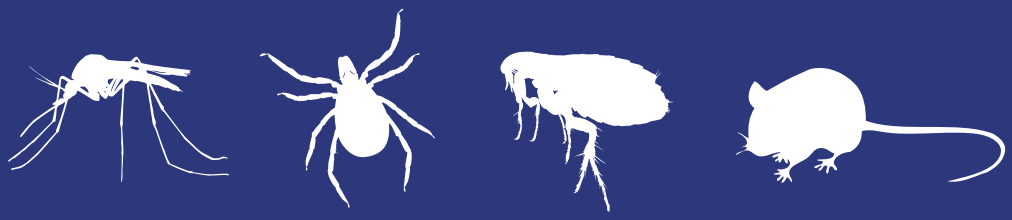
California Department of Public Health

Vector-Borne Disease Section

Annual Report

2024



CDPH

California Department of Public Health

2024

ANNUAL REPORT

VECTOR-BORNE DISEASE SECTION

INFECTIOUS DISEASES BRANCH

DIVISION OF COMMUNICABLE DISEASE CONTROL

CENTER FOR INFECTIOUS DISEASES

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

Gavin Newsom
Governor
State of California

CalHHS
California Health & Human Services Agency

CDPH
California Department of Public Health

Contents

Preface iii

Acknowledgements iv

Suggested Citations vi

Program Overview vii

Chapters

1	Mosquito-borne Diseases	1
2	Tick-borne Diseases	9
3	Flea-borne Diseases	16
4	Rodent-borne Diseases	20
5	Vector Control Technician Certification Program	24
6	Public Information, Scientific Publications	26

Preface

I am pleased to present to you the 2024 Annual Report for the Vector-Borne Disease Section (VBDS) of the California Department of Public Health (CDPH). VBDS staff conducted prevention, surveillance, and control of existing and emerging vectors and vector-borne diseases throughout California in 2024.

In 2024, West Nile virus (WNV) activity was widespread, with activity reported from 32 (55%) of 58 counties. Of the 131 human cases reported from 24 counties, 79% were the severe neuroinvasive form of the disease and there were 12 fatalities. The number of human cases was lower than the preceding five-year average and considerably lower than in 2023 when 433 cases were reported. Numbers of WNV positive mosquitoes, dead birds, and horses were also lower than the preceding years. Although there was a decline in WNV activity in 2024, West Nile continues to pose the greatest vector-borne disease threat in California, with over 8,200 cases (406 fatal) reported since 2003. In addition to WNV activity, St. Louis encephalitis virus (SLEV) activity was detected in five counties, but no human cases were reported. This is the first year that no SLEV cases were reported since this virus reemerged in 2015.

Eighteen locally transmitted cases of dengue were identified in 2024 from three counties: Los Angeles (14), San Diego (3), and San Bernardino (1). This marked the second year in which locally acquired cases of dengue were detected in California; two cases were identified in 2023. The increase in local transmission stemmed from elevated dengue virus transmission worldwide, particularly in Latin America. There were 720 travel-associated human cases of dengue reported in California, more than double the prior peak of 267 in 2019. In addition, chikungunya (43) and Zika (8) cases were reported in 2024. *Aedes aegypti* (yellow fever mosquito), the primary vector of dengue, chikungunya, and Zika viruses, is now well established in 26 California counties, whereas *Aedes albopictus* (Asian tiger mosquito), also a vector of these diseases, is found in just two counties, a reduction from five counties with reported infestations in 2023.

In 2024, 246 human cases of flea-borne typhus, caused by *Rickettsia typhi*, were reported; 85% of the case-patients required hospitalization and two were fatal. Typhus is considered endemic in parts of southern California. Plague activity was detected in rodents or carnivores from nine counties (Alpine, El Dorado, Inyo, Lassen, Mariposa, Mono, Plumas, Sierra, Siskiyou) in 2024, prompting enhanced outreach. Since 1980, hantavirus infection has been diagnosed in 93 California residents, with most cases exposed to Sin Nombre virus (SNV) in the interior mountain ranges of the state or eastern Sierra Nevada. There were two human cases (1 fatal) reported in 2024 with likely exposure in their counties of residence (Los Angeles and Sierra); SNV antibody-positive deer mice were found in 13 of 15 counties sampled.

Human cases of six tick-borne diseases were reported in California in 2024. Reports of Lyme disease (96) decreased slightly relative to 2023. Although Lyme disease is the most commonly reported tick-borne disease in California, there were also cases of soft tick relapsing fever (12), anaplasmosis (12), Rocky Mountain spotted fever (8), babesiosis (7), and ehrlichiosis (5). Of the 12 soft tick relapsing fever cases (formerly termed tick-borne relapsing fever), several were associated with unusual exposure sites, such as a tree house, glamping at 2,000 ft elevation, and camping near rodent burrows. In 2024, VBDS and collaborating agencies collected and tested thousands of ticks throughout California, including over 14,000 *Ixodes pacificus* (western blacklegged tick) from 38 counties, to aid in identifying areas at highest risk of tick-borne disease transmission.

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 optimize the health and well-being of all Californians.

Vicki L. Kramer, PhD, Chief
Vector-Borne Disease Section

Acknowledgements

The California Department of Public Health, 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 of the Section's key collaborators in 2024 are listed here.

Mosquito-borne Diseases

California Department of Fish and Wildlife (CDFW); University of California Davis Arbovirus Research and Training (DART) Laboratory; Mosquito and Vector Control Association of California; participating local health departments, physicians, and veterinarians, and local mosquito and vector control agencies.

Tick-borne Diseases

Alameda County Vector Control Service District (VCSD); Butte County Mosquito and Vector Control District (MVCD); CDFW; Contra Costa MVCD; University of California DART Laboratory; Delta MVCD; Imperial County Public Health Department; Lake County Vector Control District (VCD); Los Angeles County West MVCD; Marin County Health and Human Services; Marin-Sonoma MVCD; Mosquito and Vector Management District of Santa Barbara County; Napa County Mosquito Abatement District; Northwest MVCD; National Park Service (NPS); Nevada County Environmental Health; Orange County MVCD; Placer County MVCD; Sacramento-Yolo County MVCD; San Bernardino County Vector Control Program (VCP); San Diego County VCP; San Mateo County MVCD; Santa Clara County VCD; Santa Cruz County MVCD; Shasta MVCD; Sutter-Yuba MVCD; Ventura County Environmental Health Division.

Flea-borne Diseases

Alameda County VCSD; CDFW; El Dorado County VCP; Los Angeles County Vector Management Program; NPS; San Diego County VCP; San Mateo County MVCD; Sierra County Environmental Health Department; United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services.

Rodent-borne Diseases

Alameda County VCSD; Museum of Vertebrate Zoology at University of California Berkeley; California Department of Parks and Recreation; California State Park Systems; El Dorado County VCP; NPS; Orange County MVCD; San Bernardino County VCP; San Diego County VCP; University of California Davis School of Veterinary Medicine, Department of Veterinary Medicine and Epidemiology; West Valley MVCD.

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Suggested Citations

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California Department of Public Health. Vector-Borne Disease Section Annual Report, 2024. Kjemtrup, AM and Kramer, V. editors. Sacramento, California, 2025. pp 1-29.
https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/VBDSAnnualReports.aspx

Chapters

Many staff from the Vector-Borne Disease Section contribute to each chapter of the Annual Report; the lead author(s) for each chapter is listed below.

1 Mosquito-borne Diseases
Romo, H; Danforth, ME and Metzger, M. Chapter 1: Mosquito-borne Diseases. In: Vector-Borne Disease Section Annual Report, 2024. California Department of Public Health, Sacramento, California, 2025. pp 1-8.

2 Tick-borne Diseases
Saunders, M and Kjemtrup, A. Chapter 2: Tick-borne Diseases. In: Vector-Borne Disease Section Annual Report, 2024. California Department of Public Health, Sacramento, California, 2025. pp 9-15.

3 Flea-borne Diseases
Hacker, G; Metzger, M; Novak, M and Kjemtrup, A. Chapter 3: Flea-borne Diseases. In: Vector-Borne Disease Section Annual Report, 2024. California Department of Public Health, Sacramento, California, 2025. pp 16-19.

4 Rodent-borne Diseases
Jackson, B; Lund, A and Kjemtrup, A. Chapter4: Rodent-borne Diseases. In: Vector-Borne Disease Section Annual Report, 2024. California Department of Public Health, Sacramento, California, 2025. pp 20-23.

5 Vector Control Technician Certification Program
Niemela, M. Chapter 5: Vector Control Technician Certification Program. In: Vector-Borne Disease Section Annual Report, 2024. California Department of Public Health, Sacramento, California, 2025. pp 24-25.

6 Public Information, Scientific Publications
Nicolici, A and Kjemtrup, A. Chapter 6: Public Information, Scientific Publications. In: Vector-Borne Disease Section Annual Report, 2024. California Department of Public Health, Sacramento, California, 2025. pp 26-29.

Program Overview

The mission of the California Department of Public Health, Vector-Borne Disease Section (CDPH-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 (HSC) 116100-116108, 116110-116112; 116120; 116130; and 116180]. CDPH-VBDS provides leadership, information, and consultation on vector-borne diseases and vectors to the public and agencies engaged in disease prevention and vector control. CDPH-VBDS staff, located in three regional offices and headquartered in Sacramento, provide the following services:

- Develop and implement statewide vector-borne disease prevention, surveillance, 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 vector-borne diseases and vectors, such as West Nile virus, dengue, Zika, chikungunya, and invasive *Aedes* mosquitoes
- Conduct or coordinate emergency vector control when disease outbreaks occur
- Provide laboratory testing for vector-borne disease agents in arthropods and vertebrates
- Advise local agencies on public health issues related to vector-borne diseases
- Advise local agencies on regulatory issues pertaining to mosquito and other vector control
- Provide information, training, and educational materials to governmental agencies, the medical community, and the public
- Oversee a Cooperative Agreement (HSC 116180) between CDPH and local vector control agencies for pesticide applications
- Oversee the Vector Control Technician Certification and Continuing Education programs (HSC 116110(d))
- Provide consultation on issues related to the management of ticks, bed bugs, head lice, flies, and other arthropods of public health importance
- 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 for restricted-use public health pesticides

1 Mosquito-borne Diseases

Mosquito-borne diseases under surveillance in California include the endemic arboviral diseases caused by West Nile virus, St. Louis encephalitis virus, and western equine encephalitis virus, as well as predominantly travel-associated diseases caused by *Plasmodium* spp. (malaria), dengue, chikungunya, and Zika viruses. The California Department of Public Health, Vector-Borne Disease Section monitors and consults with local agencies regarding invasive mosquito species including *Aedes aegypti* (yellow fever mosquito) and *Aedes albopictus* (Asian tiger mosquito). 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 California Department of Public Health (CDPH) Viral and Rickettsial Disease Laboratory (VRDL), local public health laboratories, and commercial laboratories. Local and commercial laboratories tested for WNV using an IgM enzyme immunoassay (EIA) and/or an IgM immunofluorescence assay (IFA). Specimens from the first WNV case of the year from each county, as well as specimens from all cases from counties with enzootic St. Louis encephalitis virus (SLEV) activity, were forwarded to the CDPH-VRDL for further testing with plaque reduction neutralization tests (PRNT). Additional WNV infections were identified through nucleic acid test screening performed by blood and organ donation centers.

In 2024, a total of 131 symptomatic and 20 asymptomatic infections with WNV were identified, which was a 68% decrease compared to the number of total infections (473) reported in 2023 (Table 1.1). Of the 131 symptomatic cases, 103 (79%) were classified as West Nile neuroinvasive disease (e.g., encephalitis, meningitis, acute flaccid paralysis, or other neurologic dysfunction) and 28 (21%) were classified as West Nile non-neuroinvasive disease. There were 12 (9%) fatal cases. Patients were residents of 26 counties and incidence was highest (5.34 cases per 100,000 persons) in Butte County (Table 1.1, Figure 1.1). Ninety-eight (75%) patients were male. The median age for neuroinvasive cases was 61 years (range, 7 to 91 years), and among non-neuroinvasive cases, the median age was 56 years (range, 34 to 82 years). The median age of the 12 WNV-associated fatalities was 72 years (range, 21 to 86 years). Dates of symptom onset for all reported cases ranged from April 26 to December 10.

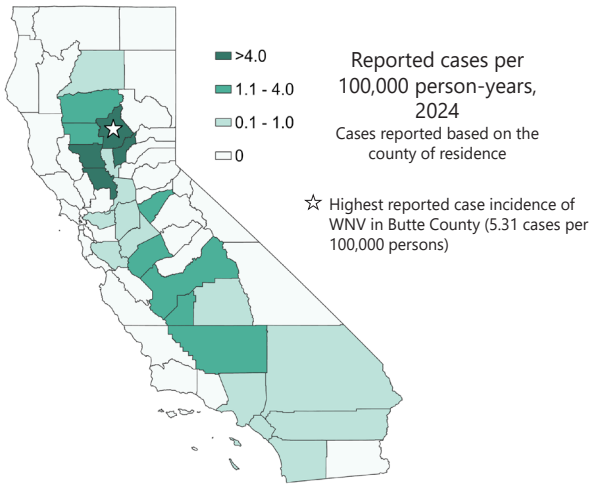


Figure 1.1. Incidence of reported human cases of West Nile virus, by county, California, 2024

St. Louis encephalitis virus

No cases of SLEV infection were reported in 2024.

