State of Oregon
West Nile Virus Summary Report
2011

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2011 Program Highlights

Some of the principal findings and accomplishments of Oregon's surveillance, education, and planning programs for West Nile virus (WNV) in 2011 include the following:

- Continued statewide surveillance of mosquitoes, humans, birds, sentinel chickens, and horses.
- A second consecutive year without any human cases of WNV.
- No cases of WNV positive birds.

Figure 1 summarizes positive WNV tests by month of collection in Oregon during 2011. Table 1 summarizes WNV in Oregon, by year, 2004-2011.

Figure 1. Positive WNV tests by month of collection for Oregon, 2011.

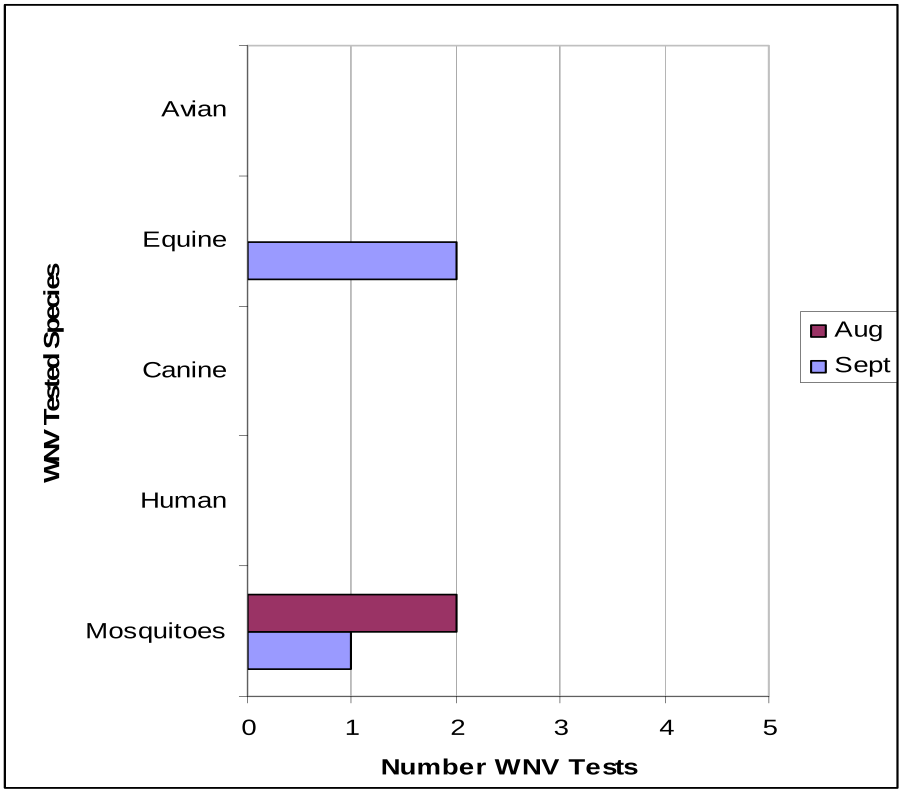


Table 1. Confirmed WNV infections in Oregon, 2004–2011.

Group	2004	2005	2006	2007	2008	2009	2010	2011
Human	5	8	73	27	16	12	0	0
Horses	32	46	35	16	0	5	0	2
Birds	23	15	25	52	2	16	0	0
Mosquito Pools	0	11	22	28	16	262	4	3
Sentinel Chickens	0	15	0	11	0	0	0	0

