Riverside County
Department of Environmental Health
Vector Control Program

Annual Report

2013
Vector Control Program

County of Riverside
Department of Environmental Health
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Riverside, California  92503

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Mosquito larvae
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INTRODUCTION

The vast majority of vector-borne diseases are found in tropical areas of the world. Although Riverside County has a more temperate climate, vector-borne diseases exist in this area that can cause serious health problems. These diseases include Plague, Encephalitis, Lyme Disease, Hantavirus, and West Nile Virus. Monitoring and reacting to the presence of these diseases is vital to the protection of the health and well being of the public.

Riverside County is under the jurisdiction of multiple agencies which provide vector control services and vector-borne disease surveillance. The Riverside County Vector Control Program has been active in surveillance and vector control activities since 1972 and provides vector control services to mid-western Riverside County and the Palo Verde Valley area outside the city limits of Blythe. Services are also provided to contract cities which include Banning, Beaumont, Hemet, Menifee, Moreno Valley, Murrieta, Perris, San Jacinto, Temecula and Wildomar. The service area is 4800 square miles with an approximate population of 990,000 people.

There are two other vector control districts within Riverside County. Northwest Mosquito and Vector Control District provides services to the northwest area of the County including the cities of Calimesa, Canyon Lake, Corona, Eastvale, Jurupa Valley, Lake Elsinore, Norco, and Riverside. The Coachella Valley Mosquito and Vector Control District provide services to the desert areas of the County, ranging from Palm Springs to Chiriaco Summit, including the Salton Sea.

Encephalitis and West Nile Virus are mosquito-borne diseases continually detected in Riverside County with most surveillance and control activities being conducted throughout the spring and summer. Lyme Disease surveillance and tick population studies are conducted throughout the spring. Plague is endemic in the ground squirrel population of the mountain areas and has been monitored during the summer since 1978. Hantavirus and Arena virus surveillance is also conducted each year. This annual report highlights the efforts of this Program during the year 2013 and its efforts to provide vector control services to the residents of Riverside County.
The Riverside County Vector Control Program responded to 421 service calls (complaints) in 2013. The majority of the service calls addressed mosquitoes and can be attributed to unmaintained backyard swimming pools, spas, and ponds which have been abandoned. Mosquito service calls are investigated and mosquito breeding sites are abated using various methods. Property owners are notified of the problem and are encouraged to correct it. If owners refuse to abate the violation, a variety of enforcement actions may be taken.

Mosquito complaints involving areas which are not private residences are assigned a source number and serviced on a routine basis to maintain mosquito control. Sources include flood channels, retention basins, ditches and similar areas which are collection points for water runoff or hold stagnant water for any length of time.

An integrated approach to controlling vectors is applied to all complaints. An example of this is introducing mosquito fish to closed water bodies like abandoned swimming pools to feed on mosquito larvae and pupae. Technicians inform members of the public on how to prevent the harborage and proliferation of vectors (including mosquitoes, rodents, and flies). Some complaints are handled by educational brochure. Others require the identification of samples and/or control measures. While non-pesticide methods are preferred, in many instances pesticides are the only effective solution.
## 2013 Complaints by Type in Contract Cities

<table>
<thead>
<tr>
<th>Type</th>
<th>Banning</th>
<th>Beaumont</th>
<th>Hemet</th>
<th>Menifee</th>
<th>Moreno Valley</th>
<th>Murrieta</th>
<th>Perris</th>
<th>San Jacinto</th>
<th>Temecula</th>
<th>Wildomar</th>
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<tbody>
<tr>
<td>Rodents (5)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<td>0</td>
<td>0</td>
<td>39</td>
<td>17</td>
<td>0</td>
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<tr>
<td>Flies (2)</td>
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<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Mosquitoes (154)</td>
<td>0</td>
<td>3</td>
<td>31</td>
<td>4</td>
<td>3</td>
<td>82</td>
<td>9</td>
<td>2</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Ticks (1)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>WNV Cases (12)</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Plague</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

### 2013 Complaints by Type for Contract Cities

![Graph showing 2013 Complaints by Type for Contract Cities]
2013 Complaints by Type for the Unincorporated Areas

2013 Total Complaints By Type

- Mosquitoes (296) - 71%
- Bees (58) - 14%
- Flies (38) - 9%
- Rodents (13)
- WNV Human Cases (12)
- Ticks (1)

Total Complaints by Type:
- Mosquitoes: 142
- Bees: 36
- Flies: 2
- Rodents: 1
- WNV Human Cases: 0
- Ticks: 0
Riverside County’s Vector Control Program has the responsibility of controlling the risk of disease transmission by mosquitoes and other vectors, for the residents and visitors of Riverside County.