Table 1.1. Reported West Nile virus human cases by county of residence, California, 2015-2024

County	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2024 incidence per 100,000 person-years	10-year incidence per 100,000 person-years
Alameda	0	0	1	0	1	0	0	1	1	0	0.00	0.02
Alpine	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Amador	0	1	0	1	1	0	0	0	0	0	0.00	0.76
Butte	53	21	4	12	5	4	13	3	18	11	5.31	6.99
Calaveras	0	0	0	0	0	0	0	0	1	1	2.23	0.45
Colusa	1	2	0	0	1	0	0	1	1	1	4.60	3.22
Contra Costa	1	4	4	4	1	4	2	1	10	4	0.35	0.31
Del Norte	0	0	0	0	0	0	0	0	0	0	0.00	0.00
El Dorado	0	1	0	0	0	1	1	0	3	0	0.00	0.32
Fresno	8	14	13	14	51	10	14	30	23	17	1.67	1.91
Glenn	19	6	0	2	0	1	2	1	4	1	3.48	12.53
Humboldt	0	0	0	1	0	0	0	0	0	0	0.00	0.08
Imperial	1	0	3	0	3	1	0	0	0	0	0.00	0.44
Inyo	0	0	4	0	0	0	0	0	0	0	0.00	2.12
Kern	11	17	30	13	28	8	8	22	16	12	1.32	1.81
Kings	0	8	5	0	3	2	8	7	9	6	3.93	3.14
Lake	2	1	0	1	0	2	0	0	6	0	0.00	1.79
Lassen	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Los Angeles	286	151	277	43	31	90	16	61	62	23	0.25	1.06
Madera	4	6	2	4	3	6	3	3	9	0	0.00	2.51
Marin	1	0	0	0	0	0	0	0	0	0	0.00	0.04
Mariposa	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Mendocino	2	0	0	0	0	0	0	0	0	0	0.00	0.22
Merced	1	0	10	2	10	12	6	7	8	3	1.04	2.05
Modoc	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Mono	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Monterey	0	1	0	1	0	0	0	0	2	0	0.00	0.08
Napa	0	0	0	1	0	0	0	0	0	0	0.00	0.07
Nevada	2	0	0	1	0	0	0	0	1	0	0.00	0.40
Orange	92	32	33	9	5	17	3	9	6	1	0.03	0.66
Placer	0	7	0	9	1	2	2	2	6	0	0.00	0.70
Plumas	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Riverside	127	11	32	15	12	10	3	0	20	6	0.25	0.97
Sacramento	4	25	6	15	4	7	6	5	53	7	0.44	0.84
San Benito	0	0	0	0	0	0	0	0	0	0	0.00	0.00
San Bernardino	54	8	57	9	7	3	1	4	28	5	0.23	0.81
San Diego	42	20	2	2	3	1	3	3	0	2	0.06	0.24
San Francisco	0	0	1	0	0	0	1	0	0	0	0.00	0.02
San Joaquin	2	13	14	14	7	2	7	4	15	2	0.25	1.01
San Luis Obispo	0	0	0	0	2	0	2	0	2	0	0.00	0.22
San Mateo	0	0	0	0	0	0	1	1	3	0	0.00	0.07
Santa Barbara	0	0	0	0	0	0	2	0	0	0	0.00	0.05
Santa Clara	8	1	0	1	1	0	3	1	3	4	0.21	0.12
Santa Cruz	0	0	0	0	0	0	1	0	0	0	0.00	0.04
Shasta	3	1	1	1	0	2	3	1	6	1	0.56	1.06
Sierra	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Siskiyou	1	0	0	0	0	0	0	0	0	0	0.00	0.23
Solano	1	4	1	0	1	1	2	2	6	0	0.00	0.40
Sonoma	0	0	0	0	0	0	0	0	1	0	0.00	0.02
Stanislaus	13	26	28	15	16	35	5	15	33	5	0.91	3.48
Sutter	2	12	3	1	1	1	0	1	7	1	1.00	2.90
Tehama	5	5	2	2	0	2	0	3	0	1	1.56	3.11
Trinity	0	0	0	0	0	0	0	0	0	0	0.00	0.00
Tulare	13	10	12	8	24	7	8	15	25	4	0.84	2.63
Tuolumne	0	0	0	1	0	0	0	0	0	0	0.00	0.18
Ventura	6	7	1	2	2	0	0	0	1	0	0.00	0.23
Yolo	8	16	6	11	1	4	3	3	39	9	4.06	4.51
Yuba	10	11	1	2	0	0	0	1	5	4	4.78	4.06
Total WNV disease	**783**	**442**	**553**	**217**	**225**	**235**	**129**	**207**	**433**	**131**	**0.33**	**0.86**
Asymptomatic Infections[a]	77	41	47	26	18	28	19	14	40	20		
Total WNV infections	**860**	**483**	**600**	**243**	**243**	**263**	**148**	**221**	**473**	**151**		

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

Local dengue virus transmission was confirmed for the second consecutive year in 2024. Eighteen human cases were reported from three southern California counties. The rise in local transmission was likely driven by record dengue transmission in Latin America, which resulted in high numbers of infected returned travelers to California.

Dengue

In 2024, 720 cases of dengue were reported to CDPH; patients were residents of 37 California counties (Table 1.2). The median age was 47 years (range, 2 to 91 years) and 334 (46%) were male. There was one fatality. Eighteen locally acquired cases were reported from symptomatic residents of three counties: Los Angeles (14), San Diego (3), and San Bernardino (1). For the travel-associated cases, travel history included Latin America and the Caribbean (592), South Asia (65), East Asia and the Pacific (37), and Sub-Saharan Africa (2). Travel was verified but the place of exposure was unknown for six case patients.

Malaria

In 2024, 178 cases of malaria were reported to CDPH. Patients were residents of 25 California counties and 129 (72%) were male. The median age was 37 years (range, 4 to 80 years). Of the 147 cases for which the *Plasmodium* species was determined, 90 were *P. falciparum*, 56 *P. vivax* and 1 was *P. ovale*; there were no reported infections with *P. malariae*. Patients reported compatible travel history to malaria-endemic areas including Sub-Saharan Africa (107), East Asia and the Pacific (28), Latin America (19), South Asia (15), the Middle East and North Africa (1), and Central Asia (1). The place of exposure was unknown for seven case patients.

Chikungunya

Forty-three cases of chikungunya were reported to CDPH in 2024 (Table 1.2). Patients were residents of 13 California counties, 13 (39%) were male, and the median age was 47 years (range, 4 to 88 years). All patients reported travel to chikungunya-endemic or outbreak areas including South Asia (31), Latin

Table 1.2. Reported confirmed and probable *Aedes*- transmitted diseases in humans by county, California, 2024

County	Chikungunya	Dengue	Zika	TOTAL
Alameda	10	52	0	62
Alpine	0	0	0	0
Amador	0	0	0	0
Butte	0	1	0	1
Calaveras	0	0	0	0
Colusa	0	0	0	0
Contra Costa	5	27	1	33
Del Norte	0	0	0	0
El Dorado	0	1	0	1
Fresno	0	8	0	8
Glenn	0	0	0	0
Humboldt	0	1	0	1
Imperial	0	2	0	2
Inyo	0	0	0	0
Kern	1	8	0	9
Kings	0	3	0	3
Lake	0	2	0	2
Lassen	0	0	0	0
Los Angeles	2	252	2	256
Madera	0	0	0	0
Marin	0	2	0	2
Mariposa	0	0	0	0
Mendocino	0	0	0	0
Merced	0	0	0	0
Modoc	0	0	0	0
Mono	0	1	0	1
Monterey	0	6	0	6
Napa	0	3	0	3
Nevada	0	0	0	0
Orange	2	47	0	49
Placer	1	3	0	4
Plumas	0	0	0	0
Riverside	2	32	0	34
Sacramento	2	17	0	19
San Benito	0	2	0	2
San Bernardino	0	23	0	23
San Diego	2	64	1	67
San Francisco	0	20	0	20
San Joaquin	1	11	0	12
San Luis Obispo	1	1	1	3
San Mateo	0	16	0	16
Santa Barbara	0	5	0	5
Santa Clara	13	46	2	61
Santa Cruz	0	6	0	6
Shasta	0	0	0	0
Sierra	0	0	0	0
Siskiyou	0	0	0	0
Solano	1	10	0	11
Sonoma	0	9	1	10
Stanislaus	0	8	0	8
Sutter	0	1	0	1
Tehama	0	1	0	1
Trinity	0	0	0	0
Tulare	0	4	0	4
Tuolumne	0	0	0	0
Ventura	0	15	0	15
Yolo	0	10	0	10
Yuba	0	0	0	0
TOTAL	**43**	**720**	**8**	**771**

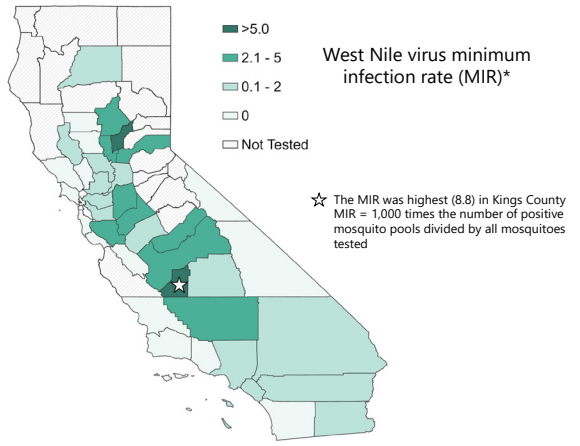


Figure 1.2. West Nile virus minimum infection rate of mosquitoes, by county, California, 2024

America and the Caribbean (8), East Asia and the Pacific (2), and Sub-Saharan Africa (2).

Zika

In 2024, eight cases of Zika virus were reported to CDPH (Table 1.2). Patients were residents of six counties and all had travel history compatible with exposure to Zika-endemic regions.

Mosquito surveillance

In 2024, a total of 1,257,701 mosquitoes (49,167 pools) collected in 40 counties were tested at the University of California, Davis Arbovirus Research and Training (DART) laboratory or at one of 13 local agencies by a real-time (TaqMan) reverse transcriptase-polymerase chain reaction (RT-qPCR) for SLEV, western equine encephalitis virus (WEEV), and/or WNV viral RNA (Table 1.3). WNV was detected in 2,011 mosquito pools from 25 counties, and SLEV was detected in 34 mosquito pools from five counties (Tables 1.3, 1.5, 1.8). Statewide, the minimum infection rate (MIR) — defined as the number of infected mosquito pools divided by the total number of mosquitoes tested multiplied by 1,000 — of WNV in all mosquitoes tested was 1.6; the MIR was highest (8.8) in Kings County (Table 1.3, Figure 1.2). Since 2003, the MIR of WNV in California has ranged from a low of 0.08 (2003) to a high of 3.9 (2014). Statewide, the SLEV MIR in all mosquitoes tested was 0.03; the MIR was highest (0.3) in Kings County. WNV was identified from six *Culex* species (*Cx. erythrothorax*, *Cx. pipiens*, *Cx. quinquefasciatus*, *Cx. stigmatosoma*, *Cx. tarsalis*, and *Cx. thriambus*) (Table 1.4), and SLEV was identified from three *Culex* species (*Cx. pipiens*, *Cx. quinquefasciatus*, and *Cx. tarsalis*). In 2024, the first detection of WNV in mosquitoes was from a *Cx. tarsalis* pool collected in Alameda County on March 8, and the last detection was from a *Cx. quinquefasciatus* pool collected in Los Angeles County on December 12.

