

**State of Oregon
West Nile Virus Summary Report
2007**

5-1-2008



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2007 Program Highlights

Some of the principal highlights of Oregon’s surveillance, education, and planning programs for West Nile virus (WNV) control in 2007 include the following:

- Eight American Robins, *Turdus migratorius*, were collected and tested positive for WNV for the first time in Oregon.
- West Nile virus-positive animal cases, other than equine, were detected in a squirrel, *Sciurus sp.*, and two pet dogs for the first time in Oregon.

Introduction

West Nile virus (WNV) first appeared in Oregon in 2004. The first human, avian, and equine WNV cases were all diagnosed in August 2004. In 2007, a total of 27 humans, 52 birds, 16 horses, 11 sentinel chickens, 2 pet dogs and 1 squirrel were diagnosed with WNV infection. Figure 1 displays the number of positive WNV tests by month of collection for Oregon in 2007; Table 1 shows the trend of WNV confirmed cases in Oregon from 2004–2007.

Figure 1 Number of positive WNV tests by month of collection for Oregon in 2007.

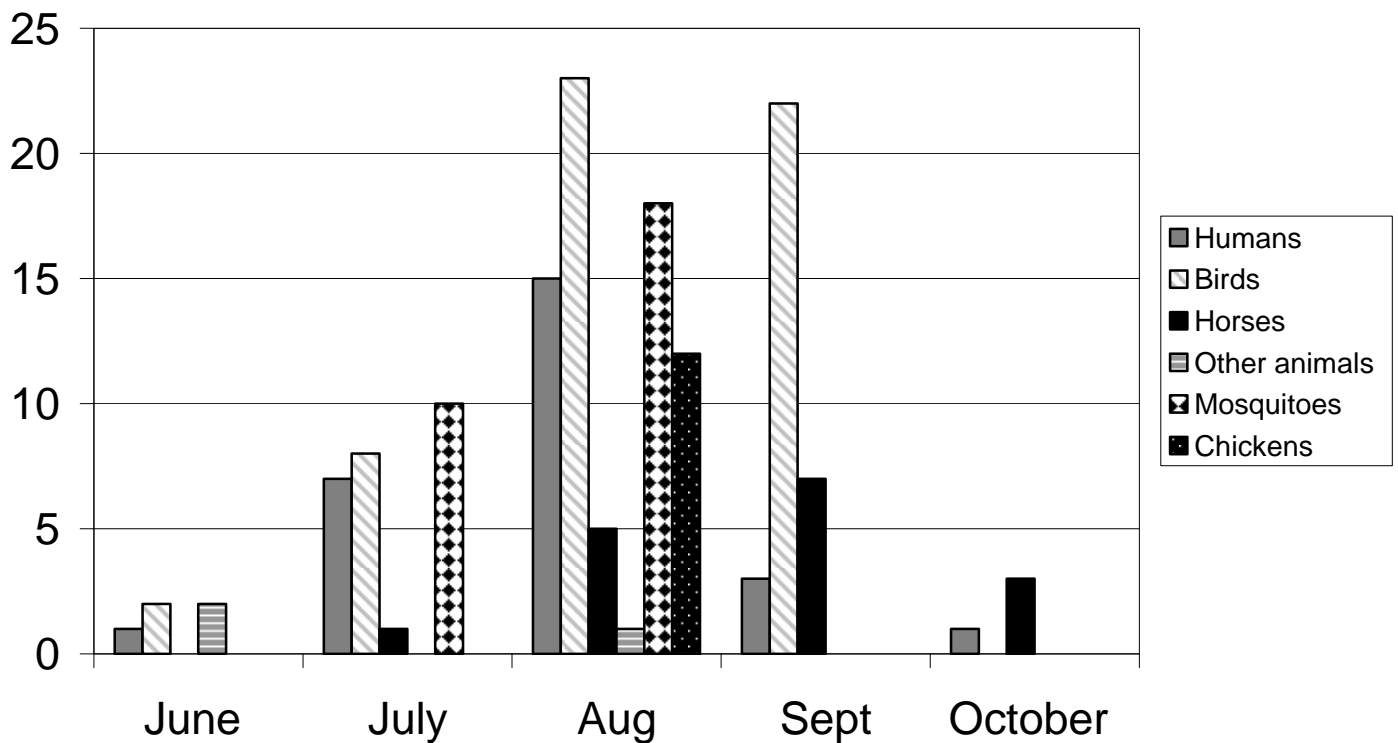
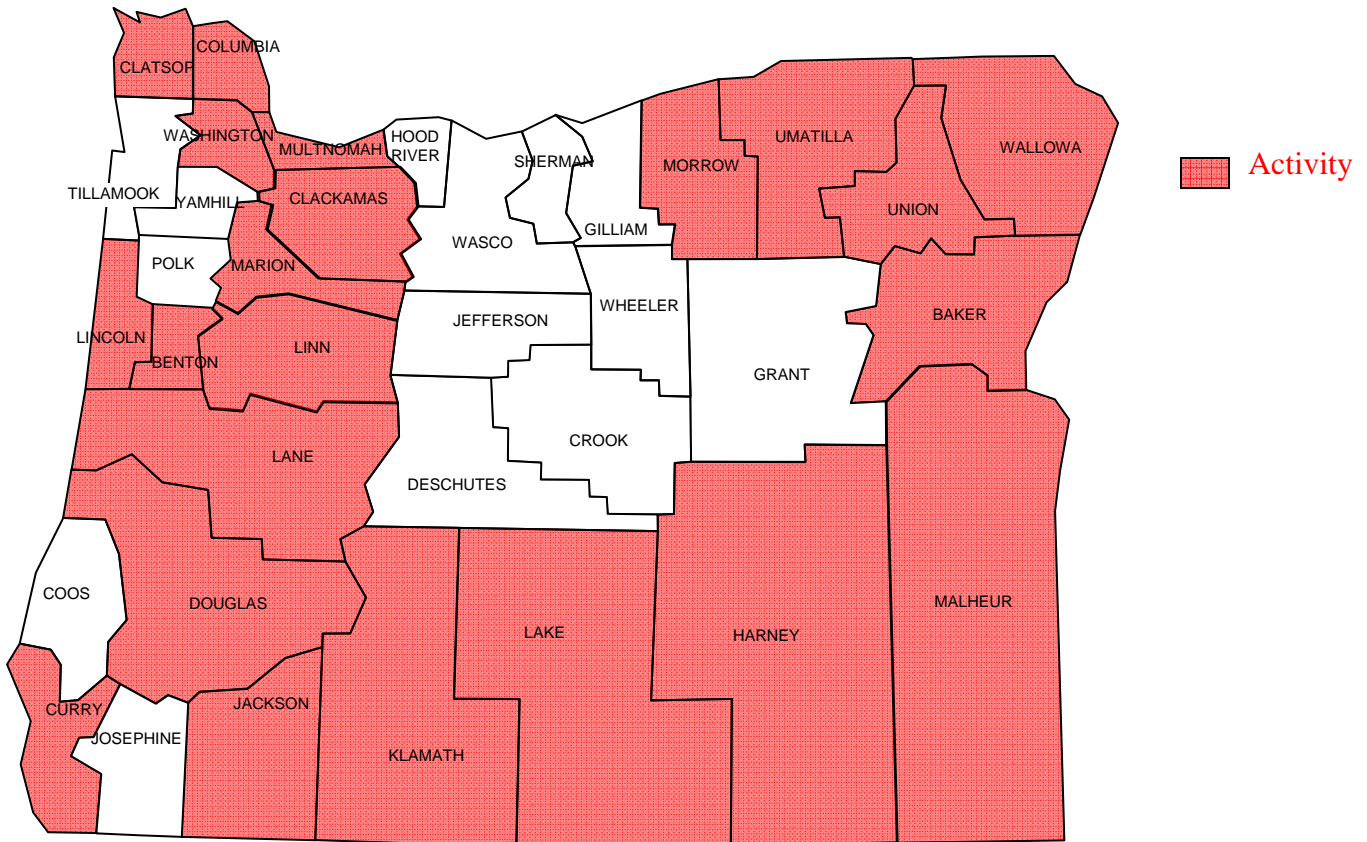


Table 1 WNV confirmed cases in Oregon 2004–2007.

