2017

State of Oregon West Nile Virus Summary Report

Oregon Health Authority

PUBLIC HEALTH DIVISION

Acknowledgments

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This report is possible because of the input and hard work of all Oregon vector control districts and the Oregon State University Oregon Veterinary Diagnostic Laboratory.

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Please cite this publication as follows:

Oregon Public Health Division. State of Oregon West Nile virus summary report 2017. Oregon Health Authority. Portland, OR. 2018 April.

Contents

List of tables

List of figures

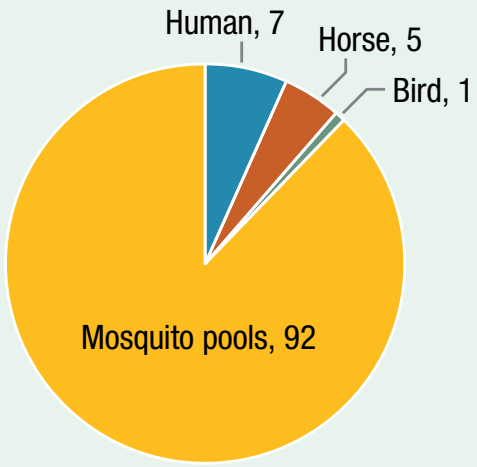
Executive summary

2017 program highlights

Oregon's surveillance for West Nile virus (WNV) in 2017 identified the following:

- 7 human cases
- 5 equine cases
- 1 avian case
- 92 positive mosquito pools

Figure 1. Number of positive WNV tests, Oregon, 2017



Source: Oregon State University Veterinary Diagnostic Laboratory and Oregon local health authorities

Table 1. Confirmed WNV infections by species, Oregon, 2004–2017

Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Human	5	8	73	27	16	12	0	0	12	16	8	1	3	7
Horse	32	46	35	16	0	5	0	2	2	6	3	6	6	5
Bird	23	15	25	52	2	16	0	0	2	2	7	11	12	1
Mosquito	0	11	22	28	16	262	4	3	71	89	58	59	51	92
Sentinel chickens	0	15	0	11	0	0	0	0	0	0	0	0	0	0

Source: Oregon State University Veterinary Diagnostic Laboratory and Oregon State Public Health Laboratory

Introduction

Oregon launched a West Nile virus (WNV) surveillance program in 2001. The virus was first identified in humans, birds and horses in Oregon in 2004. Our peak year followed two years later when 73 human cases were reported.

Incidence of human WNV disease remained low in Oregon in 2017. Seven human cases, one bird, five horses and 92 mosquito pools tested positive for WNV in 2017 (Figure 2).

