Ticks were collected, but not tested, from trails, campgrounds, and facilities (Table 12). VBDS staff gave safety presentations to personnel on the Front Country and Mountaintop Ranger Districts. Disease prevention and safety brochures and materials were distributed to District staff and concessionaires visited throughout the season. Small rodent trapping safety protocols were also discussed with the Mountaintop District Biologist.

Sequoia National Forest

VBDS staff conducted a hantavirus risk assessment at the Central California Interagency Communications Center (CCICC) in Porterville at the request of the R5 Safety office. Final report findings included recommendations for rodent exclusion and proper food storage. Recommendations were discussed with the Safety Officer and Forest leadership. Hantavirus risk assessment and surveillance at the Kern River Ranger District found one of eight (12.5%) deer mice positive for antibodies to SNV. The importance of rodent exclusion and proper food storage was emphasized to District personnel. All 18 rodent plague samples collected from Live Oak Campground and the Ranger District offices were negative for serum antibodies to *Y. pestis*. Thirty carnivore samples from lands adjacent to the Forest were also negative for antibodies to *Y. pestis* infection.

Shasta-Trinity National Forest

Tick surveillance was conducted at numerous recreation locations. Test results on *I. pacificus* ticks submitted for *Borrelia* testing found none of 78 ticks infected. One carnivore from lands adjacent to the Forest was

negative for evidence of plague. A visual hantavirus risk assessment was conducted at the Ash Creek Fire Station; risk was determined to be low because of limited opportunity for small rodent ingress into the facility. VBDS Biologists provided education and disease prevention materials to staff at Big Bar, Shasta Lake, Mt. Shasta, McCloud and Weaverville Ranger Districts, and discussed vector-borne disease issues with available District staff.

Sierra National Forest

VBDS staff flagged for adult ticks at Indian Flat Day Use Area on the North Fork Ranger District. No ticks were collected. Also, none of the 17 carnivores sampled from lands adjacent to the Forest was positive for evidence of plague.

Six Rivers National Forest

Tick surveillance was conducted at Peach Creek Campground; 1 of 11 adult *I. pacificus* ticks tested positive for *Borrelia* spirochetes by DFA. VBDS staff gave a safety presentation to Lower Trinity Ranger District staff and distributed disease prevention and safety brochures and materials to District personnel. A VBDS Biologist discussed the results of hantavirus surveillance conducted in 2010 with the Mad River Ranger District safety representative.

Stanislaus National Forest

VBDS Biologists visited numerous recreation sites throughout the Forest and distributed vector-borne disease prevention and safety information materials and brochures to Ranger District Offices and campground and other Forest concessionaires. Staff ensured campgrounds, trailheads, and other recreational sites were posted with plague caution signs. Presentations covering fly sanitation, hantavirus, Lyme disease and other tick-borne diseases were given to Forest and concessionaire personnel. A facility assessment was conducted upon request regarding Yosemite's Sachse cabin, used by Forest personnel and recognized for an association with tick-borne relapsing fever cases. Disease prevention recommendations were given to the Forest staff present.

Tahoe National Forest

VBDS Biologists conducted tick, plague, and rodent-borne disease surveillance activities at select campgrounds and Forest facilities. One *I. pacificus* tick of 81 (1.2%) collected at Bullard's Bar tested positive by DFA for *Borrelia* spp. An additional 32 *I. pacificus* collected from other locations were negative for *Borrelia* spirochetes by DFA. None of the 87 rodents trapped and tested was positive for serum antibodies to *Y. pestis*. One deer mouse from Stampede Fire Station was positive for serum antibodies to SNV. Test results were transmitted to respective Ranger Districts and safety personnel. VBDS staff also visited campgrounds and concessionaires to distribute vector-borne disease educational and safety brochures and discuss vector-borne disease risk. Staff ensured campgrounds were posted with plague caution placards.

Humboldt-Toiyabe (R4)

VBDS visually surveyed campgrounds for evidence of plague epizootics, posted plague caution signs, and provided campground concessionaires with vector-borne disease prevention brochures.