Group	2004	2005	2006	2007
Human	5	8	73	27
Horses	32	46	35	16
Birds	23	15	25	52
Mosquito pools	0	11	22	28
Sentinel chickens	0	15	0	11

Oregon’s surveillance program for WNV was launched in 2001 and has since expanded to include 10 Vector Control Districts (VCDs) and 3 county health departments with mosquito collection activities located throughout the state (see map of Oregon with participating VCDs highlighted in Figure 4). The VCDs collect mosquito pools, maintain sentinel chicken flocks and conduct initial WNV tests for mosquitoes, sentinel chickens and dead birds. In counties without VCDs, this work may be conducted by the local health department. Confirmatory testing of WNV for humans and sentinel chickens is performed by the Oregon State Public Health Laboratory (OSPHL). Oregon State University’s (OSU’s) Veterinary Diagnostic Laboratory performed all WNV testing of mosquitoes, horses and dead birds. Figure 2 illustrates the Oregon counties reporting West Nile virus in 2007. The Oregon WNV surveillance findings for humans, horses, birds and mosquitoes in 2007 are summarized in the sections that follow.

Figure 2 Map of Oregon with shaded counties reporting WNV activity.



WNV Surveillance and Related Activities

Human Surveillance

In 2007, twenty-seven Oregon residents tested positive for WNV by IgM antibody, including 26 people who contracted WNV in Oregon and 1 person who contracted WNV in another state. Of the 26 Oregon residents, one of the cases developed WNV was a result of an organ transplant. The organ recipient developed neuro-invasive WNV and further investigation revealed while the organ donor tested positive for WNV, the donor died of non-WNV related causes. Oregon cases were Malheur County residents. Descriptive data for the 27 Oregon residents who contracted WNV are presented in Table 2. Trend data of Oregon residents who contracted WNV from 2004–2007 are presented in Table 3.

Table 2 Descriptive data for Oregon residents who contracted WNV in Oregon in 2007.

	Number n=27		Percent
Sex	Male	13	48%
	Female	14	52%
Age	<19	1	4%
	19-29	3	11%
	30-39	3	11%
	40-49	4	15%
	50-59	9	33%
	60-69	4	15%
	70-79	2	7%
	>79	1	4%
County	Baker	1	4%
	Clackamas	1	4%
	Douglas	1	4%
	Klamath	2	7%
	Lane	1	4%
	Malheur	12	44%
	Marion	1	4%
	Union	7	26%
	Wallowa	1	4%
Exposure	In State	26	96%
	Out of State	1	4%
	Uncomplicated fever	19	70%
Symptoms	Encephalitis+Meningitis	7	26%
	Meningitis	0	0%
	Other/Unknown	1	4%

Table 3 Trend data for Oregon residents who contracted WNv in Oregon in 2004–2007.

Year	% NID*	Deaths
2004	0%	0
2005	13%	0
2006	18%	1
2007	26%	1

*% NID: percent neuro-invasive disease

Equine and Other Animal Surveillance

Surveillance for WNv in Oregon’s equine population resulted in 16 positive test results out of 35 horses tested by OSU’s Veterinary Diagnostic Laboratory. Seven (40%) of the horses that tested positive for WNv were from Union County. Positive equine test results for Oregon counties in 2007 are illustrated in Table 4. Other small animals in Linn and Union Counties tested positive for WNv for the first time in 2007. These data are summarized in Table 5.

Table 4 Positive Equine WNv test results, Oregon 2007.