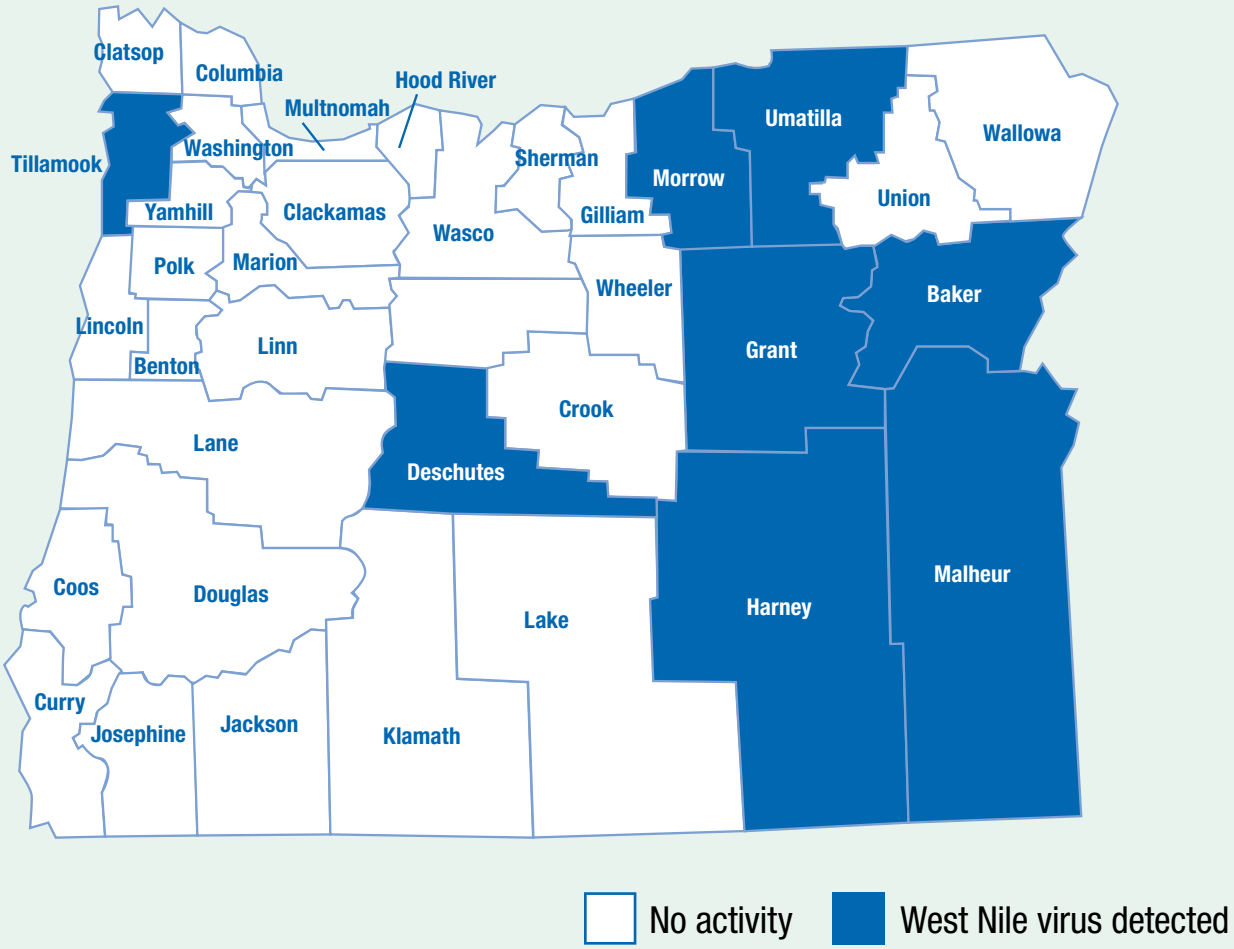
Thirteen vector control districts (VCDs) collect, identify and test mosquitoes and dead birds for WNV surveillance (Figure 4). Some VCDs conduct initial WNV tests for mosquito pools and dead birds using the Rapid Analyte Measurement Platform (RAMP). The Oregon State Public Health Laboratory (OSPHL) performs confirmatory testing of WNV for human specimens.

Oregon State University's (OSU's) Veterinary Diagnostic Laboratory performs WNV testing of mosquitoes, dead birds, horses and other mammals.

The following sections summarize Oregon WNV surveillance findings for humans, horses, birds and mosquitoes in 2017.

Figure 2. Map of Oregon with shaded counties reporting WNV, 2017

County	Mosquitoes	Birds	Horses	Human
Umatilla	5	0	0	0
Baker	9	0	0	0
Malheur	25	0	1	5
Morrow	53	0	0	0
Harney	0	0	4	0
Grant	0	0	0	1
Tillamook	0	0	0	1
Deschutes	0	1	0	0
Total	**92**	**1**	**5**	**7**



See https://public.health.oregon.gov/DiseasesConditions/DiseasesAZ/Pages/disease.aspx?did=8 for more information about West Nile virus.

WNV surveillance and related activities

Human surveillance

In 2017, seven Oregon residents tested positive for WNV by immunoglobulin M (IgM) antibody; four had neuroinvasive disease. Illnesses related to neuroinvasive disease are usually characterized by the acute onset of fever with stiff neck, altered mental status, seizures, limb weakness, cerebrospinal fluid (CSF) pleocytosis or abnormal neuroimaging. Acute flaccid paralysis (AFP) may result from anterior ("polio") myelitis, peripheral neuritis or post-infectious peripheral demyelinating neuropathy (i.e., Guillain-Barré syndrome). Less common neurological manifestations, such as cranial nerve palsies, also occur.

Table 2. Trend data for Oregon residents who contracted WNV in Oregon, 2004–2017

Year	All cases	Neuroinvasive	Deaths
2004	5	0	0
2005	8	1	0
2006	73	13	1
2007	27	7	1
2008	15	3	0
2009	8	0	0
2010	0	0	0
2011	0	0	0
2012	12	1	0
2013	16	8	0
2014	8	2	0
2015	1	0	0
2016	3	1	0
2017	7	4	1
Total	**183**	**40**	**3**

Source: Oregon local public health authorities and State Public Health Laboratory

Veterinary surveillance

WNV surveillance in Oregon's equine population resulted in five positive tests. Table 3 summarizes positive test results by county. No other mammals tested positive for WNV in 2017.