Other R5 Activities

VBDS staff responded to requests for information and safety materials from Region to District level. In southern California, the detection of the exotic Asian tiger mosquito (*Aedes albopictus*) in the Los Angeles Basin was of concern. Information on coccidioidomycosis was also provided to the R5 Safety Manager. Pesticide usage for flea control on California's National Forests was communicated to the Region 5 Office. VBDS leadership and staff met with USFS R5 personnel to coordinate and communicate goals and ideas to strengthen the Cost-Share Agreement.

Table 12. Testing results for selected vector-borne disease agents in U.S. National Forests, California 2011

National Forest	Hantavirus (<i>Peromyscus mice</i>) ^a		<i>Yersinia pestis</i> (rodents)		<i>Yersinia pestis</i> (carnivores) ^a		<i>Borrelia</i> spp. (<i>Ixodes</i> ticks)	
	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested
Angeles			0	235 ^b	0	17		
Cleveland	1	10 ^b	0	47				
Eldorado							0	4
Inyo			0	24				
Klamath					0	13	1	16
Lake Tahoe BMU	1	11	0	24				
Los Padres					0	17		
Mendocino	0	11			0	4	0	11
Modoc	6	14	0	9	2	40		
Plumas	1	4	0	61	1	18		
San Bernardino	0	15	0	140				
Sequoia	1	8	0	18	0	30		
Shasta-Trinity					0	1	0	78
Sierra					0	17		
Six Rivers							0	10
Tahoe			1	87	0	6	1	113
Total, all forests	10	73	1	410	3	163	2	232

^a Carnivore specimens taken directly from or adjacent to USFS lands. Because of the broad home range of some carnivores, results obtained can be inferred to a large area, including both USFS and adjacent lands.

^b Some testing conducted by county public health laboratories.

7

Vector Control Technician Certification Program



The California Health and Safety Code, § 106925, requires every government agency employee who handles, applies, or supervises the use of any pesticide for public health purposes to be certified by the California Department of Public Health. The Vector-Borne Disease Section administers the Public Health Vector Control Technician certification examination twice each year (May and November) to certify the competence of government agency personnel to control vectors for the health and safety of the public.

To become certified in a control category, applicants must pass the Core section and at least one Specialty section of the examination. Each applicant to the examination pays a fee for each section requested on the application. The Core section consists of questions about the safe and effective use of pesticides. Specialty sections of the examination include the Biology and Control of Mosquitoes in California, Arthropods of Public Health Significance in California, and Vertebrates of Public Health Importance in California (Table 13). Successful examinees are issued a gold certification card that is valid for up to two years in the qualified categories specified on the card. To maintain full certification status in subsequent two-year cycles, Certified Technicians must pay annual renewal fees and fulfill minimum continuing education requirements. Successful examinees who elect not to participate in continuing education are issued parchment certificates in the categories in which they qualified. These Certified Technicians (Limited) employees may use pesticides only under the direct supervision of a Certified Technician.

Over 78 continuing education programs were provided to Vector Control Technicians in 2011. VBDS staff presented at over 18 of these programs.

Table 13. Results of certification examinations administered in 2011.		
Exam section	No. Exams Given	No. Passed (%)
Core	86	54 (63)
Mosquito Control	93	53 (57)
Terrestrial Invertebrate Control	59	42 (71)
Vertebrate Vector Control	51	37 (72)
Totals	289	186 (64)

Through 2011, 1,211 Vector Control Technicians employed at 116 local public health agencies and CDPH held 2,958 certificates (Table 14). The agencies include special districts, departments of county government, departments of city government, the University of California, and CDPH.

Table 14. Vector Control Technician certificates in effect as of December 2011

Certification Category	No. Certificates		
	Full Status	Limited Status	Total
Mosquito Control	825	250	1,075
Terrestrial Invertebrate Vector Control	674	214	888
Vertebrate Vector Control	683	312	995
Totals	2,182	776	2,958

Table 15 compares the certification status among employees of Mosquito and Vector Control Association of California (MVCAC) corporate member agencies and non-MVCAC member agencies

Table 15 Certification status among MVCAC corporate member agencies and non-MVCAC agencies.

Agency Type	Certified Technicians		Certified Technicians (Limited)	
	No. Agencies	No. Employees	No. Agencies	No. Employees
MVCAC	66	777	19	106
Non-MVCAC	16	61	37	267
Totals	82	838	56	373

In 2011, CDPH developed a new Certification and Training database website that combined the CDPH database and the MVCAC intranets website. The new site allows Vector Control Technicians to view their certification records and the approved Vector Control Technician continuing education courses. This website is <http://ce.calsurv.org>.