County	Number of Positive Test Results
Harney	1
Jackson	1
Klamath	3
Lake	1
Malheur	1
Union	7
Wallowa	2
Total	16

Table 5 Other Positive WNv test results, Oregon 2007.

County	Number of Positive Test Results
Union	1 Squirrel
Linn	2 Canine
Total	3

Avian Surveillance

Surveillance for WNV in Oregon’s avian population resulted in 55 positive test results out of 248 birds tested by OSU’s Veterinary Diagnostic Laboratory and the VCDs. Numbers of avian WNV tests and positive test results for Oregon counties in 2007 are summarized in Table 6. Prevalence of WNV in Oregon by avian species in 2007 is presented in Table 7, showing that 85% of the birds that were collected and tested positive in Oregon in 2007 are the family Corvidae (aka corvids). Other bird species testing positive include American Robin *Turdus migratorius*, American White Pelican *Pelecanus erythrorhynchos*, Red-tailed Hawk *Buteo jamaicensis* and Kestrel *Falco spp.* Trend data for avian WNV testing and positive test results for Oregon counties are presented in Table 8.

Table 6 Avian WNV tests and positive test results for Oregon counties in 2007.

County*	Positive Test Results	Avian Specimens Tested	Percent positive
Baker	0	1	0
Benton	2	23	9
Clackamas	3	10	30
Columbia	2	3	67
Clatsop	1	8	13
Crook	0	2	0
Curry	1	1	100
Deschutes	0	6	0
Harney	0	1	0
Jackson	6	9	67
Lake	2	2	100
Lane	4	21	19
Lincoln	1	6	17
Linn	0	1	0
Malheur	2	2	100
Marion	0	9	0
Morrow	0	16	0
Multnomah	16	84	19
Polk	0	2	0
Tillamook	0	2	0
Umatilla	3	21	14
Union	10	11	91
Wallowa	1	1	100
Wasco	0	0	0
Washington	1	7	14
Yamhill	0	1	0
Total	55	248	22

*Counties with positive test results are indicated in **bold**.

Table 7 Prevalence of WNV by bird species in Oregon, 2007.

Corvid or non-corvid	Species	Percent tested
Corvid	American Crow <i>Corvus brachyrhynchus</i>	45%
Corvid	Jays <i>Aphelocoma californica</i> <i>Cyanocitta stelleri</i>	34%
Corvid	Magpie <i>Pica hudsonia</i>	6%
Non-corvid	Other	15%

Table 8 Avian WNV tests and trend of positive test results for Oregon counties 2004–2007.

Year	Number Positive	Number Tested	Percent Positive
2004	23	448	5%
2005	15	298	5%
2006	25	212	12%
2007	55	248	22%

Mosquito Surveillance

In 2007, the VCDs conducted surveillance for WNV in Oregon's mosquito population. Statewide, approximately 124,050 individual female mosquitoes (2,481 mosquito pools*) were collected and tested with representation from at least 20 mosquito species. Table 9 displays the number of individual female mosquitoes collected by VCDs for 20 mosquito species in 2007. PCR testing for WNV was conducted by OSPHL where 20 mosquito pools (1,000 individual female mosquitoes) tested positive. Table 10 displays the mosquito species found positive for WNV in Oregon in 2007. Table 11 displays the trend data for WNV positive mosquito species in Oregon between 2004 through 2007. Figure 3 indicates the efficiency of vector transmission for various mosquito species (information obtained from the Centers for Disease Control and Prevention). Table 11 represents the species of mosquitoes positive for WNV since 2005. Note that *Culex tarsalis* and *C. pipiens* are the most likely species of mosquito to transmit WNV in Oregon.

Table 9 Female mosquitoes collected by Oregon VCDs for each species in 2007.