We utilize the most effective and efficient Best Management Practices (BMPs) to reduce mosquito breeding sources and to minimize the use of pesticides. Our Program has adopted an integrated vector management approach. Use of pesticides is only done on an as-needed basis to accomplish our public safety goals.

The goal for mosquito control is to reduce populations at the larval stage to prevent adult mosquitoes from emerging and posing a health risk and/or nuisance. Various products (larvicides and adulticides) are utilized to accomplish this goal.

![Ounces of Methoprene Larvicide Used 2013](image)
In addition to chemical control, mosquito fish (Gambusia affinis) are planted at many isolated bodies of standing water throughout our service area. A supply of mosquito fish is also maintained at our office for distribution to the public for use in ornamental ponds.
The Riverside County Vector Control Program continued to monitor mosquito populations during 2013. Six New Jersey light traps were monitored in the western portion of Riverside County. Over the course of the 2013 season 18,818 mosquitoes were collected and identified in the western portion of Riverside County.

New Jersey Light Trap Locations (6 Locations)
**Population Specifications**

*Culex tarsalis*, the “western encephalitis mosquito”, and the main vector of West Nile Virus (WNV), St. Louis Encephalitis (SLE), and Western Equine Encephalomyelitis (WEE) in California, made up 89% of the mosquitoes collected in the western portion of Riverside County.

![Mosquito Population by Species 2013](image)

![Mosquito Populations by Month 2013](image)
Another potential vector, *Culex quinquesetius*, the “southern house mosquito”, made up less than 1% of the mosquitoes collected. *Culex erythrothorax*, the “tule mosquito”, made up 5.2% of the mosquitoes collected. *Culex stigmatosoma*, the “banded foul water mosquito”, represented less than 1% of the total collection. Most *Culex* mosquitoes primarily feed at night on wild birds, but may opportunistically feed on mammals and humans.

**Testing Mosquito Pools**

Mosquito-borne encephalitides are caused by viruses and the related diseases which affect the central nervous system of the infected animal or person. The three types of arthropod-borne viruses detected in Riverside County are St. Louis Encephalitis (SLE), Western Equine Encephalomyelitis (WEE), and West Nile Virus (WNV). These viruses normally cause infection of wild birds and small mammals. Horses and humans can show clinical conditions to these diseases although they are considered dead end hosts (i.e. cannot infect a mosquito). The viruses that cause WEE, SLE, and WNV are normally transmitted from bird to mosquito to bird; and less commonly from bird to mosquito to man or horse.

![Positive Mosquito Pools by Month for 2013](chart.png)
A program for monitoring Encephalitis in Riverside County has been in effect for more than two decades. Our Program has joined a cooperative effort with the California Department of Public Health (CDPH), the University of California, the Mosquito and Vector Control Association of California, and the Riverside County Public Health Department. Since its introduction to Southern California in 2003, surveillance for West Nile Virus has been a primary focus of our Program.

Historic Mosquito Counts

The type of surveillance we utilize is driven by live mosquito trapping. Carbon dioxide baited traps are set overnight, returned to our lab in the morning for initial processing which consists of identifying mosquito types down to the genus/species. We then “pool” them into groups of individuals of the same species from 12-50 individuals. These will all be females which were searching for a blood meal since female mosquitoes are attracted to the carbon dioxide used in the baiting process. These pooled samples are sent to a lab at UC Davis for virus detection. All collection sites are registered with the State Department of Public Health and are included in the West Nile Virus detection and oversight surveillance program.
WNV POSITIVE MOSQUITO POOL LOCATIONS

WNV Positive Mosquito Pools by Surveillance Area 2013

<table>
<thead>
<tr>
<th>Area</th>
<th>Pools</th>
</tr>
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<tbody>
<tr>
<td>Banning</td>
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<tr>
<td>Beaumont</td>
<td>0</td>
</tr>
<tr>
<td>Hemet</td>
<td>0</td>
</tr>
<tr>
<td>Menifee</td>
<td>1</td>
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<td>Moreno Valley</td>
<td>5</td>
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<td>Murreta</td>
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<td>San Jacinto</td>
<td>5</td>
</tr>
<tr>
<td>Tansuela</td>
<td>1</td>
</tr>
<tr>
<td>Nuevo/Lakeview</td>
<td>13</td>
</tr>
</tbody>
</table>

Menifee, Wheatfield Park
Moreno Valley Locations

Murrieta Locations
Vector Control Program

San Jacinto Locations

Temecula Location
The following numbers of permanent or semi-permanent “source check” locations have evolved over the years either by responding to service calls or by pro-actively seeking out problem areas.