Table 1.3. West Nile virus positive mosquito pools and minimum infection rate, by county, California, 2024

County	No. mosquitoes tested[a]	No. mosquito pools tested	WNV positive pools[a]	WNV minimum infection rate[b]
Alameda	37,804	1,510	19	0.5
Alpine	0	0	0	0.0
Amador	0	0	0	0.0
Butte	18,131	404	70	3.9
Calaveras	0	0	0	0.0
Colusa	450	9	0	0.0
Contra Costa	17,899	484	10	0.6
Del Norte	0	0	0	0.0
El Dorado	0	0	0	0.0
Fresno	56,498	1,698	208	3.7
Glenn	400	8	0	0.0
Humboldt	0	0	0	0.0
Imperial	4,774	243	3	0.6
Inyo	338	10	0	0.0
Kern	19,929	563	48	2.4
Kings	9,887	262	87	8.8
Lake	9,877	409	13	1.3
Lassen	0	0	0	0.0
Los Angeles	160,176	3,944	206	1.3
Madera	31,298	726	110	3.5
Marin	2,702	145	0	0.0
Mariposa	0	0	0	0.0
Mendocino	0	0	0	0.0
Merced	34,281	997	44	1.3
Modoc	0	0	0	0.0
Mono	53	2	0	0.0
Monterey	0	0	0	0.0
Napa	3,740	219	0	0.0
Nevada	0	0	0	0.0
Orange	90,144	3,830	53	0.6
Placer	24,434	1,883	93	3.8
Plumas	0	0	0	0.0
Riverside	226,073	7,001	217	1.0
Sacramento	36,959	3,601	53	1.4
San Benito	222	134	0	0.0
San Bernardino	69,851	2,530	76	1.1
San Diego	23,139	2,567	0	0.0
San Francisco	5	1	0	0.0
San Joaquin	55,307	1,740	188	3.4
San Luis Obispo	753	18	0	0.0
San Mateo	6,115	546	0	0.0
Santa Barbara	3,478	168	0	0.0
Santa Clara	10,665	2712	34	3.2
Santa Cruz	1,002	96	0	0.0
Shasta	24,550	827	37	1.5
Sierra	0	0	0	0.0
Siskiyou	0	0	0	0.0
Solano	22,227	613	13	0.6
Sonoma	12,426	448	0	0.0
Stanislaus	27,786	998	56	2.0
Sutter	10,120	286	32	3.2
Tehama	0	0	0	0.0
Trinity	0	0	0	0.0
Tulare	156,781	5,310	243	1.5
Tuolumne	0	0	0	0.0
Ventura	373	8	0	0.0
Yolo	41,535	2,038	66	1.6
Yuba	5,519	179	32	5.8
Total	**1,257,701**	**49,167**	**2,011**	**1.6**

[a] Tested by University of California Davis Arbovirus Research and Training Laboratory or local mosquito/vector control agency.
[b] Minimum Infection Rate = (No. pools positive/No. mosquitoes tested) X 1,000

Table 1.4. West Nile virus positive mosquito pools and minimum infection rate, by mosquito species, California, 2024

Mosquito Species	No. pools tested	No. mosquitoes	WNV positive pools	WNV minimum infection rate[a]
***Culex* species**				
Cx. erythrothorax	2,345	87,180	7	0.1
Cx. pipiens	8,973	131,435	204	1.6
Cx. quinquefasciatus	19,535	558,690	818	1.5
Cx. restuans	7	7	0	0.0
Cx. stigmatosoma	1,007	12,623	37	2.9
Cx. tarsalis	16,337	457,512	943	2.1
Cx. thriambus	89	239	2	8.3
Culex species	2	2	0	0.0
All Culex	**48,295**	**1,247,688**	**2,011**	**1.6**
***Anopheles* species**				
An. franciscanus	2	22	0	0.0
An. hermsi	2	30	0	0.0
All *Anopheles*	**4**	**52**	**0**	**0.0**
***Aedes* species**				
Ae. aegypti	504	3,146	0	0.0
Ae. melanimon	31	956	0	0.0
Ae. notoscriptus	1	1	0	0.0
All *Aedes*	**536**	**4,103**	**0**	**0.0**
Other species				
Arthropoda	1	1	0	0.0
Culiseta incidens	302	5,171	0	0.0
Culiseta inornata	22	585	0	0.0
Culiseta particeps	6	51	0	0.0
Unknown	1	50	0	0.0
All other	**332**	**5,858**	**0**	**0.0**

[a] Minimum Infection Rate = (No. pools positive/No. mosquitoes tested) X 1,000

Table 1.5. Infections with St. Louis encephalitis virus in humans, mosquito pools, and sentinel chickens, by county, California, 2024

County	Humans	Mosquito pools[a]	Sentinel chickens
Fresno	0	14	NT
Imperial	0	1	NT
Kings	0	3	NT
Madera	0	4	NT
Tulare	0	12	0
State Totals	**0**	**34**	**0**

NT= no samples tested

[a]Positive mosquito pools included *Culex pipiens (1), Cx. quinquefasciatus (25), and Cx. tarsalis (8)*

The first detection of SLEV in mosquitoes was from a *Cx. quinquefasciatus* pool collected in Fresno County on May 14, and the last detection was collected on October 8 from a *Cx. quinquefasciatus* and a *Cx. tarsalis* pool collected in Fresno and Tulare counties, respectively.

Animal surveillance

Chicken serosurveillance

In 2024, 24 local mosquito and vector control agencies in 20 counties maintained 75 sentinel chicken flocks (Table 1.6). Blood samples were collected from chickens every other week and tested for antibodies to WNV, SLEV, and WEEV by an EIA at the CDPH Vector-Borne Disease Section (CDPH-VBDS) and one local agency. Positive samples were confirmed at CDPH-VBDS by IFA or western blot. Of 4,889 chicken blood samples tested, 159 seroconversions to WNV were detected among 45 flocks in 16 counties (Tables 1.6, 1.8).

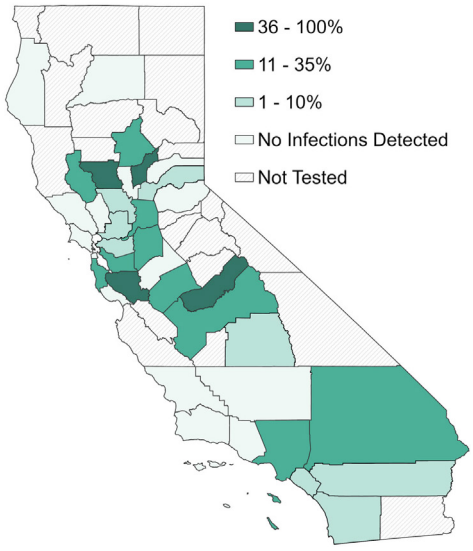


Figure 1.3. Prevalence of West Nile virus infection in dead birds, California, 2024

Statewide, 32% 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 40% (2023). In 2024, the first and last WNV seroconversions were detected in Contra Costa County on July 15 and in Los Angeles County on November 19, respectively. No SLEV seroconversions were detected in 2024 (Table 1.5).

Dead bird surveillance for West Nile virus

In 2024, the California WNV and Dead Bird Call Center and website received 6,703 dead bird reports from the public in 54 counties (Table 1.7). Oral swabs or other samples (e.g., brain, kidney, ocular) from dead bird carcasses were tested by RT-qPCR at the DART laboratory or at one of 13 local agencies or by IHC at the California Animal Health and Food Safety Laboratory. Of the 1,933 carcasses deemed suitable for testing, WNV was detected in 536 (28%) carcasses from 37 counties (Tables 1.7, 1.8, Figure 1.3). Since 2003, the prevalence of WNV-positive dead birds has ranged from a low of 5% (2003) to a high of 60% (2014). In 2024, the first WNV-positive dead bird was an American Crow reported from Alameda County on January 11, and the last was an American Crow reported from San Mateo County on December 11.

Many birds are susceptible to WNV and some species will die from the infection. Dead birds are an important component of WNV surveillance, serving as early indicators of virus activity in the environment. In 2024, WNV was detected in 28% of dead birds tested across 37 counties.

Table 1.6. Results of testing sentinel chickens for West Nile virus, by county, California, 2024

County	No. flocks	No. chickens[a]	No. WNV positive flocks	WNV positive chickens
Alameda	3	21	1	2
Alpine	0	0	0	0
Amador	0	0	0	0
Butte	7	43	7	28
Calaveras	1	10	0	0
Colusa	1	10	1	2
Contra Costa	4	24	2	8
Del Norte	0	0	0	0
El Dorado	0	0	0	0
Fresno	0	0	0	0
Glenn	0	0	0	0
Humboldt	0	0	0	0
Imperial	0	0	0	0
Inyo	0	0	0	0
Kern	0	0	0	0
Kings	0	0	0	0
Lake	2	14	2	7
Lassen	0	0	0	0
Los Angeles	19	105	13	42
Madera	0	0	0	0
Marin	0	0	0	0
Mariposa	0	0	0	0
Mendocino	0	0	0	0
Merced	4	24	3	12
Modoc	0	0	0	0
Mono	0	0	0	0
Monterey	0	0	0	0
Napa	0	0	0	0
Nevada	6	35	1	1
Orange	0	0	0	0
Placer	0	0	0	0
Plumas	0	0	0	0
Riverside	0	0	0	0
Sacramento	3	16	1	1
San Benito	1	8	0	0
San Bernardino	0	0	0	0
San Diego	0	0	0	0
San Francisco	0	0	0	0
San Joaquin	0	0	0	0
San Luis Obispo	0	0	0	0
San Mateo	2	13	0	0
Santa Barbara	0	0	0	0
Santa Clara	0	0	0	0
Santa Cruz	0	0	0	0
Shasta	3	18	2	2
Sierra	0	0	0	0
Siskiyou	0	0	0	0
Solano	3	21	2	8
Sonoma	0	0	0	0
Stanislaus	0	0	0	0
Sutter	5	35	5	20
Tehama	3	30	1	6
Trinity	0	0	0	0
Tulare	1	10	1	10
Tuolumne	0	0	0	0
Ventura	3	29	0	0
Yolo	2	15	2	3
Yuba	2	14	1	7
Total	**75**	**495**	**45**	**159**

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

Table 1.7. Dead birds reported, tested, and positive for West Nile virus, by county, California, 2024

County	Reported	Tested[a]	Positive	Percent
Alameda	515	187	53	28
Alpine	0	0	0	0
Amador	7	0	0	0
Butte	56	19	4	21
Calaveras	7	0	0	0
Colusa	3	1	1	100
Contra Costa	439	67	6	9
Del Norte	2	0	0	0
El Dorado	54	6	0	0
Fresno	91	6	2	33
Glenn	4	0	0	0
Humboldt	7	2	0	0
Imperial	1	0	0	0
Inyo	2	0	0	0
Kern	22	1	0	0
Kings	9	0	0	0
Lake	28	14	3	21
Lassen	3	0	0	0
Los Angeles	800	126	17	13
Madera	14	1	1	100
Marin	53	1	0	0
Mariposa	4	0	0	0
Mendocino	9	0	0	0
Merced	40	6	1	17
Modoc	0	0	0	0
Mono	2	0	0	0
Monterey	30	0	0	0
Napa	22	5	0	0
Nevada	23	4	0	0
Orange	276	62	1	2
Placer	208	91	4	4
Plumas	7	0	0	0
Riverside	145	45	4	9
Sacramento	737	325	66	20
San Benito	4	0	0	0
San Bernardino	133	39	10	27
San Diego	246	108	8	7
San Francisco	80	8	0	0
San Joaquin	137	31	6	19
San Luis Obispo	29	5	0	0
San Mateo	551	160	37	23
Santa Barbara	29	5	0	0
Santa Clara	1,077	436	301	69
Santa Cruz	70	9	0	0
Shasta	20	2	0	0
Sierra	0	0	0	0
Siskiyou	2	0	0	0
Solano	113	38	2	5
Sonoma	117	10	0	0
Stanislaus	102	10	0	0
Sutter	42	6	0	0
Tehama	8	0	0	0
Trinity	0	0	0	0
Tulare	38	13	1	8
Tuolumne	2	0	0	0
Ventura	81	15	0	0
Yolo	179	66	6	9
Yuba	23	3	2	67
Totals	**6,703**	**1,933**	**536**	**28**

[a] Tested by the University of California Davis Arboviral Research and Training laboratory or local mosquito/vector control agency

Table 1.8. Infections with West Nile virus in humans, horses, dead birds, mosquito pools, and sentinel chickens, by county, California, 2024

County	Humans[a]	Horses	Dead birds	Mosquito pools	Sentinel chickens
Alameda	1	0	53	19	2
Alpine	0	0	NT	NT	NT
Amador	0	0	NT	NT	NT
Butte	12	0	4	70	28
Calaveras	1	0	NT	NT	0
Colusa	1	0	1	0	2
Contra Costa	6	0	6	10	8
Del Norte	0	0	NT	NT	NT
El Dorado	0	0	0	NT	NT
Fresno	20	0	2	208	NT
Glenn	2	0	NT	0	NT
Humboldt	0	0	0	NT	NT
Imperial	0	0	NT	3	NT
Inyo	0	0	NT	0	NT
Kern	12	0	0	48	NT
Kings	7	0	NT	87	NT
Lake	0	0	3	13	7
Lassen	0	0	NT	NT	NT
Los Angeles	29	1	17	206	42
Madera	0	0	1	110	NT
Marin	0	0	0	0	NT
Mariposa	0	0	NT	NT	NT
Mendocino	0	0	NT	NT	NT
Merced	3	0	1	44	12
Modoc	0	0	NT	NT	NT
Mono	0	0	NT	0	NT
Monterey	0	0	NT	NT	NT
Napa	0	0	0	0	NT
Nevada	0	0	0	NT	1
Orange	1	0	1	53	NT
Placer	0	1	4	93	NT
Plumas	0	0	NT	NT	NT
Riverside	6	0	4	217	NT
Sacramento	7	1	66	53	1
San Benito	0	0	NT	0	0
San Bernardino	7	0	10	76	NT
San Diego	2	1	8	0	NT
San Francisco	0	0	0	0	NT
San Joaquin	2	1	6	188	NT
San Luis Obispo	0	0	0	0	NT
San Mateo	1	0	37	0	0
Santa Barbara	0	0	0	0	NT
Santa Clara	6	0	301	34	NT
Santa Cruz	0	0	0	0	NT
Shasta	1	0	0	37	2
Sierra	0	0	NT	NT	NT
Siskiyou	0	0	NT	NT	NT
Solano	0	0	2	13	8
Sonoma	0	0	0	0	NT
Stanislaus	5	0	0	56	NT
Sutter	1	0	0	32	20
Tehama	1	1	NT	NT	6
Trinity	0	0	NT	NT	NT
Tulare	4	0	1	243	10
Tuolumne	0	0	NT	NT	NT
Ventura	0	0	0	0	0
Yolo	9	0	6	66	3
Yuba	4	1	2	32	7
State Totals	**151**	**7**	**536**	**2,011**	**159**

[a]Includes asymptomatic infections detected through blood bank screening

NT= no samples tested

Horses

Serum or brain tissue specimens from horses displaying neurological symptoms were tested for WNV at the California Animal Health and Food Safety Laboratory. In 2024, WNV infection was detected in seven horses from seven counties (Table 1.8); one was euthanized because of their infection.