Vector Control District	<i>Culex tarsalis</i>	<i>Culex pipiens</i>	<i>Culex stigmatosoma</i>	<i>Aedes vexans</i>	<i>Aedes dorsalis</i>	<i>Culiseta inornata</i>	<i>Aedes increpitus</i>	<i>Aedes nigromaticus</i>	<i>Culex erythrothorax</i>	<i>Anopheles freeborni</i>	<i>Aedes washinoi</i>	<i>Anopheles punctipennis</i>	<i>Aedes sticticus</i>
Baker	5,970			541	779	30		1,348		12			
Benton	50	350											
Clackamas	241	1,230		86							36		15
Columbia	299	828		3,610		1				10		238	
Curry	104					28							
Deschutes (Four Rivers)	5,714	5		27,920		114		342		153			
Jackson	4,976	5,431	338	1,555					2,005				
Klamath	5,254	585		8,742		1,446		278		114			
Lane	1,512	5,573		2,215									
Morrow	11,289	8,885		704	11					56			
Multnomah	6,885	5,677		4,212		32				27	442	827	230
Umatilla	8,398	6,554			5	20							
Union	1,883	21		1,050									
Wasco		49											
Washington	454	5,151	10	79		3			2	1		91	
Total	53,029	40,339	348	50,714	795	1,674	528	1,968	2,007	373	478	1,156	245

*50 mosquitoes/pool

Table 9 Female mosquitoes collected by Oregon VCDs for each species in 2007 *continued*.

Vector Control District	<i>Culiseta particeps</i>	<i>Culex spp.</i>	<i>Aedes spp.</i>	<i>Aedes cinereus</i>	<i>Culiseta impatiens</i>	<i>Culiseta spp.</i>	<i>Coquilletidia perturbans</i>
Baker							
Benton							
Clackamas							
Columbia	2						1,099
Curry							
Deschutes (Four Rivers)							
Jackson	267						2,776
Klamath							
Lane							
Morrow							
Multnomah		50		59		117	77
Umatilla		512	24			32	
Union							
Wasco						16	
Washington	20	122			6		6
Total	289	684	24	59	6	165	3,958

Table 10 WNV-positive mosquitoes by species in Oregon counties, Oregon 2007

VCD	Mosquito Species	Number of Positive Mosquitoes	Mosquito pool 50 mosquitoes/pool	Date of Collection
Baker	<i>Culex tarsalis</i>	300	6	7/23 – 8/14
Jackson	<i>Culex pipiens</i>	50	1	8/10
Klamath	<i>Aedes vexans</i>	100	2	7/23 – 8/07
Union	<i>Aedes vexans</i>	50	1	7/06
Union	<i>Culex pipiens</i>	50	1	8/1
Union	<i>Culex tarsalis</i>	850	9	7/12 – 8/16

Table 11 Trend data of WNV positive mosquitoes, Oregon 2004–2007

Year	Mosquito Species	Number Positive
2004	-	-
2005	<i>Culex tarsalis</i> – <i>Culex stigmatosoma</i> <i>Culex pipiens</i>	550 mosquitoes (11 pools)*
2006	<i>Culex tarsalis</i>	1,100 mosquitoes (22 pools)
2007	<i>Culex tarsalis</i> <i>Culex pipiens</i> <i>Aedes Vexans</i>	1150 mosquitoes (23 pools) 100 mosquitoes (2 pools) 150 mosquitoes (8 pools)

*fifty mosquitoes/pool

**Figure 3 Potential Oregon vectors of WNV based on laboratory vector competence studies (2).
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Table 3. Potential for selected North American mosquitoes to transmit WNV based on bionomics, vector competence, virus isolations, and involvement with other arboviruses