Table 3. Positive equine WNV test results, Oregon, 2017

County	Horses tested for WNV	Horses with positive WNV test results
Clackamas	1	0
Clatsop	1	0
Deschutes	2	0
Grant	1	0
Harney	6	5
Jackson	3	0
Jefferson	1	0
Lake	1	0
Linn	1	0
Union	2	0
Total	**19**	**5**

Source: Oregon State University Veterinary Diagnostic Laboratory

Avian surveillance

WNV surveillance in Oregon's avian population resulted in one positive test result out of 27 birds tested by OSU's Veterinary Diagnostic Laboratory and the VCDs. Of the 27 birds collected, 17 were of the family Corvidae (aka corvids), while the remaining 10 were American species other than corvid. Table 4 shows Oregon's avian species collection totals by county for 2017. Table 5 presents trend data for avian WNV testing and positive test results for Oregon counties for the years 2004–2017.

Table 4. Avian WNV test results by county, Oregon, 2017

County	Corvids tested	All other species tested	Total positives
Baker	1	1	0
Benton	1	0	0
Clackamas	1	0	0
Clatsop	1	0	0
Deschutes	0	2	1
Jackson	1	0	0
Klamath	0	1	0
Lane	4	0	0
Malheur	0	3	0
Morrow	1	0	0
Multnomah	6	0	0
Umatilla	0	2	0
Wasco	1	0	0
Yamhill	0	1	0
TOTAL	**17**	**10**	**1**

Source: Oregon State University Veterinary Diagnostic Laboratory

Table 5. Avian WNV tests and trend of positive test results, Oregon, 2004–2017

Year	Number tested	Number positive	% positive
2004	448	23	5%
2005	298	15	5%
2006	212	25	12%
2007	246	55	22%
2008	117	2	2%
2009	90	16	18%
2010	24	0	0%
2011	20	0	0%
2012	35	2	6%
2013	22	2	9%
2014	35	7	20%
2015	36	11	30%
2016	44	12	27%
2017	27	1	4%

Source: Oregon State University Veterinary Laboratory and Oregon vector control districts

Sentinel chicken surveillance

Sentinel chicken surveillance was discontinued in 2011.

Mosquito surveillance

In 2017, the VCDs conducted WNV surveillance in Oregon's mosquito population. Figure 4 (page 10) shows the counties with participating VCDs and their activities. Statewide, 225,116 mosquitoes were sampled (see Table 7, page 7). Of those, 151,520 mosquitoes in 3,788 mosquito pools were tested for WNV (see Table 8, page 7). The tested mosquitoes comprise 14 mosquito species. OSU conducted polymerase chain reaction (PCR) testing, and some VCDs performed RAMP. Table 6 below displays the number of Oregon mosquito pools by species that tested positive for WNV in 2017. Table 9, page 8 displays Oregon mosquito species between 2004 and 2017 found positive for WNV. Figure 3, page 9 indicates the efficiency of vector transmission for various mosquito species (information obtained from the Centers for Disease Control and Prevention).

Table 6. WNV-positive mosquito pools, Oregon, 2017

VCD	Mosquito species	Number of positive mosquito pools	Collection date
Baker	*Culex tarsalis*	9	7/10-9/5
Malheur	*Genus culex*	25	7/18-8/17
Morrow	*Culex pipiens*	48	7/31-9/12
Morrow	*Culex tarsalis*	4	7/31-9/5
Umatilla	*Culex pipiens*	1	8/8
Umatilla	*Culex tarsalis*	2	6/21, 8/29
Umatilla	*Genus Culex*	3	8/17
Total		**92**	

Source: Oregon vector control districts

Table 7. Total female mosquitoes collected for surveillance purposes by Oregon VCDs, 2017