Invasive mosquito surveillance

Three species of invasive *Aedes* mosquitoes became established in California between 2011 and 2014: the Asian tiger mosquito, *Ae. albopictus* (2011), the yellow fever mosquito, *Ae. aegypti* (2013), and the Australian backyard mosquito, *Ae. notoscriptus* (2014). All three species have similar biology and behavior, live in close association with human-made environments, and are container breeders. *Aedes aegypti* is the primary worldwide vector of dengue, chikungunya, Zika, and yellow fever viruses, and *Ae. albopictus* can also serve as a vector of these arboviruses. In Australia, *Ae. notoscriptus* is an important urban vector of dog heartworm and has been found infected with Ross River and Barmah Forest viruses. None of these viruses are endemic to California.

Since 2011, local vector control agencies have detected one or more species of invasive *Aedes* mosquitoes in over 400 cities or census-designated places (CDP) in 29 counties; however, populations of *Ae. aegypti* and *Ae. albopictus* are only considered established within urbanized areas of 25 and 2 counties, respectively (Figure 1.4). In 2024, *Ae. aegypti* were discovered for the first time in four new cities. In contrast, the range of *Ae. albopictus* has been declining since 2017. Local vector control agencies from Orange, Sacramento, and San Bernardino counties report that this species is no longer being detected, leaving only areas of Los Angeles and Shasta counties with detectable populations. *Aedes notoscriptus*, a third invasive species not currently considered a public health threat, appears to be established in parts of Los Angeles, Orange, and San Diego counties, and since 2014, have been detected in over 45 cities. In 2024, a total of 13,399 *Ae. aegypti* mosquitoes were tested for dengue, chikungunya, and Zika viruses; all were negative, including those collected near known locally acquired dengue cases. In addition, 3,146 *Ae. aegypti* were tested for WNV, SLEV, and WEEV; all were negative (Table 1.4).

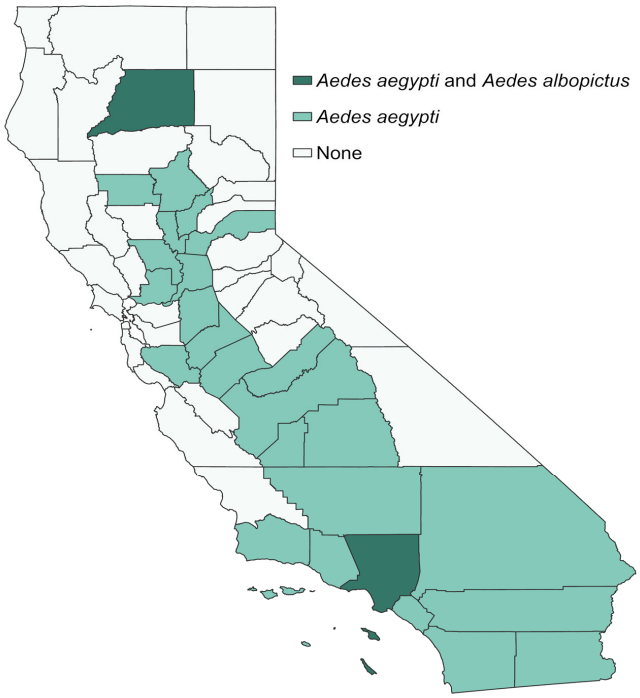


Figure 1.4. Invasive *Aedes* mosquito detections, by county, California, 2024

2 Tick-borne Diseases

Nine tick-borne diseases have been documented as endemic in California. Residents can be exposed to these and to others when traveling outside of the state. A goal of the California Department of Public Health, Vector-Borne Disease Section is to reduce human morbidity from tick-borne diseases in California through ongoing surveillance of disease-causing agents and ticks, investigation of human cases, management of tick populations when appropriate, collation of state-wide tick data from participating agencies, and timely dissemination of findings and prevention messages to the public, medical and public health communities, and vector control agencies.

Human disease surveillance

Anaplasmosis

In 2024, 12 cases of anaplasmosis caused by *Anaplasma phagocytophilum* were reported to the California Department of Public Health (CDPH); six (50%) met national surveillance criteria for a confirmed case and six (50%) met the criteria for a probable case. Median age was 72.5 years (range, 31 to 85 years), nine (75%) were male and three (25%) were female. Of those self-reporting race and ethnicity, nine (75%) were White, three (25%) were Unknown. Six (50%) identified as Hispanic or Latino. Patients were residents of Los Angeles (2), Marin (2), Sacramento, San Diego, San Mateo, Santa Barbara (2), and Sonoma (3) counties. Three (25%) patients reported exposure within California, including Humboldt, Marin (2), and Sonoma counties, eight (67%) reported exposure in the northeast or upper Midwest of the United States, and for one (8%), exposure could not be determined (Figure 2.1).

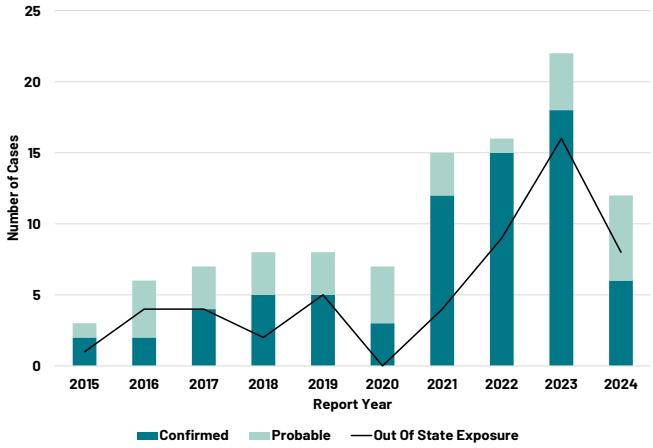


Figure 2.1. Confirmed and probable anaplasmosis cases, including cases reporting travel within incubation period, by report year 2015 - 2024

Babesiosis

In 2024, seven cases of babesiosis were reported to CDPH; six (86%) met national surveillance criteria for confirmed case and one (14%) was a probable case for infection with *Babesia microti*. Four (57%) were male; three (43%) were female. The median age was 68 years (range, 46 to 91 years). Self-reported race and ethnicity were White (5), or Unknown (2); one reported Hispanic or Latino ethnicity. One case was fatal. Patients were residents of Kern, Los Angeles (2), Placer, San Francisco (2), and Yolo counties. All exposure was travel to eastern United States where *B. microti* is endemic.

Ehrlichiosis

Five cases of ehrlichiosis were reported to CDPH in 2024; one met national surveillance criteria for a confirmed case for infection with *Ehrlichia chaffeensis*; four were probable cases of *E. chaffeensis*. Two cases had travel history to midwestern states where the Lone Star tick (*Amblyomma americanium*), the primary tick vector for *E. chaffeensis*, occurs. Travel history was unknown for three cases.

Lyme disease

A total of 96 cases of Lyme disease caused by *Borrelia burgdorferi* were reported in 2024; 64 (67%) of these met the surveillance case definition criteria for a confirmed case, 27 (28%) were probable, and 5 (5%) were suspect cases with erythema migrans (EM) rash and exposure in California (Figure 2.2). Of the 64 confirmed cases, patients were residents of 22 counties, with Los Angeles County reporting the greatest number of

cases (8) (Table 2.1). The median age of confirmed Lyme disease case-patients was 39.5 years (range, 5 to 83 years); 27 (42%) were female, 36 (56%) were male, and one (2%) declined to state. Of the 46 confirmed patients for whom race and ethnicity were reported, 38 (83%) self-identified as White, 1 (2%) as American Indian or Alaska Native, 1 (2%) as Black, and 6 (13%) as Other. Five (11%) self-identified as Hispanic or Latino. Erythema migrans was identified in 24 (38%) confirmed patients, with onset of EM noted primarily in the summer months (13 or 54%) of June through August. Between 2015 and 2024, the highest incidence of Lyme disease was in the north to central coastal counties and some northern counties with western-facing Sierra slopes (Figure 2.2). Of the 38 (41%) confirmed and probable patients reporting travel history outside of California one month prior to onset, the most common areas of exposure were the Northeast or upper Midwest of the United States (30 or 79%) followed by Europe (4 or 11%), western United States (2 or 6%), and Canada (2 or 6%).

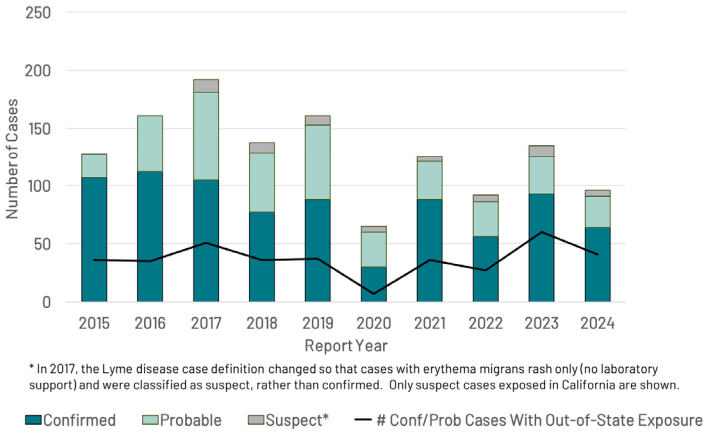
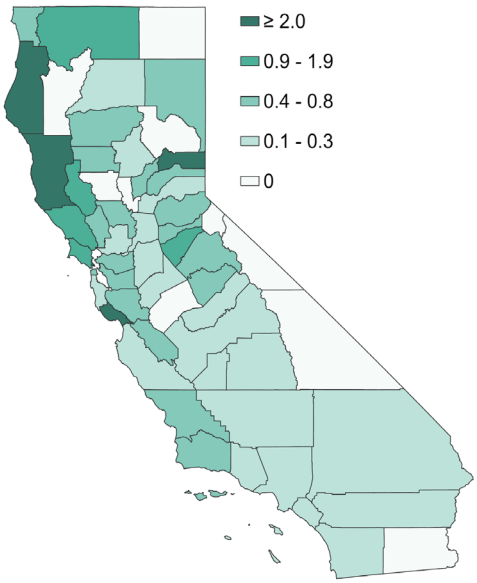


Figure 2.2. Confirmed, probable and suspect Lyme disease cases, including cases reporting travel within incubation period, by report year 2015 - 2024

Spotted fever group rickettsiosis

Eight cases of Rocky Mountain spotted fever (RMSF), caused by *Rickettsia rickettsii*, were reported to CDPH in 2024. Seven (88%) met the surveillance criteria for a confirmed case and one (12%) was probable. Five (63%) were male, three (37%) were female; median age was 38.5 years (range, 5 to 78 years). Of the seven patients self-reporting race and ethnicity, four (50%) were White, one (12%) each Asian, Black, Other or Unknown; two (25%) were Hispanic or Latino. Patients were residents of Alameda, Imperial, Los Angeles, Mendocino, San Bernardino, and San Diego (3) counties. Exposure locations included California (3), midwestern United States (2), northeastern and northwestern United States, and Mexico.



Santa Cruz	3.4
Sierra	3.2
Mendocino	3.1
Humboldt	2.2
Siskiyou	1.4
Sonoma	1.3
Calaveras	1.1
Marin	1.1
Lake	0.9
Nevada	0.8

* Reported by county of residence. Though Lyme disease cases have been reported in nearly every county, cases are reported based on the county of residence, which does not necessarily reflect the county of infection.