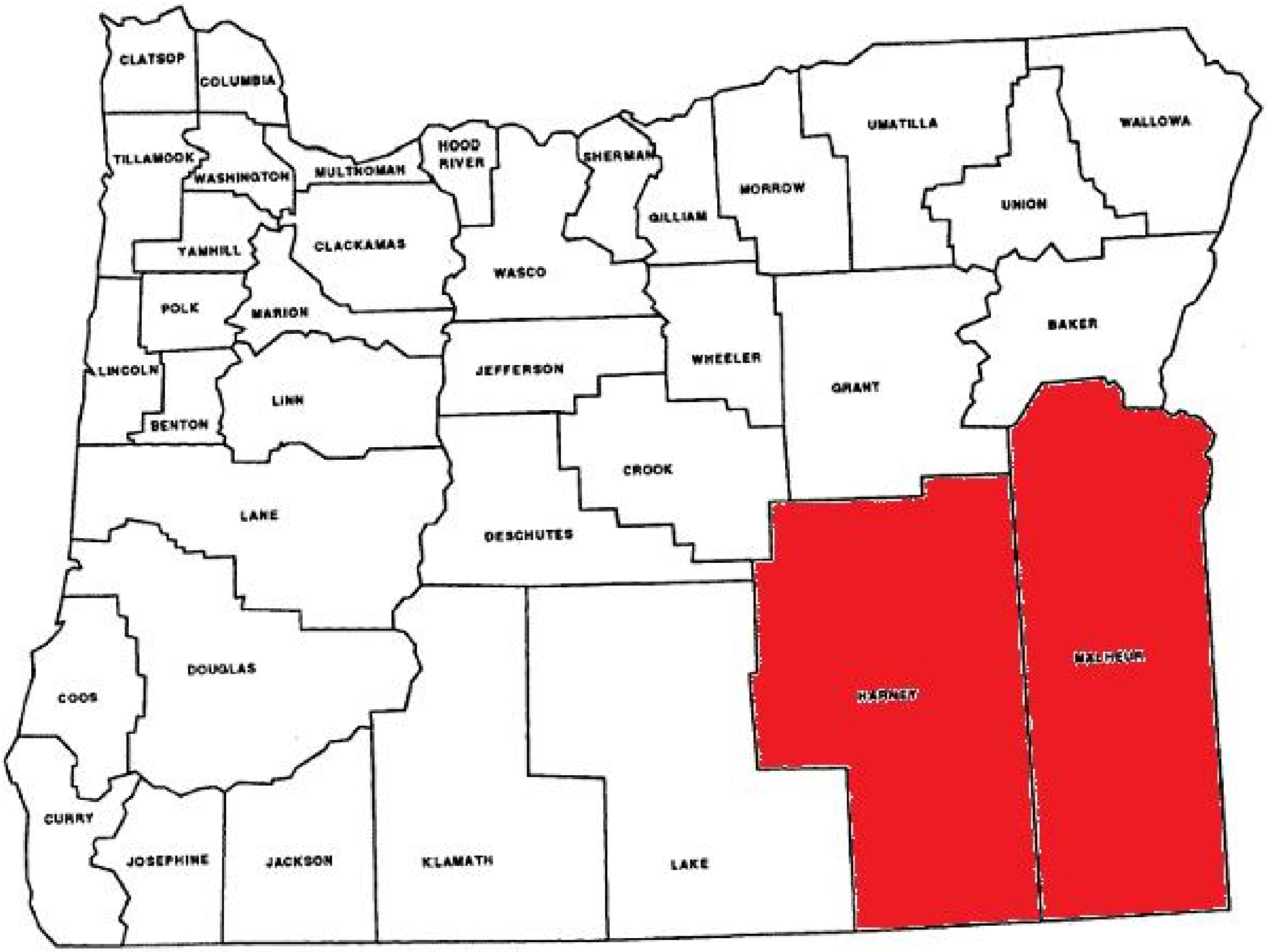
Introduction

West Nile virus (WNV) first appeared in Oregon in 2004. Our first human, avian, and equine WNV cases were all diagnosed in August 2004. In 2011, no humans, birds, or domesticated canines were diagnosed with WNV infection, although two unrelated horses were diagnosed with WNV in Harney and Malheur counties during September.

Oregon's surveillance program for WNV was launched in 2001 and for 2011 included 12 Vector Control Districts (VCDs) located throughout the state representing 14 counties (see map of Oregon with participating VCDs highlighted in Figure 4). The VCDs collect mosquitoes and dead birds, identify them, and prepare them for testing. Some VCDs conduct initial WNV tests for mosquito pools and dead birds using RAMP (Rapid Analyte Measurement Platform). One sentinel chicken surveillance flock located in Jackson County (southern Oregon) was also used in 2011. In counties without VCD, this work may be conducted by the local health department or the Oregon Department of Fish and Wildlife (ODFW). Confirmatory testing of WNV for humans is performed by the Oregon State Public Health Laboratory (OSPHL). Oregon State University's (OSU's) Veterinary Diagnostic Laboratory performs WNV testing of mosquitoes, dead birds, horses, and other mammals.