**Contract Cities (404 sites)**
- Banning: 7
- Beaumont: 24
- Hemet: 91
- Menifee: 91
- Moreno Valley: 78
- Murrieta: 26
- Perris: 42
- San Jacinto: 41
- Wildomar: 4

**Unincorporated Areas (123)**
- Blythe area
- Menifee area
- Beaumont area
- Cherry Valley
- Gavilan Hills
- Hemet area
- Horsethief Canyon
- Homeland
- Idyllwild
- Lake Elsinore area
- Lakeview/Nuevo
- Mead Valley
- Perris area
- Temecula area
- Wildomar area
The dead bird surveillance program is coordinated by CDPH where the public can report dead birds via their website (www.westnile.ca.gov). If CDPH staff determines that a dead bird is deemed acceptable for testing, our office is notified. Our staff collects the requested dead bird and ships it to U.C. Davis for testing. A total of 18 dead birds were sent off for testing, with 11 birds testing positive for the WNV. All dead bird surveillance was suspended in August of 2013 due to the prevalence of WNV within the jurisdiction.
WNV POSITIVE DEAD BIRD LOCATIONS

Beaumont Locations

Hemet Locations
Vector Control Program

Perris Location

Nuevo/Lakeview Location
Another aspect of this Program consists of sentinel chicken flocks being placed in areas where high populations of *Culex tarsalis*, the western encephalitis mosquito, are known to exist and where such areas infringe on local communities. Blood samples are collected on a biweekly basis via filter strips and sent to the CDPH Viral & Rickettsial Disease Laboratory where they are analyzed for the antibodies to the viruses. Our Program maintains five surveillance flocks in the western portion of Riverside County. Of the 50 chickens tested as sentinels during the 2013 season, there were 13 positive seroconversions for WNV, 8 were in the San Jacinto Wildlife Area (SJWA) east of Lake Perris.
Lyme disease is a potentially debilitating illness transmitted to people and other animals by certain ticks. The disease is caused by a spirochete, *Borrelia burgdorferi*, a cork-screw shaped bacterium. In California, Western Black-legged Ticks (*Ixodes pacificus*) are thought to be responsible for most human infections. The first California report of the disease came in 1978. California health authorities began monitoring Lyme disease in 1983 and designated it a reportable disease in 1989. Only 2 to 3 percent of the ticks carry the spirochete which causes this disease in California.

People appear to be at risk in spring and early summer, when nymphal ticks are most abundant. Nymphs attach readily to people and their size makes them hard to see. Adult ticks are most active in cooler weather, especially in the winter. They feed on medium to large animals such as field mice, dogs, deer, and humans.

Lyme disease in Riverside County is monitored via adult tick collections. Flagging material made up of white flannel is cut to a 3 by 3 foot square and attached to a handle approximately 4 feet long. The flag is passed over grasses and small shrubbery and examined for attached ticks. This collecting method takes advantage of the questing behavior of adult ticks. When searching for a host they will climb to the tips of grasses, etc., and hold out their legs attaching to the fur of a passing animal.

Ticks are readily collected in various areas of the San Jacinto Mountains, Santa Rosa Mountains, in the Banning and Beaumont foothill areas, the Santa Rosa Plateau area, and in the Ortega Mountains. The collections are principally made along well-worn paths frequently utilized by deer and hikers.

During the 2013 surveillance timeframe (November to March), 375 ticks were collected. In cooperation with CDPH, tick pools of *Ixodes pacificus* were sent to the U.S. Army Center for Health Promotion and Preventive Medicine for analysis. Tick samples were screened for evidence of *Borrelia* spirochetes and *Ehrlichia* rickettsia. The genus *Ehrlichia* contains rickettsial bacteria that are the causal agent for Human Monocytic Ehrlichiosis and Human Granulocytic Ehrlichiosis. Tick samples were also screened for evidence of *Babesia microti*, the causative agent of Human babesiosis. There were no positives recorded from any sites during the 2013 season.
The proper precautions should be taken when visiting areas where ticks inhabit. Since it may take a day or more for the tick to transmit the bacteria, prompt removal of ticks should prevent disease transmission. Grasp the tick with tissue or tweezers (never with bare hands) as close to the skin as possible. Exposure to tick body fluids may transmit disease. Gently pull the tick from the skin. Do not twist the tick. Apply slow steady pressure. Do not remove the tick with a burning match, cigarette, or with Vaseline, kerosene, etc. Disinfect the bite area after removal and disinfect hands. Save the tick for identification. If the tick cannot be removed, or a part is left in, see your physician.