Figure 2.3. Ten- year incidence of reported confirmed Lyme disease, by county, California 2015 - 2024

Table 2.1. Reported confirmed Lyme disease cases by county of residence, California, 2015-2024*

County	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL	10-year Incidence per 100,000 person-years
Alameda	9	9	11	3	9	5	4	4	5	5	64	0.39
Alpine	0	0	0	0	0	0	0	0	0	0	0	0.00
Amador	2	0	0	0	0	0	0	0	0	1	3	0.76
Butte	0	2	0	0	1	0	1	0	1	0	5	0.24
Calaveras	1	0	1	0	1	0	0	0	1	1	5	1.12
Colusa	0	0	0	0	0	0	0	0	0	0	0	0.00
Contra Costa	4	8	11	10	1	2	5	2	1	4	48	0.42
Del Norte	0	0	0	0	0	0	0	1	0	0	1	0.38
El Dorado	3	2	1	0	0	0	1	4	0	2	13	0.69
Fresno	1	1	0	1	1	0	1	1	0	0	6	0.06
Glenn	0	0	0	1	0	0	0	0	0	0	1	0.35
Humboldt	6	4	2	2	5	1	0	4	5	0	29	2.18
Imperial	0	0	0	0	0	0	0	0	0	0	0	0.00
Inyo	0	0	0	0	0	0	0	0	0	0	0	0.00
Kern	1	1	0	0	1	0	0	0	1	0	4	0.04
Kings	0	1	0	0	0	0	0	0	0	1	2	0.13
Lake	1	1	0	1	2	1	0	0	0	0	6	0.90
Lassen	1	0	0	0	0	0	0	0	0	0	1	0.35
Los Angeles	6	1	3	2	2	0	6	5	14	8	47	0.05
Madera	0	0	0	0	0	1	0	1	0	0	2	0.13
Marin	5	2	0	1	8	0	5	3	0	4	28	1.11
Mariposa	1	0	0	0	0	0	0	0	0	0	1	0.59
Mendocino	0	1	1	1	8	1	6	3	3	4	28	3.13
Merced	0	0	0	0	0	0	0	0	0	0	0	0.00
Modoc	0	0	0	0	0	0	0	0	0	0	0	0.00
Mono	0	0	0	0	0	0	0	0	0	0	0	0.00
Monterey	0	1	0	0	1	0	2	1	0	0	5	0.11
Napa	3	1	1	0	0	1	1	2	0	0	9	0.67
Nevada	2	2	0	2	1	0	0	0	1	0	8	0.80
Orange	0	1	0	0	0	0	0	0	0	0	1	0.00
Placer	0	2	3	0	0	0	0	1	1	0	7	0.17
Plumas	0	0	0	0	0	0	0	0	0	0	0	0.00
Riverside	1	3	1	2	1	2	2	0	3	0	15	0.06
Sacramento	0	1	1	3	2	0	0	2	4	2	15	0.10
San Benito	1	0	0	0	0	0	0	0	1	0	2	0.30
San Bernardino	1	0	0	0	2	0	3	0	0	1	7	0.03
San Diego	9	9	4	4	0	2	6	2	10	2	48	0.15
San Francisco	0	2	10	14	8	3	12	2	3	6	60	0.71
San Joaquin	0	1	0	1	3	0	0	0	1	0	6	0.08
San Luis Obispo	3	1	0	1	2	1	2	2	0	1	13	0.47
San Mateo	6	5	3	0	2	1	0	0	0	3	20	0.27
Santa Barbara	4	7	3	3	2	1	2	1	2	1	26	0.59
Santa Clara	10	11	9	3	2	3	5	4	11	7	65	0.34
Santa Cruz	10	7	17	7	12	2	13	4	12	6	90	3.43
Shasta	0	0	0	0	0	1	1	0	1	1	4	0.22
Sierra	0	0	0	1	0	0	0	0	0	0	1	3.15
Siskiyou	1	1	1	1	0	0	1	0	1	0	6	1.38
Solano	0	3	2	2	0	1	1	0	1	0	10	0.22
Sonoma	12	12	10	6	5	0	3	4	8	2	62	1.30
Stanislaus	0	1	3	2	0	0	0	0	0	0	6	0.11
Sutter	0	0	0	0	0	0	0	0	0	0	0	0.00
Tehama	0	3	1	0	0	0	0	0	0	0	4	0.62
Trinity	0	0	0	0	0	0	0	0	0	0	0	0.00
Tulare	1	1	0	1	3	0	0	0	1	0	7	0.15
Tuolumne	1	0	0	0	1	0	0	0	0	0	2	0.37
Ventura	0	3	3	2	2	0	3	1	1	1	16	0.19
Yolo	1	1	3	0	0	0	1	1	0	1	8	0.36
Yuba	0	0	0	0	0	1	1	1	0	0	3	0.36
TOTAL	**107**	**112**	**105**	**77**	**88**	**30**	**88**	**56**	**93**	**64**	**820**	**0.21**

Two cases of spotted fever group *Rickettsia* (not including RMSF) caused by other *Rickettisia* spp. were reported to CDPH in 2024. Both cases were travel related probable cases of *R. africae* acquired from tick bites in South Africa.

Soft tick relapsing fever

Twelve cases of soft tick relapsing fever (STRF), previously known as tick-borne relapsing fever and caused by *Borrelia hermsii*, were reported to CDPH in 2024; 11 (92%) met CDPH working surveillance case definition criteria for confirmed cases; 1 (8%) was probable. Median age was 41 years (range, 7 to 67 years), three (25%) were male, 8 (67%) were female, and 1 (8%) non-binary. Patients were residents of Alameda, Kern, Los Angeles (2), Marin, Mono, Placer, San Francisco, San Mateo (2), and Santa Clara (2) counties. Places where patients were likely exposed in the three weeks prior to illness onset were Alpine, Calaveras, El Dorado (3), Lake, Mono (4), and Nevada counties, and the state of Nevada.

Tularemia

No tick-exposure related tularemia cases were reported in 2024.

Tick surveillance

Anaplasma phagocytophilum

In 2024, a total of 1 larval, 2,014 nymphal, and 6,013 adult western blacklegged ticks (*Ixodes pacificus*) were collected and tested for the presence of *Anaplasma phagocytophilum*, the causative agent of anaplasmosis. Of these ticks, the CDPH Vector-Borne Disease Section (CDPH-VBDS) tested 3,939 adults, 504 nymphs, and one larva from 35 counties (Table 2.2); 17 (0.4%) adults and 11 (2.2%) nymphs tested positive by real-time polymerase chain reaction (RT-PCR) (Table 2.2). Alameda County Department of Environmental Health, Butte Mosquito and Vector Control District (MVCD), and San Mateo MVCD share *A. phagocytophilum* tick testing data with CDPH-VBDS. In 2024, these agencies collected and tested a total of 2,074 adult western blacklegged ticks in 430 pools and 1,510 nymphal ticks in 760 pools from sites in their counties. Twenty-four (1.2%) adult tick pools and 25 (1.7%) nymphal pools tested positive for *A. phagocytophilum* (Table 2.2).

As molecular testing expands, more knowledge is gained about pathogen and vector, species, often leading to new names. Two recent changes are the tick *Dermacentor similis* (formerly *D. variabilis*) and the pathogen *Rickettsia rickettsii* subspecies *californica* (formerly *R. philipii/R*. 364D).

Francisella tularensis

In 2024, CDPH-VBDS tested a total of 475 adult western American dog ticks (*Dermacentor similis*) and 201 adult Pacific Coast ticks (*D. occidentalis*) from Alameda, Contra Costa, El Dorado, Kern, Lake, Los Angeles, Marin, Merced, Monterey, Napa, Nevada, Sacramento, San Francisco, San Luis Obispo, San Mateo, Santa Barbara, Santa Cruz, Solano, Sonoma, Stanislaus, Tehama, and Yolo counties for *Francisella tularensis*, the causative agent of tularemia. One adult western American dog tick from Marin County tested positive for *F. tularensis* by RT-PCR, for a statewide infection prevalence of 0.2%. All Pacific Coast ticks tested by CDPH-VBDS were negative. Reported to CDPH-VBDS, San Diego Environmental Health's Vector Control Program tested 2,601 Pacific Coast ticks, 550 western American dog ticks, 11 western blacklegged ticks, 2 rabbit ticks (*Haemaphysalis leporispalustris*), and 1 bighorn sheep tick (*D. hunteri*) for *F. tularensis* by RT-PCR. All ticks tested negative.

Spotted fever group rickettsiosis

The spotted fever group rickettsioses (SFGR) species includes several human pathogenic *Rickettsia* spp., including *Rickettsia rickettsii*, the causative agent of Rocky Mountain spotted fever (RMSF), *Rickettsia rickettsii* subspecies californica, the causative agent of Pacific Coast tick fever, and newly recognized *Rickettsia* species CA6269. In 2024, CDPH tested 2,791 adult and 81 nymphal Pacific Coast ticks for SFGR species from Alameda, Calaveras, Colusa, Contra Costa, El Dorado, Fresno, Kern, Lake, Los Angeles, Marin, Mariposa, Mendocino, Merced, Monterey, Napa, Nevada, Orange, Sacramento, San Bernardino, San

Table 2.2. Infection prevalence and minimum infection prevalence of *Anaplasma phagocytophilum* in *Ixodes pacificus* ticks, California, 2024

Non-pooled testing	No. Ticks Tested			Positive *A. phagocytophilum*			
County	Adults	Nymphs	Larvae	Adults (IP[a])	Nymphs (IP[a])	Collected by	Laboratory
Alameda	72					CDPH, VBDS	CDPH, VBDS
Calaveras	76					CDPH, VBDS	CDPH, VBDS
Colusa	33	3				CDPH, VBDS	CDPH, VBDS
Contra Costa	116	17		2 (1.7)		CDPH, VBDS	CDPH, VBDS
El Dorado	495	148			1 (0.7)	CDPH, VBDS	CDPH, VBDS
Fresno	17					CDPH, VBDS	CDPH, VBDS
Glenn	1	1				CDPH, VBDS	CDPH, VBDS
Lake	4					CDPH, VBDS	CDPH, VBDS
Los Angeles	64	0				CDPH, VBDS	CDPH, VBDS
Marin	590	46		4 (0.7)		CDPH, VBDS	CDPH, VBDS
Mariposa	4	3				CDPH, VBDS	CDPH, VBDS
Mendocino	118			2 (1.7)		CDPH, VBDS	CDPH, VBDS
Merced	144					CDPH, VBDS	CDPH, VBDS
Monterey	12					CDPH, VBDS	CDPH, VBDS
Napa	308					CDPH, VBDS	CDPH, VBDS
Nevada	74	31	1	1 (1.4)		CDPH, VBDS	CDPH, VBDS
Orange	9					CDPH, VBDS	CDPH, VBDS
Placer	510	24		3 (0.6)	1 (4.2)	CDPH, VBDS	CDPH, VBDS
Sacramento	5					CDPH, VBDS	CDPH, VBDS
San Bernardino	3					CDPH, VBDS	CDPH, VBDS
San Luis Obispo	677					CDPH, VBDS	CDPH, VBDS
San Mateo	3	2		1 (33.3)		CDPH, VBDS	CDPH, VBDS
Santa Barbara	174			2 (1.1)		CDPH, VBDS	CDPH, VBDS
Santa Clara	25					CDPH, VBDS	CDPH, VBDS
Santa Cruz	98	5		1 (1.0)		CDPH, VBDS	CDPH, VBDS
Sierra	33					CDPH, VBDS	CDPH, VBDS
Solano	31					CDPH, VBDS	CDPH, VBDS
Sonoma	28	221		1 (3.6)	9 (4.1)	CDPH, VBDS	CDPH, VBDS
Sutter	38					CDPH, VBDS	CDPH, VBDS
Tehama	2					CDPH, VBDS	CDPH, VBDS
Tulare	1					CDPH, VBDS	CDPH, VBDS
Tuolumne	1					CDPH, VBDS	CDPH, VBDS
Ventura	4					CDPH, VBDS	CDPH, VBDS
Yolo	140					CDPH, VBDS	CDPH, VBDS
Yuba	29	3				CDPH, VBDS	CDPH, VBDS
Non-pooled totals	**3,939**	**504**	**1**	**17 (0.4)**	**11 (2.2)**		
Pooled testing	**No. Ticks Tested**			**Positive *A. phagocytophilum* pools**			
County	**Adults**	**Nymphs (pools)**		**Adults (MIP[b])**	**Nymphs**	**Collected by**	**Laboratory**
Alameda	1,122 (229)	322 (161)		19 (1.7)	19 (5.9)	Alameda County DEH	Alameda County DEH
Butte	130 (32)					Butte MVCD	Placer MVCD
San Mateo	822 (169)	1,188 (599)		5 (0.6)	6 (0.5)	San Mateo MVCD	San Mateo MVCD
Pooled totals	**2,074 (430)**	**1,510 (760)**		**24 (1.2)**	**25 (1.7)**		
All tick totals	**6,013 (4,369)**	**2,014 (1,264)**		**41 (0.7)**	**36 (1.8)**		

Abbreviations:
IP, Infection prevalence; MIP, Minimum infection prevalence; CDPH-VBDS, California Department of Public Health, Vector-Borne Disease Section; MVCD, Mosquito and Vector Control District; DEH, Department of Environmental Health.

[a] Infection prevalence is the number of individually tested ticks positive divided by the number of ticks tested multiplied by 100.

[b] Minimum infection prevalence is the number of positive pools divided by the number of ticks tested multiplied by 100.

Luis Obispo, San Mateo, Santa Barbara, Santa Cruz, Sierra, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Ventura, Yolo, and Yuba counties. Additionally, 81 adult and 658 nymphal western American dog ticks and 8 adult rabbit ticks from Contra Costa, Marin, Monterey, San Mateo, Santa Clara, Santa Cruz, and Sonoma counties were tested for SFGR species. DNA from all ticks was extracted by CDPH-VBDS and tested by RT-PCR by the CDPH Viral and Rickettsial Disease Laboratory (CDPH-VRDL). All ticks tested negative for *R. rickettsii*.

Thirty-eight adult Pacific Coast ticks tested positive for *Rickettsia rickettsii* ssp.californica at CDPH-VRDL, with positive ticks detected from Contra Costa (1 of 271 or 0.4%), Los Angeles (16 of 427 or 3.8%), San Bernardino (8 of 115 or 7.0%), San Luis Obispo (4 of 191 or 2.1%), Santa Barbara (7 of 221 or 3.2%), and Tuolumne (2 of 28 or 7.1%) counties. One adult Pacific Coast tick (1 of 271 or 0.4%) from Contra Costa County and two nymphal rabbit ticks (2 of 635 or 0.3%) from San Mateo County tested positive for *Rickettsia* sp. CA6269 at CDPH-VRDL.