All training manuals, as well as practice questions and the Continuing Education Guide, are posted on the website dedicated to the Vector Control Technician Program: <http://www.cdph.ca.gov/certlic/occupations/Pages/VectorControlTechnicianProgram.aspx>.

8

Outreach, Public Information Materials, Publications



Vector-Borne Disease Section staff present information on vector-borne diseases at scientific conferences, continuing education workshops, university courses, and training sessions. Research projects in which Vector-Borne Disease Section staff were a principal or collaborating investigator are published in the peer-reviewed scientific literature.

Presentations

In 2011, Vector-Borne Disease (VBDS) section staff gave 46 presentations and training sessions as shown in Table 16, page 28.

Public Information Materials

In 2011, new public education materials as listed below were created and distributed. In addition, eight documents were revised or updated. All public education materials are available from the VBDS webpage (<http://www.cdph.ca.gov/programs/vbds/Pages/default.aspx>).

- California Rodent-borne Disease Report, Spring 2011; Winter 2011
- Guidelines for Local Plague Surveillance and Control Programs in California
- California Plague Report Winter 2010; Summer 2011; Winter 2011
- Western Black-legged Tick (*Ixodes pacificus*) Collection Locations, California (map)
- Epidemiology and Prevention of Tick-borne Diseases of Interest in California (website presentation for physicians)
- Tick-bite Prevention Public Service Announcements (website videos)
- Dengue Fact Sheet
- Bed Bugs in California: Local Agency Services and Response

The two winning videos in the Tick-bite Prevention Public Service Announcement contest are posted on the CDPH YouTube website.

Table 16: Presentations provided by Vector-Borne Disease Section staff, 2011

Subject Area	Number of Talks	Audiences
Vector-Borne Diseases, General	20	PAPA; Vertebrate Pest Control; Western University of Health Sciences; Stanford University; UC Davis; UC Berkeley; MVCAC; Association of Sacramento Area Planners; Lassen County PH; Boy Scouts of America; USFS
Flea-Borne Diseases	2	CDPH; Lassen County PH
Tick-Borne Diseases	4	Palm Hospital; Sebastapol; UC Davis; Lassen County Public Health; MVCAC; USFS
Mosquito-Borne Diseases	7	MVCAC; Lassen County PH; UC Davis; Shasta MVCD
Rodent-Borne Diseases	2	USFS
Other Vectors and Public Health Pests	8	Alameda County VCSD; MVCAC; West Valley MVCD; Riverside County DEH; UC Davis; California Environmental Health Association
Miscellaneous	3	AMCA; ESA; MVCAC

Abbreviations:

- AMCA: American Mosquito Control Association
- CDPH: California Department of Public Health
- DEH: Department of Environmental Health
- ESA: Entomological Society of America
- MVCAC: Mosquito and Vector Control Association of California
- MVCD: Mosquito and Vector Control District
- PAPA: Pest Control Applicators Professional Association
- PH: Public Health
- UC: University of California
- USFS: United States Forest Service
- VCSD: Vector Control Services District

Publications

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Harbison JE, **Metzger ME, Hu R**. 2011. Seasonal oviposition of *Culex quinquefasciatus* in proprietary below-ground stormwater treatment systems in an urban area of southern California. *Journal of Vector Ecology*. 36: 224-226.

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Padgett KA, Bonilla DL. 2011. Novel exposure sites for nymphal *Ixodes pacificus* within picnic areas. *Ticks and Tick-Borne Diseases*. 2: 191-195.

Pakingan MJ, Kjemtrup A, Koehler J, **Kramer V, Bonilla D**. 2011. Trench fever re-emergence in the "Urban Jungle." *Infectious Disease News*. 24:12. 5-6.

Wright SA, **Tucker JR**, Donohue AM, Castro MB, Kelly KL, **Novak MG**, Macedo PA. 2011. Avian hosts of *Ixodes pacificus* (Acari: Ixodidae) and detection of *Borrelia burgdorferi* in larvae feeding on Oregon junco. *Journal of Medical Entomology*. 48(4): 852-859.

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