	Aedes cinereus	Aedes dorsalis	Aedes increpitus	Aedes melanimon	Aedes Nigromaculis	Aedes nipadopsis	Aedes species	Aedes sierrensis	Aedes sticticus	Aedes vexans	Aedes /Oc. washinoi	Anopheles species	Anopheles punctipennis	Anopheles freeborni	Coquillettidia perturbans	Culex erythrothorax
									2,815				724			
Clackamas						4			4	220		59				8
Columbia			3,834				524					522	19	3,478		
Crook													790			
Deschutes									4,220				1,130			
Jackson		9	3,206	43	22		337	3	544			215	438	632	143	
Klamath		603		772	75				679				4,187			
Lane																
Malheur									1,736				112			
Morrow		14	671		14				344			53	3,180	10		
Multnomah									63	443		997	55	121		
Umatilla																
Union									2,330				569			
Washington	17					6	19		859	294		631	168	116		
Total:	**17**	**626**	**7,711**	**815**	**111**	**10**	**880**	**3**	**19,279**	**957**	**0**	**2,477**	**11,372**	**4,357**	**151**	

Additional Mosquito species

	Culex pipiens	Culex restuans	Culex species	Culex stigmatosoma	Culex tarsalis	Culex territans	Culiseta incidens	Culiseta inornata	Culiseta minnesotae	Culiseta moristans	Culiseta particeps	Culiseta species	Ochlerotatus dorsalis	Ochlerotatus nigromaculis	Ochlerotatus sierrensis	Ochlerotatus sticticus	**Total mosquitoes collected**
Baker	134				23,310			1,885					6,283	11,926			**47,077**
Clackamas	753		8	1	95		617								11	1	**1,781**
Columbia	840				1,274		79				209						**12,579**
Crook	147				2,018			285									**3,240**
Deschutes	420				2,210			2,256									**10,236**
Jackson	10,717		44		6,411		59	131			82						**23,036**
Klamath					9,332			1,546									**17,194**
Lane	201				1,380												**7,266**
Malheur			3,526					222					731	952			**7,279**
Morrow	34,155				7,773		4	1,684									**47,902**
Multnomah	2,669				6,123		865	870	612		7				82	38	**12,945**
Umatilla	5,934		2,671		5,047							11					**13,663**
Union	2,446				4,313			199									**9,857**
Washington	6,562			1	1,020		969	75	293	11	14	2					**11,061**
Total all species:	**64,978**	**0**	**6,249**	**2**	**70,306**	**0**	**2,593**	**9,153**	**905**	**11**	**312**	**13**	**7,014**	**12,878**	**93**	**39**	**225,116**

Source: Oregon vector control districts

Table 8. Female mosquito pools collected by Oregon VCDs and tested for WNV at Oregon State University, 2017

	Aedes dorsalis	Aedes increpitus	Aedes sticticus	Aedes vexans	Anopheles freeborni	Anopheles punctipennis	Coquillettidia peturbans	Culex pipiens	Culex tarsalis	Culiseta incidens	Culiseta inornata	Family culicidae	Genus Aedes	Genus Culex	**Total mosquito pools**
Baker								1	539						**540**
Columbia						6	78	17	24						**125**
Deschutes				31	10			4	22		22				**89**
Jackson				12				305	193						**510**
Klamath	8			16	44				74		13		21		**176**
Lane				204				12	40						
Malheur														237	**237**
Morrow		13		3				810	272					2	**1,100**
Multnomah						5	1	22	69	5					**102**
Umatilla								81	71					23	**175**
Union				61				51	143						**255**
Washington				15		17	3	156	32						**223**
Total:	**8**	**13**	**0**	**342**	**54**	**28**	**82**	**1,459**	**1,479**	**5**	**35**	**0**	**21**	**262**	**3,788**

Source: Oregon vector control districts and Oregon State University Veterinary Diagnostic Laboratory

Table 9. Trend data, WNV-positive mosquito pools*, Oregon, 2004–2017

Year	Mosquito species	Number of positives
2004	-	-
2005	*Culex tarsalis*	11 pools
	Culex stigmatosoma	
	Culex pipiens	
2006	*Culex tarsalis*	22 pools
2007	*Aedes vexans*	8 pools
	Culex pipiens	2 pools
	Culex tarsalis	23 pools
2008	*Aedes vexans*	5 pools
	Culex pipiens	3 pools
	Culex tarsalis	8 pools
2009	*Aedes vexans*	1 pool
	Anopheles freeborni	1 pool
	Anopheles punctipennis	1 pool
	Coquillettidia perturbans	1 pool
	Culex pipiens	75 pools
	Culex tarsalis	131 pools
	Culex sp.	52 pools
2010	*Culex pipiens*	1 pool
	Culex tarsalis	2 pools
	Culex sp	1 pool
2011	*Culex* sp.	3 pools
2012	*Culex pipiens*	53 pools
	Culex tarsalis	3 pools
	Culex sp.	15 pools
2013	*Culex pipiens*	14 pools
	Culex tarsalis	74 pools
	Anopheles freeborni	1 pool
2014	*Aedes vexans*	4 pools
	Culex pipiens	13 pools
	Culex tarsalis	41 pools
2015	*Culex pipiens*	20 pools
	Culex tarsalis	35 pools
	Genus Culex	4 pools