Species	Association with other viruses ^a	Host preference	Activity time	Flight range	Vector competence for WNV ^b	Field isolations of WNV ^c	Potential to serve as a	
							Enzootic vector ^d	Bridge vector ^e
<i>Ae. aegypti</i>		Mammals	Crepuscular/day	200 m	+++ , 3	+	0	+
<i>Ae. albopictus</i>	EEE	Opportunistic	Crepuscular/day	200 m	++++, 3, 6	+	+	++++
<i>Ae. vexans</i>	EEE, WEE, SLE	Mammals	Crepuscular/night	>25 km	++ 1, 5, 8	+++	0	++
<i>Cq. perturbans</i>	EEE	Opportunistic	Crepuscular/night	5 km	+, 4	+	+	+
<i>Cs. melanura</i>	EEE	Birds	Crepuscular/night	9 km	+, 8	++	++	0
<i>Cs. inornata</i>	WEE	Mammals	Crepuscular/night	2 km	+++ , 5	+	+	++
<i>Cx. stigmatosoma</i>	SLE	Birds	Night	1 km	+++ , 5	0	+++	+
<i>Cx. erythrothorax</i>	WEE	Opportunistic	Crepuscular/day	<2 km	++++, 5	0	++	+++
<i>Cx. nigripalpus</i>	EEE, SLE	Opportunistic ^f	Crepuscular	5 km	++ , 4	+++	+++	++
<i>Cx. pipiens</i>	SLE	Birds	Crepuscular/night	2 km	+++ , 1, 3, 5	++++	++++	++
<i>Cx. quinquefasciatus</i>	SLE	Birds	Crepuscular/night	2 km	+++ , 4, 5	0	++++	++
<i>Cx. restuans</i>	SLE	Birds	Crepuscular/night	2 km	++++, 4	+++	++++	++
<i>Cx. salinarius</i>	EEE, SLE	Opportunistic	Crepuscular/night	10 km	++++, 4	+++	+++	++++
<i>Cx. tarsalis</i>	WEE, SLE	Opportunistic ^f	Crepuscular/night	>6 km	++++, 5, 7	++++	++++	+++
<i>Oc. atropalpus</i>		Mammals	Day and night	1 km	++++, 3	+	+	++
<i>Oc. canadensis</i>	EEE	Mammals	Day	2 km	++ , 8	+	0	++
<i>Oc. cantator</i>	EEE	Mammals	Day	>10 km	++ , 8	+	0	++
<i>Oc. dorsalis</i>	WEE	Mammals	Day and night	5 km	+++ , 5	+	0	++
<i>Oc. japonicus</i>	JE?	Mammals	Crepuscular/day	unk	++++, 2, 3	+++	+	++++
<i>Oc. melanimon</i>	WEE	Mammals	Day and night	>10 km	+++ , 5	0	0	++
<i>Oc. sierrensis</i>		Mammals	Crepuscular/day	1 km	+, 5	0	0	+
<i>Oc. sollicitans</i>	EEE	Mammals	Crepuscular/night	>25 km	++ , 1, 3	+	0	+
<i>Oc. taeniorhynchus</i>	EEE	Mammals	Day and night	>25 km	+, 1, 3	+	0	+
<i>Oc. triseriatus</i>		Mammals	Day	200 m	+++ , 8	++	0	+++
<i>Ps. ferox</i>	SLE	Mammals	Day	2 km	0, 8	+	0	0

Distribution and bionomics based on and generalized from information in Carpenter and LaCasse (1955), Darsie and Ward (1981), and Moore et al. (1993).

^a Known association with other viruses with a similar transmission cycle. EEE, eastern equine encephalomyelitis virus; JE; Japanese encephalitis virus; SLE; St. Louis encephalitis virus; WEE; western equine encephalomyelitis virus. Based on Karabatsos (1985).

^b Efficiency with which this species is able to transmit WNV in the laboratory. 0, incompetent; +, inefficient; +++++, extremely efficient vector. Based on 1 (Turell et al. 2000), 2 (Sardelis and Turell 2001), 3 (Turell et al. 2001), 4 (Sardelis et al. 2001), 5 (Goddard et al. 2002), 6 (Sardelis et al. 2002), 7 (Turell et al. 2003), or 8 (present study).

^c Relative number of WNV-positive pools detected. 0, none; +, few; +++++, many.