The Alameda County Vector Control Program tested 1,220 adult Pacific Coast ticks in 263 pools and 231 adult western American dog ticks in 96 pools for SFGR. Fourteen pools of Pacific Coast ticks were positive for *Rickettsia rickettsii* ssp. californica for a county MIP of 1.1%. Additionally, Orange County MVCD tested 647 adult Pacific Coast ticks in 114 pools and 20 western American dog ticks in 10 pools for SFGR. No ticks tested by Orange County MVCD were positive for SFGR.

Borrelia spirochetes

Borrelia burgdorferi sensu lato

In 2024, local, state, and federal agencies, in collaboration with CDPH-VBDS, collected 11,966 adult, 2,320 nymphal, and 15 larval western blacklegged ticks from 38 counties to test for *Borrelia burgdorferi*, the causative agent of Lyme disease (Tables 2.3, 2.4). Collection and testing data for western blacklegged ticks are collated by CDPH-VBDS. From the counties where ticks were tested individually by RT-PCR, 84 (1.5%) of 5,800 adult and 83 (12.4%) of 669 nymphal ticks tested positive for *B. burgdorferi* sensu lato (Table 2.3). Ticks tested by local vector control agencies in pools were tested by RT-PCR or IFA. In the counties where ticks were tested in pools, of 6,166 adult ticks, 79 pools (1.3% minimum infection prevalence – MIP- defined as number of positive pools divided by total ticks tested multiplied by 100) tested positive for *B. burgdorferi* sl and of 1,651 nymphal ticks, 127 pools (7.7% MIP) tested positive for *B. burgdorferi* sl (Table 2.4). All larval ticks tested negative. Additionally, CDPH-VBDS tested 4 adult and 15 nymphal *Ixodes spinipalpis* from five counties (Contra Costa, El Dorado, Nevada, San Mateo, and Sonoma) for *B. burgdorferi* sl; five (33%) nymphs tested positive from Contra Costa (1) and San Mateo (4) counties; four adult ticks tested negative.

Borrelia hermsi

In 2024, three soft ticks (*Ornithodoros hermsi*) from Nevada (2) and Calaveras (1) counties tested negative for Borrelia hermsi, the causative agent of soft tick relapsing fever, at CDPH-VBDS.

Borrelia miyamotoi

In 2024, of the western blacklegged ticks collected, 1 larval, 2,209 nymphal, and 10,318 adult ticks were tested for *Borrelia miyamotoi*, the causative agent of hard tick relapsing fever. Of the 5,783 individually tested adults and 669 individually tested nymphs, 52 (0.9%) and 8 (1.2%), respectively, tested positive for *B. miyamotoi* (Table 2.3). Of the 4,535 adult ticks tested in 996 pools and 1,510 nymphs tested in 760 pools, 55 (1.2% MIP) and 29 (1.9% MIP), respectively, tested positive (Table 2.4).

Borrelia spp. coinfection

In 2024, of 3,939 western blacklegged ticks tested for both *B. burgdorferi* sl and *A. phagocytophilum*, eight adults from Contra Costa (1), Marin (1), Mendocino (2), Placer (2), Santa Cruz (1), and Sonoma (1) counties tested positive for both disease agents for a statewide adult co-infection prevalence of 0.2%. Of 504 western blacklegged tick nymphs tested for both *B. burgdorferi* sl and *A. phagocytophilum*, one (0.2%) from Sonoma County tested positive for both disease agents. Of 5,783 adult and 669 nymphal western blacklegged ticks tested for both *B. burgdorferi* sl and *B. miyamotoi*, two (0.04%) adult and one (0.1%) nymph from El Dorado County tested positive for both disease agents. Of 3,939 individually tested adult western blacklegged ticks tested for both *B. miyamotoi* and *A. phagocytophilum*, one (0.1%) from Marin County tested positive for both disease agents.

Mammal surveillance

Francisella tularensis

CDPH-VBDS collaborates with the CDPH Microbial Diseases Laboratory to test mammals for *Francisella tularensis*, the agent of tularemia, by serology, DFA, PCR, and culture. Mammals may be tested for tularemia in response to reported human cases or for environmental risk assessment including specific carcass testing requests. In 2024, four small mammal carcasses tested negative for *F. tularensis* from El Dorado (3) and Sierra (1) counties.

Table 2.3. Infection prevalence of *Borrelia burgdorferi* sensu lato and *Borrelia miyamotoi* spirochetes in *Ixodes pacificus* ticks, California, 2024

County	No. Ticks Tested			Positive *B. burgdorferi*		Positive *B. miyamotoi* *		Collected by	Laboratory
	Adults	Nymphs	Larvae[a]	Adults (IP)[b]	Nymphs (IP)[b]	Adults (IP)[b]	Nymphs (IP)[b]		
Alameda	72			1 (1.4)		1 (1.4)		CDPH, VBDS	CDPH, VBDS
Calaveras	76			5 (6.6)				CDPH, VBDS	CDPH, VBDS
Colusa	33	3		1 (3.0)		1 (1.3)		CDPH, VBDS	CDPH, VBDS
Contra Costa	116	17		1 (0.9)	2 (11.8)			CDPH, VBDS	CDPH, VBDS
El Dorado	497	149		28 (5.7)	54 (36.2)	8 (1.6)	2 (1.3)	CDPH, VBDS	CDPH, VBDS
Fresno	17							CDPH, VBDS	CDPH, VBDS
Glenn	1	1						CDPH, VBDS	CDPH, VBDS
Lake	4							CDPH, VBDS	CDPH, VBDS
Los Angeles	64							CDPH, VBDS	CDPH, VBDS
Marin	591	92		8 (1.4)	9 (9.9)	6 (1.0)	1 (1.1)	CDPH, VBDS; Marin-Sonoma MVCD	CDPH, VBDS; Marin-Sonoma MVCD
Mariposa	4	3						CDPH, VBDS	CDPH, VBDS
Mendocino	118			3 (2.5)		1 (0.9)		CDPH, VBDS	CDPH, VBDS
Merced	144							CDPH, VBDS	CDPH, VBDS
Monterey	12							CDPH, VBDS	CDPH, VBDS
Napa	308			2 (0.7)				CDPH, VBDS	CDPH, VBDS
Nevada	74	31	1	2 (2.7)	3 (9.7)	3 (4.1)		CDPH, VBDS	CDPH, VBDS
Orange	9							CDPH, VBDS	CDPH, VBDS
Placer	510	24		14 (2.8)	1 (4.2)	5 (1.0)		CDPH, VBDS	CDPH, VBDS
Sacramento	5							CDPH, VBDS	CDPH, VBDS
San Bernardino	3							CDPH, VBDS	CDPH, VBDS
San Diego	13							County of San Diego VCP	County of San Diego VCP
San Joaquin	4							San Joaquin MVCD	San Joaquin MVCD
San Luis Obispo	677					4 (0.6)		CDPH, VBDS	CDPH, VBDS
San Mateo	3	2			1 (50.0)			CDPH, VBDS	CDPH, VBDS
Santa Barbara	174			2 (1.2)				CDPH, VBDS	CDPH, VBDS
Santa Clara	1,178	114		7 (0.6)	5 (4.4)	16 (1.4)	3 (2.6)	CDPH, VBDS; Santa Clara VCD	CDPH, VBDS; Santa Clara VCD
Santa Cruz	785	5		4 (0.6)		5 (0.6)		CDPH, VBDS; Santa Cruz County MVCD	CDPH, VBDS; Santa Cruz County MVCD
Sierra	33			1 (3.0)		2 (6.1)		CDPH, VBDS	CDPH, VBDS
Solano	31							CDPH, VBDS	CDPH, VBDS
Sonoma	28	221		5 (17.9)	8 (3.6)		2 (0.9)	CDPH, VBDS	CDPH, VBDS
Sutter	38							CDPH, VBDS	CDPH, VBDS
Tehama	2							CDPH, VBDS	CDPH, VBDS
Tulare	1							CDPH, VBDS	CDPH, VBDS
Tuolumne	1							CDPH, VBDS	CDPH, VBDS
Ventura	4							CDPH, VBDS	CDPH, VBDS
Yolo	140							CDPH, VBDS	CDPH, VBDS
Yuba	30	7						CDPH, VBDS	CDPH, VBDS
Total	**5,800**	**669**	**1**	**84 (1.5)**	**83 (12.4)**	**52 (0.9)**	**8 (1.2)**		

Abbreviations:
CDPH-VBDS, California Department of Public Health, Vector-Borne Disease Section; MVCD, Mosquito and Vector Control District; VCD, Vector Control District; VCP, Vector Control Program

All *Ixodes pacificus* ticks tested at CDPH-VBDS are tested by multiplex real-time polymerase chain reaction (RT-PCR) for *Borrelia burgdorferi* sensu lato and *Borrelia miyamotoi* .

[a] No larvae tested positive for *B. burgdorferi* sensu lato or *B. miyamotoi* , so IP was not calculated.

[b] IP: Measure of prevalence. IP (infection prevalence) is equal to the number of positive ticks divided by the number of ticks tested multiplied by 100.

[*] 5,783 adults tested for Borrelia miyamotoi, County of San Diego VCD and San Joaquin MVCD do not test for *B. miyamotoi* .

Table 2.4. Minimum infection prevalence of *Borrelia burgdorferi* sensu lato and *Borrelia miyamotoi* in *Ixodes pacificus* ticks, California, 2024

County	No. Ticks Tested		Positive Pools, *B. burgdorferi*		Positive Pools, *B. miyamotoi* [c]		Collected by	Laboratory
	Adults (pools)	Nymphs (pools)	Adults (MIP)[b]	Nymphs (MIP)[b]	Adults (MIP)[b]	Nymphs (MIP)[b]		
Alameda	1,122 (229)	322 (161)	16 (1.4)	20 (6.2)	12 (1.1)	1 (0.3)	Alameda County DEH	Alameda County DEH
Butte	130 (32)				2 (1.5)		Butte County MVCD	Placer MVCD
Los Angeles[a]	125 (40)						VCD	Los Angeles County West VCD
Marin	250 (53)		9 (3.6)		1 (0.4)		Marin-Sonoma MVCD	Marin-Sonoma MVCD
Orange	73 (21)						Orange County MVCD	Orange County MVCD
Placer	867 (222)		14 (1.6)		11 (1.3)		Placer MVCD	Placer MVCD
Sacramento	922 (241)	139 (35)	31 (3.4)	15 (10.8)			Sacramento-Yolo MVCD	Sacramento-Yolo MVCD
San Diego	453 (62)						County of San Diego VCP	County of San Diego VCP
San Mateo	822 (169)	1,188 (599)	5 (0.6)	92 (7.7)	9 (1.1)	28 (2.4)	San Mateo MVCD	San Mateo MVCD
Santa Clara	1,080 (232)		3 (0.3)		16 (1.5)		Santa Clara VCD	Santa Clara VCD
Sonoma	264 (59)		1 (0.4)		4 (1.5)		Marin-Sonoma MVCD	Marin-Sonoma MVCD
Yolo	58 (28)	2 (2)					Sacramento-Yolo MVCD	Sacramento-Yolo MVCD
Total	**6,166 (1,388)**	**1,651 (797)**	**79 (1.3)**	**127 (7.7)**	**55 (1.2)**	**29 (1.9)**		

Abbreviations:
DEH, Department of Environmental Health; MVCD, Mosquito and Vector Control District; VCD, Vector Control District; VCP, Vector Control Program.
*14 larvae in 10 pools tested negative for *Borrelia burgdorferi* at Sacramento-Yolo MVCD.

[a] Tested by immunofluorescent antibody (IFA) test.

[b] MIP: Measure of prevalence. MIP (minimum infection prevalence) is equal to the number of positive pools divided by the number of ticks tested multiplied by 100.

[c] 4,535 (996) adult ticks and 1,510 (760) nymphs tested for *Borrelia miyamotoi*, Sacramento-Yolo MVCD, San Diego VCP, and Los Angeles County West VCD do not test for *B. miyamotoi* .

3 Flea-borne Diseases

Flea-borne typhus and plague 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 California Department of Public Health, 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, implements preventive and control actions.

Human disease surveillance

Flea-borne typhus

Human testing for *Rickettsia typhi*, the causative agent of flea-borne typhus, is principally performed at commercial laboratories. The California Department of Public Health (CDPH) Viral and Rickettsial Disease Laboratory (VRDL) performs serology or PCR for samples requiring additional confirmation. Two hundred forty-six cases of confirmed or probable cases of flea-borne typhus were reported to CDPH in 2024. Seventy (28%) of these were confirmed according to CDPH working surveillance definition, and 176 (72%) were probable. Median age was 45 years (range 0 to 83 years); 148 (60%) were male, and 98 (40%) were female. Two hundred eight (85%) of the case-patients required hospitalization, two (0.8%) were fatal. Patients were residents of Los Angeles (212-86%), Orange (16-7%), San Bernardino (13 -5%), Riverside (3-1%), and one each from Contra Costa and San Francisco counties. Typhus is considered endemic in Southern California; patients reported from outside Southern California had travel history to endemic areas prior to exposure.

Plague

Human cases of plague are reportable to CDPH by local health jurisdictions. Presumptive positive test results for reported cases are typically confirmed by either the CDPH Microbial Diseases Laboratory (CDPH-MDL) or the U.S. Centers for Disease Control and Prevention. Environmental investigation in response to a human case of plague typically includes an evaluation and risk assessment of all potential exposure sites.