*1 pool ≈ 40 mosquitoes

Year	Mosquito species	Number of positives
2016	*Culex pipiens*	21 pools
	Culex tarsalis	28 pools
	Genus Culex	2 pools
2017	*Culex pipiens*	49 pools
	Culex tarsalis	15 pools
	Genus Culex	28 pools

Source: Oregon State University Veterinary Diagnostic Laboratory

*1 pool ≈ 40 mosquitoes

Figure 3. Potential Oregon vectors of WNV based on laboratory vector competence studies

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

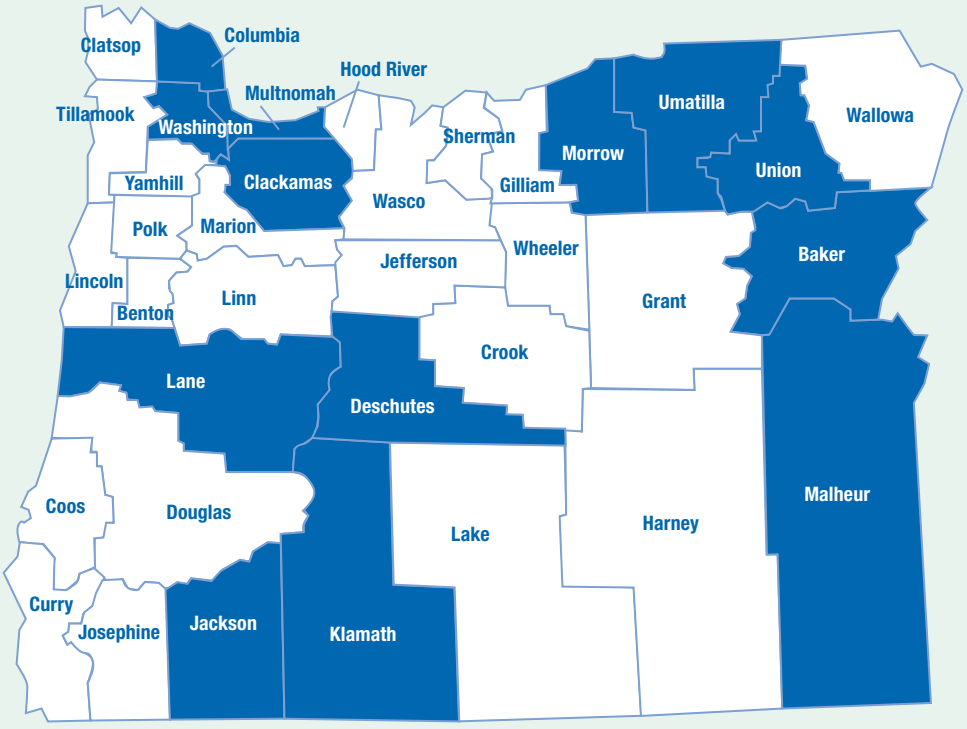
[f] Feeds primarily on avian hosts in spring and early summer and mixed between avian and mammalian hosts in late summer and fall.

Reference: Turell MJ, Dohm DJ, Sardelis MR, Oquinn ML, Andreadis DJ, Blow JA. An update on the potential of North American mosquitoes (Diptera: Culicidae) to transmit West Nile virus. J Med Entomol 2005; 42: 57–62. Used with permission.

Vector control districts in Oregon

Figure 4. Oregon counties with participating vector control districts (VCDs) and their activities

County	Mosquito collection	Bird collection
Baker	YES	YES
Clackamas	YES	YES
Columbia	YES	YES
Crook	YES	YES
Deschutes	YES	YES
Jackson	YES	YES
Klamath	YES	YES
Lane	YES	YES
Malheur	YES	YES
Morrow	YES	YES
Multnomah	YES	YES
Umatilla	YES	YES
Washington	YES	YES



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