Protect yourself from tick bites by wearing long pants and long sleeved shirts and shoes when visiting tick-infested areas. Wear light colored clothing so ticks will show up. Check yourself at least once every hour. Tuck your pants into your socks or boots and your shirts into your pants. Use insect repellent on the outside of your clothing and follow label instructions. Walk in the middle of trails and avoid bushy or grassy areas when hiking off the trails.

![Tick Specimen Types Collected 2013](image-url)

**Tick Specimen Types Collected 2013**

- *Ixodes Pacificus*: 38
- *Dermacentor Occidentalis*: 288
Twenty million people died in Europe from 1346 to 1352. This period was known as the great pestilence and was later referred to as the Black Death. Today it is called the Plague. The disease has obviously undergone a decline since those times, but still occurs sporadically in various parts of the world today including the United States.

Plague is a specific disease caused by a bacterium named *Yersinia pestis*. The bacterium that causes Plague produces a toxin that causes the destruction of blood vessels. Plague can also attack the lungs leading to pneumonic Plague, the most serious form of this disease. It occurs in localized and sometimes devastating epidemics among persons living in crowded conditions.

Plague has historically been transmitted by the bite of the Oriental Rat Flea (*Xenopsylla cheopsis*). The hosts for this flea have been the Norway rat (*Rattus norvegicus*) and the Roof rat (*Rattus rattus*).

This disease is thought to have been introduced into California in 1900 through the seaport of San Francisco where it was first recorded. It was later recorded in Los Angeles in 1908. The infected rats were arriving from Asia where an epidemic was in progress. Outbreaks in rats and human epidemics followed this introduction in San Francisco and Los Angeles. These epidemics involved domestic rats, rat fleas, and humans.

Plague was first isolated from native ground squirrels and wood rats in California in 1908. A pneumonic Plague epidemic occurred in 1919 in Oakland where a hunter contracted the disease from native ground squirrels. Thirteen out of fourteen of these cases were fatal. The second and last epidemic in California occurred in 1924 in Los Angeles where thirty-one of thirty-two individuals infected died from this disease. There have been a total of 426 human Plague cases in early California epidemics, 55% of which were fatal.

Since 1970, there have been approximately 40 human Plague cases in California, all associated directly or indirectly with the sylvatic (wilderness) Plague cycle. This has occurred in a variety of habitats ranging from sea level on the coast to an elevation of approximately 9000 feet in our California wilderness areas.
In Riverside County, Plague is commonly associated with animal disease outbreaks in populations of California Ground Squirrels (*Spermophilus beecheyi*). The vector is the Squirrel Flea (*Oropsylla montana*). In 1970 during a disease outbreak among California ground squirrels in Silent Valley, located south of the City of Banning, a boy contracted Plague. It was properly diagnosed and he recovered. This incident provided impetus to start our Plague Surveillance Program and eventually establish our Vector Control Program. Over the course of the past several decades surveillance activities have isolated Plague endemic areas in the San Jacinto Mountain range.

During the 2013 season 47 California Ground Squirrels were collected and processed from eight sites in the San Jacinto Mountains. Blood samples were sent to CDPH for Plague testing. In addition, 132 fleas were collected, identified, and held for potential Plague testing. Of the fleas collected, 93% were found to be *Oropsylla montana* and 7% were found to be *Hoplopsyllus anomalus*. CDPH only accepts testing pools of fleas collected from rodents associated with a human case investigation or an apparent plague epizootic. Knowledge about the infection histories of these animals provided by ear-tagging data has helped to make sure that control measures are undertaken only when absolutely necessary.
The 2013 Season was cut short due to fires in the Idyllwild and Mountain Center areas
During the Korean War 2,500 soldiers became infected with a mysterious illness. The symptoms included fevers, weakness, and kidney failure. The virus responsible for these infections was isolated years later. It was found to belong to a group of rodent-borne viruses called Hantaviruses. The Hantaviruses belong to the family Bunyaviridae and the Korean strain was named for the Hantaan River where it was first encountered. It has been determined that the disease is contracted through skin exposure or inhalation of airborne particles of feces or urine from infected rodents.