The Oregon WNV surveillance findings for humans, horses, birds, and mosquitoes in 2011 are summarized in the sections that follow.

Figure 2. Map of Oregon with shaded counties reporting WNV, 2011.



WNV Surveillance and Related Activities

Human Surveillance

In 2011, no Oregon residents tested positive for WNV by IgM antibody

Table 2. Trend data for Oregon residents who contracted WNV in Oregon, 2004–2011

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

Veterinary Surveillance

Surveillance for WNV in Oregon's equine population resulted in 2 positive tests while 9 other equine tests were negative for WNV. Positive test results for Oregon counties in 2011 are summarized in Table 3. No other mammals tested positive for WNV in 2011.

Table 3. Positive Equine WNV test results, Oregon 2011.

County	Number of Positive Test Results
Harney	1
Malheur	1
Total	**2**

Avian Surveillance

Surveillance for WNV in Oregon's avian population resulted in no positive test results out of 20 birds tested by OSU's Veterinary Diagnostic Laboratory and the VCDs. Of the 20 birds that were collected, 13 were of the family Corvidae (a.k.a. corvids) while the remaining six were American species other than corvid. Table 4 shows the avian species collection totals in Oregon by county for 2011. Trend data for avian WNV testing and positive test results for Oregon counties for the years 2004–2011 are presented in Table 5.

Table 4. Avian WNV test results for Oregon counties, 2011.

Avian Species Collection Totals by County		
County	**Total Corvid Tested**	**Total Other Tested**
Clackamas County	2	0
Columbia County	1	0
Crook County	2	0
Deschutes County	0	1
Josephine County	1	0
Lane County	0	1
Malheur County	0	1
Marion County	1	0
Multnomah County	1	0
Umatilla County	2	1
Union County	0	1
Washington County	3	1
TOTAL	13	6

Table 5. Avian WNV tests and trend of positive test results for Oregon counties, 2004–2011.

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%

Sentinel Chicken Surveillance

The only sentinel chicken flock for 2011 was located in Jackson County. None of the sentinel chickens were diagnosed with WNV in 2011.

Mosquito Surveillance

In 2011, the VCDs conducted surveillance for WNV in Oregon's mosquito population. Figure 4 shows the counties with participating VCDs and their activities. Statewide, 91,331 individual female mosquitoes were collected and tested for WNV. The mosquitoes submitted represent 14 mosquito species. PCR testing for WNV was conducted by OSPHL and RAMP was performed by some VCDs. Table 6 displays the number of mosquito pools per species that tested positive for WNV in Oregon in 2011 only. Table 7 displays the mosquito species and the number of individual female mosquitoes that VCDs collected for testing in Oregon in 2011. Table 8 displays the mosquito species in Oregon between 2004 through 2011 found positive for WNV. Figure 3 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 2011.

VCD	Mosquito Species	Number of Positive Mosquito Pools	Collection Date
Malheur County	*Culex* sp.	1	08/23/11
Malheur County	Unknown/Other	1	08/24/11
Malheur County	*Culex* sp.	1	09/14/11

Table 7. Female mosquitoes collected for testing by Oregon VCDs, 2011.

County	*Aedes cinereus*	*Aedes dorsalis*	*Aedes increpitus*	*Aedes sticticus*	*Aedes vexans*	*Anopheles freeborni*	*Anopheles punctipennis*	*Coquillettidia perturbans*	*Culex erythrothorax*	*Culex pipiens*	*Culex* sp.	*Culex tarsalis*	*Culiseta inornata*	*Other Species/Unkown*
Baker					547							6,686	170	
Clackamas					136					731				
Columbia			83	2,995	1,852			87		93		140		
Crook						170				70		95		
Deschutes					1,860	325				160		1,315	335	65
Jackson					591			1893	1110	702		819		86
Klamath		202			8,141	307						163	1741	452
Lane					5,259					872		121		
Malheur											361	3,657		
Morrow		11			2,505	18		12		4033		9,769	816	
Multnomah	50			101	2,077			42		664		1,145		
Umatilla					137					8,271	2,803	7,500		
Union												3,974		
Washington							136	48		2,427		300		
Total	50	213	83	3,096	23,105	820	236	2,082	1,110	18,023	3,164	35,684	3,062	603

Table 8. Trend data, WNV positive mosquito pools, Oregon 2004–2011.