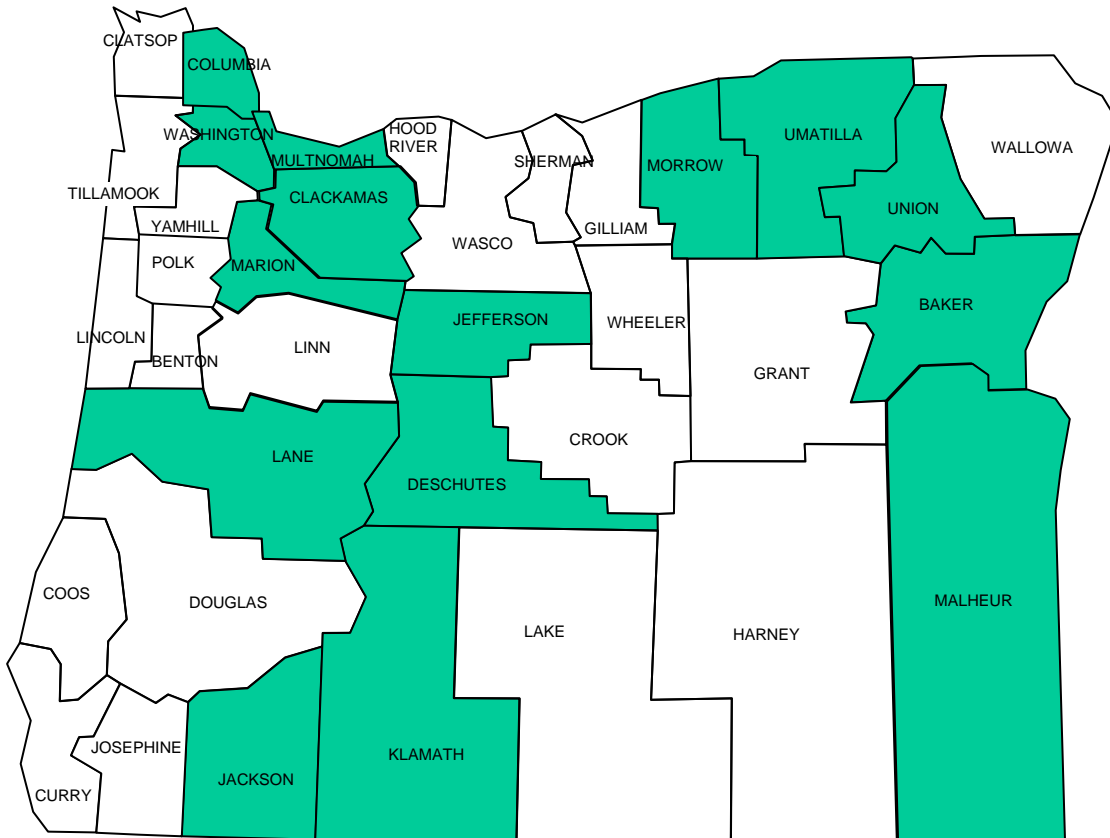
^d Potential for this species to be an enzootic or maintenance vector based on virus isolations from the field, vector competence, feeding behavior, etc. 0, little to no risk; +++++, this species may play a major role.

^e Potential for this species to be an epizootic or bridge vector based on virus isolations from the field, vector competence, feeding behavior, etc. 0, little to no risk; +++++, this species may play a major role.

^f Feeds primarily on avian hosts in spring and early summer and mixed between avian and mammalian hosts in late summer and fall.

Vector Control Districts

Figure 4 Map of Oregon with the counties of participating Vector Control Districts (VCDs) and their activities.



County	Mosquito surveillance	Mosquito fish	Sentinel Chickens	Birds collection	Larvaciding	Adulticiding
Baker	*			*	*	*
Clackamas	*		*	*	*	*
Columbia	*			*	*	*
Deschutes	*			*	*	*
Jackson	*		*	*	*	*
Jefferson	*			*		
Klamath	*	*		*		*
Lane	*			*		
Malheur				*		
Marion	*			*	*	*
Morrow	*		*	*	*	*
Multnomah	*	*	*	*	*	*
Umatilla	*	*	*	*	*	*
Union	*	*	*	*	*	*
Washington	*	*		*	*	*

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