There were no human cases of plague reported to CDPH in 2024.

Animal disease surveillance (plague)

Rodent and flea surveillance is conducted to test for antibodies to *Yersinia pestis* in rodents and the presence of *Y. pestis* in fleas, which can provide evidence of plague transmission in local rodent populations. Reported rodent carcasses are submitted to CDPH and tested for *Y. pestis* when plague infection is suspected. Recreational area closures for flea control may be initiated depending on surveillance findings and estimated plague transmission risks. Domestic pet plague cases and *Y. pestis* antibody presence in carnivores are used as indicators of regional plague activity and positive results are typically followed by local rodent and flea surveillance.

Domestic pets

No cases of plague in domestic pets were reported in 2024. However, a domestic feline plague case from Sierra County with onset in late December 2023 required follow up rodent surveillance in 2024 (Table 3.1).

Wild animals

The CDPH Vector-Borne Disease Section (CDPH-VBDS) plague surveillance program tested 533 wild rodents, and 140 carnivores and feral pigs sampled from 31 California counties in 2024 (Figure 3.1, Table 3.1). Serum antibody to *Y. pestis* was detected in eight (1.5%) rodents from six counties (Figure 3.1, Table 3.1). The 533 rodents tested for plague antibodies included: 313 deer

Table 3.1. CDPH-VBDS *Yersinia pestis* test results for wild rodents and carnivores sampled in 2024

Location	Rodent blood tested by serology	Rodent carcasses tested by culture	Carnivore/pig blood tested by serology	Positive specimens	
				Species	Collection Month
Alameda	**0**		**1**		
Alpine	**39**		**1**		
Humboldt-Toiyabe NF: Lost Lakes				*Tamias speciosus*	September
Butte	**0**		**5**		
Calaveras	**0**		**10**		
Contra Costa	**0**		**4**		
Del Norte	**0**		**5**		
El Dorado	**28**	**3**	**6**		
Emerald Bay SP				*Otospermophilus beecheyi*	July
South Lake Tahoe				*Ursus americanus*	October
Humboldt	**0**		**11**		
Inyo	**0**		**1**		
Bishop				*Ursus americanus*	January
Kern	**0**		**44**		
Kings	**0**		**1**		
Lassen	**0**		**2**		
Lassen NF: Caribou Wilderness				*Vulpes vulpes necator*	July
Los Angeles	**0**		**3**		
Mariposa	**83**		**19**		
Yosemite NP				*Peromyscus maniculatus*	July
Yosemite NP				*Pekania pennanti*	January
Yosemite NP				*Pekania pennanti*	January
Yosemite NP				*Pekania pennanti*	February
Yosemite NP				*Pekania pennanti*	February
Yosemite NP				*Pekania pennanti*	February
Yosemite NP				*Urocyon cinereoargenteus*	February
Yosemite NP				*Pekania pennanti*	February
Yosemite NP				*Pekania pennanti*	November
Yosemite NP				*Pekania pennanti*	November
Yosemite NP				*Pekania pennanti*	November
Yosemite NP				*Pekania pennanti*	November
Yosemite NP				*Pekania pennanti*	December
Yosemite NP				*Pekania pennanti*	December
Yosemite NP				*Pekania pennanti*	December
Modoc	**0**		**4**		
Mono	**24**		**2**		
Sweetwater Mountains				*Ursus americanus*	May
Napa	**0**		**5**		
Nevada	**15**		**0**		
Orange	**1**		**0**		
Placer	**0**		**2**		
Plumas	**69**		**0**		
Plumas Eureka SP				*Tamias senex*	August
Riverside	**1**		**1**		
San Diego*	**0**		**0**		
San Luis Obispo	**1**		**3**		
Santa Clara	**0**		**1**		
Santa Cruz	**0**		**1**		
Shasta	**19**		**0**		
Sierra	**58**	**1**	**0**		
Loyalton				*Peromyscus maniculatus*	January
Loyalton				*Peromyscus maniculatus*	January
Loyalton				*Peromyscus maniculatus*	January
Siskiyou	**91**		**3**		
Lava Beds National Monument				*Otospermophilus beecheyi*	June
Sonoma	**0**		**1**		
Tehama	**7**		**0**		
Tuolumne	**97**		**4**		
Total	**533**	**4**	**140**		

*No samples were tested by CDPH-VBDS. Refer to text for details on testing conducted by the county of San Diego

CG: Campground

NF: National Forest

NP: National Park

SP: State Park

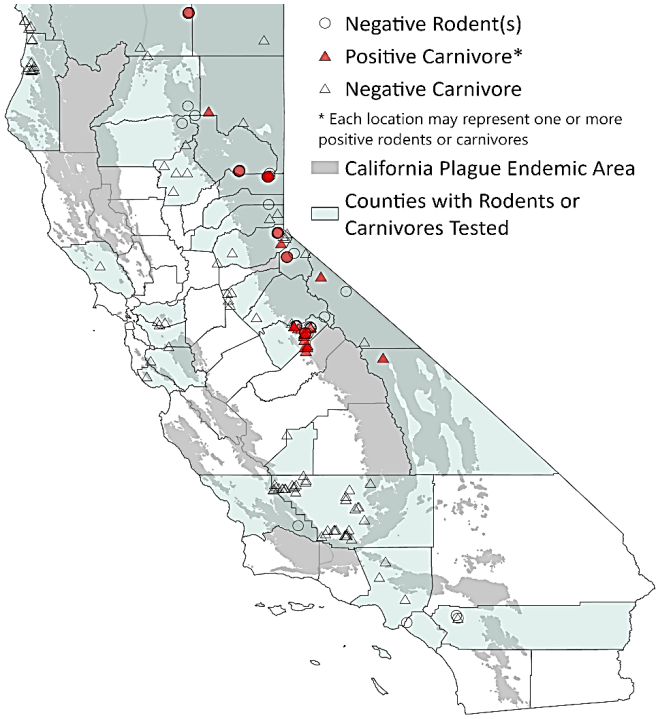


Figure 3.1. Approximate locations of carnivores or rodents collected in 2024 that were tested by serology or culture for *Yersinia pestis*

mice (*Peromyscus maniculatus*), 113 chipmunks (*Tamias* spp.), 26 woodrats (*Neotoma* spp.), 21 golden-mantled ground squirrels (*Callospermophilus lateralis*), 21 other *Peromyscus* spp., 19 California ground squirrels (*Otospermophilus beecheyi*), 8 montane voles (*Microtus montanus*), 4 western harvest mice (*Reithrodontomys megalotis*), 2 Belding's ground squirrels (*Urocitellus beldingi*), 2 California kangaroo rats (*Dipodomys californicus*), 2 house mice (*Mus musculus*), 1 giant kangaroo rat (*Dipodomys ingens*), and 1 Norway rat (*Rattus norvegicus*). Two lagomorphs, a desert cottontail (*Sylvilagus audubonii*) and a black-tailed jackrabbit (*Lepus californicus*), were also tested. Antibody to *Y. pestis* was detected in four deer mice from Mariposa and Sierra counties, two California ground squirrels from El Dorado and Siskiyou counties, one lodgepole chipmunk (*Tamias speciosus*) from Alpine County, and one Allen's Chipmunk (*Tamias senex*) from Plumas County (Table 3.1). Four rodent carcasses from El Dorado and Sierra counties tested negative for *Y. pestis* by the CDPH-MDL reference bacteriology unit (Table 2.1). The 140 wild carnivore (and feral pig) samples included: 64 coyotes (*Canis latrans*), 33 black bears (*Ursus americanus*), 16 fishers (*Pekania pennanti*), 9 feral pigs (*Sus scrofa*), 8 mountain lions (*Puma concolor*), 5 raccoons (*Procyon lotor*), 2 bobcats (*Lynx rufus*), 2 gray foxes (*Urocyon cinereoargenteus*), and 1 Sierra Nevada red fox (*Vulpes vulpes necator*). One Virginia opossum (*Didelphis virginiana*), a marsupial, was also tested. Serum antibody to *Y. pestis* was detected in 18 (12.9%) wild carnivores from five counties. Positive samples included 13 fishers, 3 black bears, 1 gray fox, and 1 Sierra Nevada red fox (Table 3.1). Additional carnivore samples from 2024 were collected and will be tested at a later date.

In 2024, the San Diego County Department of Environmental Health-Vector Control Program conducted independent, county-wide surveillance and testing for plague in rodents. None of 81 rodents tested were positive for antibody to *Y. pestis* via a passive hemagglutination and inhibition assay. These results are not included in Table 3.1 since CDPH-VBDS did not test the samples.

Table 3.2. CDPH-VBDS *Yersinia pestis* test results in fleas from rodents by California county, 2024		
County Location	**Flea Pools (Total # Fleas) Tested by PCR**	**Number Positive Pools**
Alpine	**16 (21)**	**0**
El Dorado	**11 (33)**	**0**
Mariposa	**20 (50)**	**0**
Mono	**21 (39)**	**0**
Nevada	**11 (32)**	**0**
Plumas	**46 (146)**	**0**
Shasta	**63 (88)**	**0**
Sierra	**20 (25)**	**0**
Siskiyou	**49 (205)**	**0**
Tuolumne	**41 (69)**	**0**
Total	**277 (669)**	**0**

PCR: Polymerase Chain Reaction

Rodent flea testing

In 2024, the Los Angeles County Department of Public Health, Vector Management Program conducted flea-borne typhus surveillance in two areas within the city of Los Angeles. A total of 107 fleas were collected from 25 Norway rats and sent to CDPH for processing and testing. A total of 98 *Xenopsylla cheopis* and 9 *Ctenocephalides felis* were identified, sorted into pools ≤10 fleas, and sent to CDPH-VRDL. Two of 22 pools of *X. cheopis* fleas tested PCR-positive for *R. typhi* resulting in a minimum infection prevalence — defined as the number of positive pools divided by the number of fleas tested multiplied by 100 — of 2%.

A total of 669 fleas collected from sylvatic rodents were identified to 18 different species from nine counties in 2024 (Tables 3.2, 3.3). They were combined into 277 pools and tested for the presence of *Y. pestis* bacteria. No flea pools tested PCR-positive for *Y. pestis* in 2024 (Tables 3.2, 3.3).

Table 3.3. CDPH-VBDS *Yersinia pestis* test results in fleas from rodents by flea species, California, 2024		
County Location	**Flea Pools (Total # Fleas) Tested by PCR**	**Number Positive Pools**
Oropsylla montana	**64 (289)**	**0**
Ceratophyllus ciliatus	60 (117)	0
Atheca wagneri	54 (82)	0
Orchopeas agilis	11 (47)	0
Orchopeas cascadensis	3 (23)	0
Peromyscopsylla hesperomys adelpha	19 (32)	0
Oropsylla idahoensis	17 (22)	0
Eumolpianus eutamiadis	17 (21)	0
Opisodasys keeni	13 (18)	0
Eumolpianus eumolpi	16 (30)	0
Malareus telchinus	10 (11)	0
Malareus sinomus	4 (4)	0
Phalacropsylla allos	2 (3)	0
Orchopeas sexdentatus	1 (2)	0
Catallagia sp.	3 (3)	0
Peromyscopsylla selenis	1 (1)	0
Catallagia sculleni sculleni	1 (1)	0
Meringis cummingi	1 (1)	0
Unknown	1 (1)	0
Total	**298 (708)**	**0**

PCR: Polymerase Chain Reaction

4 Rodent-borne Diseases

Rodent-borne diseases in California include hantavirus and Chagas disease. Hantavirus infection is the most important rodent-borne disease in California and is most commonly caused by Sin Nombre virus. Since the disease was first identified in 1993, the California Department of Public Health, Vector-Borne disease Section (CDPH-VBDS) 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 public. Chagas disease, caused by the parasite *Trypanosoma cruzi* and transmitted by droppings from kissing bugs (*Triatoma* spp.), is found predominantly in woodrats in California. People are rarely infected through contact with droppings from infected kissing bugs. CDPH-VBDS performs environmental follow up on human Chagas disease cases if they are acquired in California.

Human disease surveillance

Hantavirus

Human cases of hantavirus infection, which include both hantavirus pulmonary syndrome (HPS) and non-pulmonary syndrome, are reported to the California Department of Public Health (CDPH) and are usually confirmed serologically and molecularly by the CDPH Viral and Rickettsial Disease Laboratory (CDPH-VRDL). When necessary, the CDPH Vector-Borne Disease Section (CDPH-VBDS) follows up human cases with environmental investigations, which may include trapping rodents and collaborating with CDPH-VRDL for testing for Sin Nombre virus (SNV) to evaluate exposure circumstances and potential for additional exposures. In 2024, two cases of HPS were reported from Sierra and Los Angeles counties, one of which was fatal. Months of illness onset were March and May, respectively. Laboratory tests and environmental investigations confirmed exposure likely occurred at the case-patients' residences. SNV antibodies were detected in 24 (47%) of 51 deer mice collected from the Sierra County location and 1 (13%) of 8 deer mice from the Los Angeles County location. Since 1980, hantavirus infection has been diagnosed in 93 California residents, with the majority exposed to SNV in the interior mountain ranges of the state or eastern Sierra Nevada (Figure 4.1).