Year	Mosquito Species	Number of Positives
2004	-	-
2005	*Culex tarsalis* *Culex stigmatosoma* *Culex pipiens*	(11 pools)*
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)

*1 pool ≈ 50 mosquitoes

Figure 3. Potential Oregon vectors of WNV based on laboratory vector competence studies[1]. (Posted with permission).

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]	Potential to serve as a: 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.

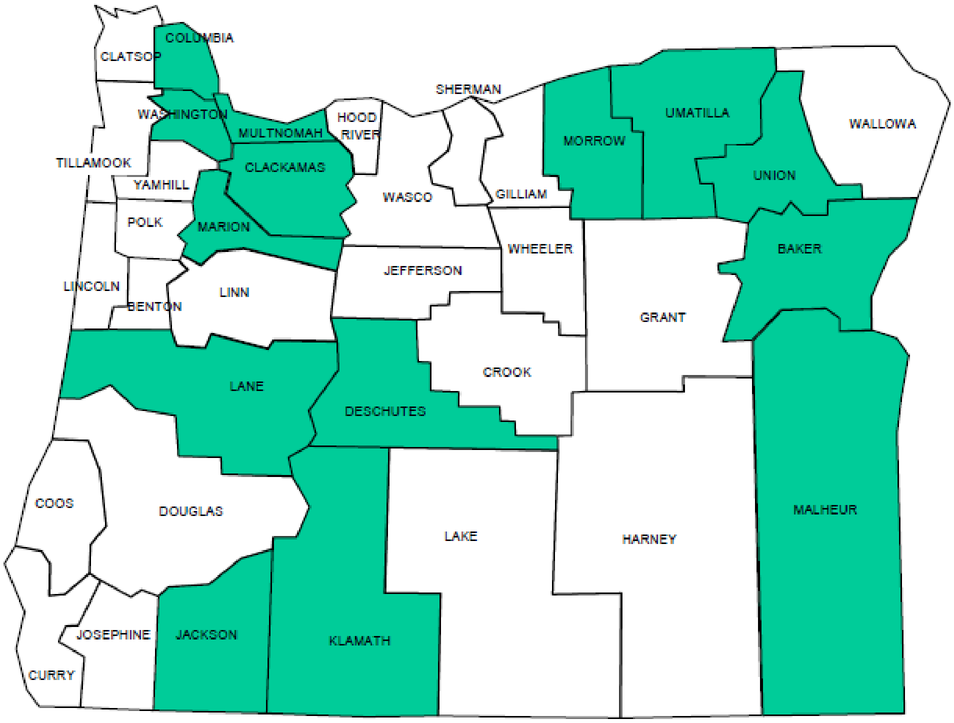
[d] Potential for this species to be an enzootic or maintenance vector based on virus isolations from the field, vector competence, feeding behavior, etc. 0, little to no risk; +++++, this species may play a major role.

[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.

Vector Control Districts

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



District/county	Mosquito collection	Mosquito fish	Sentinel Chickens	Bird collection	Larvaciding	Adulticiding
Columbia	*			*	*	*
Deschutes	*			*	*	*
Jackson	*			*	*	*
Klamath	*	*		*		*
Lane	*			*		
Malheur				*		
Marion	*			*	*	*
Morrow	*			*	*	*
Multnomah	*	*		*	*	*
Umatilla	*	*		*	*	*
Union	*	*		*	*	*
Washington	*	*		*	*	*

References

1. Kilpatrick AM, Kramer LD, Jones MJ, Marra PP, Daszak P (2006) West Nile virus epidemics in North America are driven by shifts in mosquito feeding behavior. PLoS Biol 4(4): e82.
2. Turell, MD, et al. "An Update on the Potential of North American Mosquitoes (*Diptera: Culicidae*) to Transmit West Nile Virus. J. Med. Entomol. 42(1): 57-62 (2005).

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