In 1993, the investigation of two fatal cases in New Mexico revealed a new strain of Hantavirus. It was named the Sin Nombre (no name) Virus and the clinical conditions it caused in humans were referred to as Hantavirus Pulmonary Syndrome (HPS).

HPS is a rare but life-threatening illness that has been diagnosed in many areas of the western United States. The western portion of Riverside County has many habitats that are suitable locations for the development of deer mice. Surveillance activities were conducted during the Spring, Fall, and Winter seasons in 2013 due to the necessary focus of WNV surveillance and mosquito control activities during the summer. Blood samples were collected, processed at our laboratory, and sent to CDPH for Hantavirus antibody analysis. There were 5 positive results returned out of 80 specimens submitted.
POSITIVE HANTAVIRUS LOCATIONS

Eastern Valle Vista — 1 positive
(*Reithrodontomys megalotis*)

Santa Rosa Plateau Preserve — 1 positive
(*Peromyscus boylii*)
Norton Younglove Preserve — 3 positives  
(2 Peromyscus maniculatus)  
(1 Peromyscus eremicus)
As defined by Riverside County Ordinance No. 565, a commercial poultry ranch is any building, structure, enclosure, or premises located within the unincorporated territory of Riverside County, where 1,000 or more domestic fowl are kept or maintained for the primary purpose of producing fowl, eggs, or meat for sale.

The maintenance of sanitary conditions on poultry ranches is essential in the control of synanthropic flies, mosquitoes, and commensal rodents. To insure sanitary conditions, bimonthly inspections are conducted on 17 poultry ranches located in the western portion of Riverside County. Many aspects of ranch management are investigated during these inspections including manure management, manure disposal, maintenance of watering and feeding devices, timely removal of dead fowl and broken eggs and other conditions that could result in a vector breeding situation.

Bimonthly inspections were conducted at all permitted poultry ranches during 2013. Our Environmental Health Technicians comply with very strict bio-security measures due to past quarantines such as Exotic New Castle Disease and the potential threat of Avian Influenza.

**Permitted Poultry Ranches**

Beaumont Ranch, Beaumont  
Cramer Lake Ranch, Riverside  
Demler Egg Ranch, San Jacinto  
Golden Fresh Egg Ranch, Cherry Valley  
Hidden Villa-Cajalco, Perris  
McAnally Enterprises #6, Lakeview  
MCM Lakeview, Lakeview  
Romoland Pullet Ranch, Romoland  
Cottonwood Pullet Ranch, San Jacinto  
Cramer Perris Ranch, Perris  
Fairgrow Pullets, Hemet  
Jong’s Poultry Farm Inc., Riverside  
Hidden Villa-Juniper Flats, Homeland  
McAnally Ranch #9, San Jacinto  
MCM San Timoteo, El Casco  
Romoland Ranch, Menifee  
Sage Ranch, Hemet
In accordance with California Health and Safety Code, Section 106925 and Title 17 of California Code of Regulations, Sections 30001-30061, every government agency employee who handles, applies, or supervises the use of any pesticide for public health purposes must be certified by CDPH. Applicants striving for full certification status must pass all four examinations in the categories of pesticide safety, mosquito control, terrestrial invertebrate control, and vertebrate vector control. In addition, personnel must acquire a set number of continuing education units in all categories. At the end of 2013, our Program had seven fully certified staff. Fifty Environmental Health Specialists are classified with Limited status meaning that they have obtained one or more certifications without being required to acquire continuing education units.

Vector Control and the associated discipline, Medical Entomology, are constantly changing. Keeping abreast of these changes would be an impossible task without the aid of memberships in various organizations. Active memberships were maintained with the Mosquito and Vector Control Association of California, the Society of Vector Ecology, and the American Mosquito Control Association in order to keep our Program informed of the current trends of importance in vector control.

Environmental Health Specialists and Environmental Health Technicians obtaining Vector Control Certifications in 2013

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<th>Exam Category</th>
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<td>B  - Mosquito Control</td>
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<tr>
<td>C  - Terrestrial Invertebrate Control</td>
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</tr>
<tr>
<td>D  - Vertebrate Vector Control</td>
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</tbody>
</table>
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Doug Osborn

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For more information go to our website
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