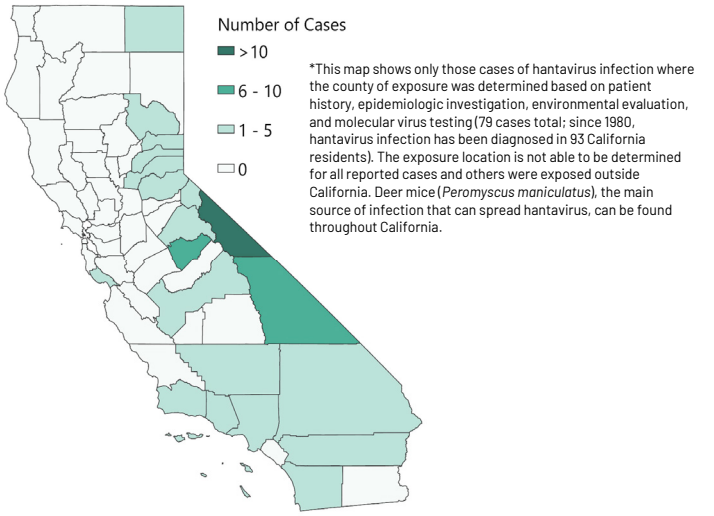


Figure 4.1. Likely county of exposure for reported hantavirus infections, California (1980 – 2024)*

Chagas disease

Chagas disease is transmitted to humans through contact with droppings from kissing bugs (*Triatoma* spp.) which are found predominantly associated with woodrats (*Neotoma* spp.) in California. Human testing for *Trypanosoma cruzi*, the causative agent of Chagas disease, is done primarily by blood banks and commercial laboratories; infection can be confirmed by additional testing at the U.S. Centers for Disease Control and Prevention. In 2024, 12 cases of *T. cruzi* infection or Chagas disease were reported to CDPH-VBDS. Three (25%) cases met national surveillance criteria for confirmed infection, six (50%) were classified as probable, and three (25%) as suspect. Median age was 53 years (range, 16 to 81 years) and 9 (75%) patients were male. Four (33%) patients reported symptoms, while two (17%) asymptomatic patients received a

Table 4.1. Serologic evidence of hantavirus (Sin Nombre) infection in California rodents, 2015 - 2024

		2024			2015-2024		
Species	Common name	No. tested	No. reactive	Percent	No. tested	No. reactive	Percent
Peromyscus boylii	brush mouse	56	0		699	10	1.4
Peromyscus californicus	California mouse	170	0		1,526	21	1.4
Peromyscus crinitus	canyon mouse	5	0		40	2	5.0
Peromyscus eremicus	cactus mouse	175	0		1,968	14	0.7
Peromyscus maniculatus	deer mouse	605	79	13.1	4,521	580	12.8
Peromyscus truei	piñon mouse	14	0		438	2	0.5
Peromyscus spp.	unspeciated *Peromyscus*	0	0		29	0	
Peromyscus spp. subtotal		1,025	79	7.7	9,221	629	6.8
Reithrodontomys megalotis	western harvest mouse	100	19	19.0	675	91	13.5
Neotoma spp.	woodrats	12	0		233	0	
Microtus spp.	voles	50	6	12.0	101	12	11.9

positive screening after donating blood. Patients were residents of eight counties: Monterey, Orange, Riverside, San Bernardino (2), San Mateo (4), Sonoma, and Ventura (2). Of the eight (67%) patients for whom travel history data were available, six (50%) reported travel to the following countries in Latin America: El Salvador, Bolivia, Guatemala, and Mexico. Travel history was not available for two (17%) patients. No patients reported encounters with kissing bugs, which are the vector of Chagas disease.

Rodent surveillance

In 2024, 1,187 rodents (Genera: *Microtus*, *Neotoma*, *Peromyscus*, and *Reithrodontomys*) were tested for antibodies to SNV (Table 4.1). Of 1,025 *Peromyscus* spp. sampled, 79 (7.7%) were positive for SNV antibodies. Seroprevalence in deer mice, the primary reservoir for SNV, was 13.1% (Table 4.2). At least one deer mouse was SNV antibody-positive in 13 of 15 counties sampled in 2024 (Table 4.2). SNV antibody has been detected in deer mice from 28 (65%) of 43 counties sampled in the last 10 years; prevalence ranged from 0.9% to 45.5% (average 12.8%) over that period (Table 4.2).

Additionally, blood samples from 19 (19%) of 100 western harvest mice (*Reithrodontomys megalotis*) and 6 (12%) of 50 voles (*Microtus* spp.) demonstrated reactivity to SNV (Table 4.1). None of 12 woodrats (*Neotoma* spp.) demonstrated reactivity to SNV (Table 1.1). Seropositivity in these rodents may represent spillover of SNV from deer mice or infection with other hantaviruses, which cross react to the SNV assay. In California, no hantaviruses other than SNV have been shown to be pathogenic to humans.

Table 4.2. Serologic evidence of hantavirus (Sin Nombre) infection in *Peromyscus maniculatus* in California, 2015-2024

	2024			2015-2024		
County	No. tested	No. reactive	Percent	No. tested	No. reactive	Percent
Alameda	34	1	2.9	115	1	0.9
Alpine	18	2	11.1	27	4	14.8
Amador				4	0	0.0
Butte				6	0	0.0
Calaveras				4	1	25.0
Contra Costa				12	0	0.0
Del Norte				1	0	0.0
El Dorado	12	1	8.3	317	67	21.1
Fresno				8	0	0.0
Glenn				5	1	20.0
Humboldt				69	0	0.0
Inyo				11	5	45.5
Kern				66	1	1.5
Lassen				26	8	30.8
Los Angeles	8	1	12.5	33	1	3.0
Marin				43	0	0.0
Mariposa	60	13	21.7	402	41	10.2
Modoc				38	3	7.9
Mono	30	4	13.3	386	139	36.0
Monterey				10	0	0.0
Napa				5	1	20.0
Nevada	9	0	0.0	115	17	14.8
Orange	5	2	40.0	5	2	0.0
Placer				24	2	8.3
Plumas	23	2	8.7	138	27	19.6
Riverside				141	26	18.4
San Bernardino				85	0	0.0
San Diego	145	6	4.1	1,369	63	4.6
San Joaquin				4	0	0.0
San Mateo				147	25	17.0
Santa Barbara				12	0	0.0
Santa Clara				1	0	0.0
Santa Cruz				18	5	27.8
Shasta	22	1	4.5	111	13	11.7
Sierra	112	29	25.9	123	29	23.6
Siskiyou	52	4	7.7	133	26	19.5
Sonoma				46	0	0.0
Sutter				9	0	0.0
Tehama	7	0	0.0	53	14	26.4
Trinity				3	0	0.0
Tulare				28	2	7.1
Tuolumne	68	13	19.1	333	55	16.5
Ventura				35	1	2.9
Total	**605**	**79**	**13.1**	**4,521**	**580**	**12.8**

National Park hantavirus prevention

In May 2013, Yosemite National Park (YOSE) of the National Park Service (NPS) and Heluna Health (HH, formerly Public Health Foundation Enterprises) began a cooperative agreement to decrease the risk of contracting vector-borne diseases through increased health education, vector surveillance, and public health research. CDPH-VBDS and HH worked with YOSE staff in 2024 on hantavirus prevention activities including rodent surveillance to estimate deer mouse abundance and SNV prevalence, facility evaluations to improve rodent exclusion, and improving employee training and public education. Deer mouse surveillance was conducted in developed areas of Yosemite Valley, Tuolumne Meadows, Crane Flat, and along Glacier Point Road. The deer mouse trap success rate (13.7%) at Yosemite Valley locations in 2024 was similar to the overall Yosemite Valley trap success of 11.0% for surveillance conducted from 2012 through 2023. Six (13.0%) of 46 deer mice collected from Yosemite Valley locations tested positive for SNV antibodies in 2024, compared to 7.0% (27/384) of deer mice sampled from 2012 through 2023. The 36.6% trap success rate for deer mice outside of Yosemite Valley was higher than the overall trap success rate of 21.8% for surveillance events in these areas from 2012 through 2023, and the SNV seroprevalence of 24.3% (18/74) was higher than the overall SNV seroprevalence (15.8%, 69/437) for deer mice sampled outside of Yosemite Valley from 2012 through 2023. In addition to rodent surveillance and SNV testing, over 50 structures were evaluated for rodent-borne disease risks. CDPH-VBDS and HH staff provided hantavirus prevention recommendations to YOSE and its associated partners based on the rodent surveillance results and facility evaluations.

Lassen Volcanic National Park (LAVO) renewed a cooperative agreement with HH and CDPH-VBDS in 2024 for services that included facility evaluations to improve rodent exclusion and deer mouse surveillance to estimate rodent abundance and SNV prevalence. Deer mouse surveillance was conducted in four developed areas of LAVO, and 3 (6.7%) of 45 deer mice tested seropositive for SNV antibodies. For comparison, 21.7% (55/254) of deer mice in LAVO tested positive for SNV antibodies from 2014 through 2023. In addition, two buildings were evaluated for hantavirus or other vector-borne disease risks. CDPH-VBDS and HH staff provided hantavirus prevention recommendations to LAVO based on the surveillance results and facility evaluations.

5 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 5.1). 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 Technician employees must pay annual renewal fees and fulfill minimum continuing education requirements. The California Department of Public Health (CDPH) Vector-Borne Disease Section (VBDS) approved 135 continuing education events in 2024. Successful examinees that 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.

Through 2024, 1,209 Vector Control Technicians employed at 101 local public health agencies and CDPH held 2,950 certificates (Table 5.2). The agencies include special districts, departments of county government, departments of city government, and CDPH. Of these agencies, 72 are signatory to a cooperative agreement with CDPH. In 2024, 917 individuals employed at 72 agencies held full certification status. In addition, 292 employees from 49 agencies held limited status. Many agencies employ technicians with both full and limited status.

Vector Control Technicians can view their certification records and the approved Vector Control continuing education courses at: 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: https://bit.ly/VCTCertification

Table 5.1. Results of certification examinations administered in 2024		
Exam section	**No. Exams Given**	**No. Passed (%)**
Core	159	110 (69)
Mosquito Control	169	103 (61)
Terrestrial Invertebrate Control	131	69 (53)
Vertebrate Vector Control	118	78 (66)
Totals	**577**	**360 (62)**

Table 5.2. Vector Control Technician certificates in effect as of December 2024			
	No. Certificates		
Certification Category	**Full Status**	**Limited Status**	**Total**
Mosquito Control	917	214	1,131
Terrestrial Invertebrate Vector Control	733	158	891
Vertebrate Vector Control	740	197	937
Totals	**2,390**	**569**	**2,959**

6 Public Information, Scientific Publications

A goal of the California Department of Public Health, Vector-Borne Disease Section is to provide clear and effective information on disease prevention and injurious pests to a wide audience. This goal is pursued through approaches including presentations, development and distribution of printed and digital materials, and maintenance of websites with up-to-date information. Research projects in which staff from the California Department of Public Health, Vector-Borne Disease Section were principal or collaborating investigators are published in peer-reviewed scientific literature.

Expanded resources in 2024

- Tick-Borne Disease Prevention (webpage – Spanish)
- Dengue (webpage – English/Spanish)
- WNV FAQs (webpage)

Collaborative Newsletters

- University of California Integrated Pest Management Home & Garden Pest Newsletter
  - » Fall 2024 – Controlling Ticks Around Your Home

- University of California Natural Reserve System Newsletter
  - » January 2024 - Adult *Ixodes pacificus* Tick Season
  - » May 2024 – Hantavirus Risk
  - » July 2024 – Plague Risk in Summer

- Mosquito and Vector Control Association of California News Briefs
  - » Winter 2024 – CDPH Tick Resources Reminder
  - » Spring 2024 – CDPH Lyme Disease Awareness Resources

UC IPM

Home & Garden Pest Newsletter

Controlling Ticks Around Your Home

In this issue:

Controlling Ticks p.1

Neonicotinoid Restrictions p.3

Webinar Survey p.3

Invasive Pest Spotlight p.4

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You might think ticks are found only on hiking trails or in wild, natural areas, but in some parts of California, ticks can also live in backyards and neighborhoods. Californians living near natural areas (such as open fields, parks, or urban hiking trails) should get to know their arachnid neighbors and learn how to avoid ticks at home.

Meet the Western Blacklegged Tick

Ticks are found outdoors in brushy, wooded areas on plants, rocks, logs, and in leaves and twigs on the ground. Beginning in fall, adult western blacklegged ticks emerge in California, especially in northern coastal counties and the Sierra Nevada foothills. These ticks lurk on bushes, shrubs, and the tips of tall grasses waiting for a person or animal to brush against them so they can attach and feed on their blood.

Blood-sucking ticks can spread bacteria and other germs when they bite, causing diseases like Lyme disease in people and pets. The best way to prevent tick bites around your home is to keep ticks away from and out of your home.

Tick-Safe Landscaping

Landscaping and maintaining your yard can help make your backyard less desirable for ticks. Western blacklegged ticks prefer to live in shady, humid, overgrown areas, especially in tall grass and overgrown vegetation. These ticks are usually not found in open, sunny areas such as on mowed lawns.

continued on page 2

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Ixodes pacificus (western blacklegged tick).

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Mow grass to protect against hitchhiking ticks.

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