WEST NILE VIRUS SUMMARY REPORT 2016 SEASON
UTAH DEPARTMENT OF HEALTH

Purpose

The purpose of this report is to provide Utah West Nile virus (WNV) partners a concise summary of activities, efforts and trends during the 2016 WNV season. Information contained in this report has been compiled by the Utah Department of Health (UDOH), but reflects information obtained from concerted joint efforts. All activities related to the 2016 WNV season involved major contributions from many different agencies, including blood banks of Utah, local health departments (LHDs), Utah Department of Agriculture and Food (UDAF), Utah Division of Wildlife Resources (UDWR), Utah Mosquito Abatement Association (UMAA), the Utah Public Health Laboratory (UPHL), and the Utah Veterinary Diagnostic Laboratory (UVDL). In addition to the direct contribution of surveillance data, these agencies were also involved in systematic planning and preparation for the 2016 WNV season.

Note: *Specific surveillance counts may be subject to change as data continues to be reconciled for the season.*

Introduction to WNV

During the summer of 2016, WNV reemerged in Utah. This was the thirteenth year WNV activity was detected in Utah. WNV is a disease transmitted by mosquitoes. Birds are the natural hosts of the disease with humans and horses serving as accidental hosts. The majority of people infected with WNV never develop symptoms. A small percentage of infected individuals will display West Nile fever symptoms (i.e., fever, headache, body aches). A more serious form of the disease, West Nile neuroinvasive illness, may also occur when the virus infects the central nervous system. People with this form of the disease will have high fevers, severe headaches, neck stiffness, and mental confusion. Hospitalization is often required and death is possible.

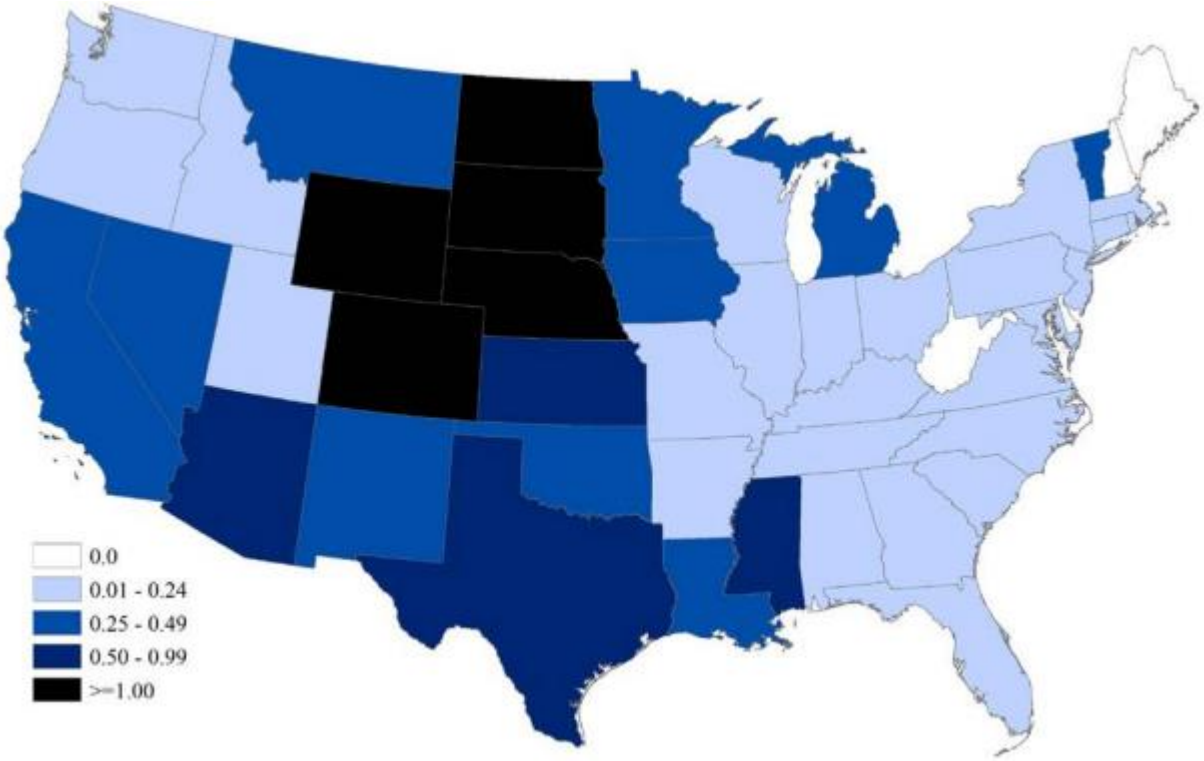
Introduction to WNV Surveillance in Utah

Surveillance for WNV activity involves several different components. Since the disease is zoonotic in nature, both human and animal surveillance occurs. In past years, WNV surveillance in Utah involved human, mosquito, wild bird, horse, and sentinel chicken populations. Due to the involvement of these different populations, surveillance efforts this season enlisted the expertise and abilities of many different agencies. Budget constraints again limited surveillance for the 2016 season, and in order to keep more critical surveillance running, wild bird testing, sentinel chicken testing, and official, coordinated equine testing efforts at UDAF were eliminated from routine surveillance. Local mosquito abatement districts (MADs), in conjunction with the UMAA, performed necessary trapping and identification for mosquito surveillance. Confirmation of these mosquitoes occurred at UPHL. Major healthcare providers submitted human samples across the state with testing occurring at both the UPHL and private laboratories such as ARUP (Associated Regional and University Pathologists). The three major blood banks servicing Utah (American Red Cross, ARUP, and Mountain Star) coordinated screening of donated blood for identification of viremic donors. All LHDs in Utah conducted surveillance activities, including investigations, monitoring local WNV activity and trends, and disseminating information.

National Highlights

West Nile virus neuroinvasive disease incidence maps present data reported by state and local health departments to CDC's ArboNET surveillance system. Figure 1 shows the incidence of human neuroinvasive disease (i.e., meningitis, encephalitis, or acute flaccid paralysis) by state for 2016 ranging from 0.01-0.24, 0.25-0.49, 0.50-0.99, and greater than, or equal to, 1.00 case per 100,000 population.

Figure 1
West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2016 (as of December 06, 2016)



This map shows the incidence of human West Nile virus neuroinvasive disease (i.e., meningitis, encephalitis, or acute flaccid paralysis) by state for 2016 with shading ranging from 0.01-0.24, 0.25-0.49, 0.50-0.99, and greater than, or equal to, 1.00 case per 100,000 population.

Neuroinvasive disease cases have been reported to ArboNET from the following states for 2016: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin and Wyoming.

For 2016, of the 1,662 human cases reported to CDC, 877 (53%) were reported as West Nile meningitis or encephalitis (neuroinvasive disease) and 785 (47%) were reported as West Nile fever (milder disease); as opposed to 1,996 total human cases reported to CDC in 2015, with 1,312 (66%) reported as West Nile meningitis or encephalitis (neuroinvasive disease), and 684 (34%) reported as

West Nile fever (milder disease). There were a total of 84 fatalities in 2016, compared to 111 fatalities in 2015.

Utah Highlights

Activity during the 2016 WNV season in Utah was higher in human cases and equine cases than the previous 2015 season. However, mosquito activity was lower, with 244 pools testing positive in 2016, compared to 281 in 2015. The vast majority of activity occurred along the Wasatch Front, with sporadic positive reports in other areas of the state. A total of three counties reported activity during the 2016 season. All positive Rapid Analyte Measurement Platform (RAMP) tests for mosquitoes were confirmed by PCR at UPHL.

Table 1: WNV activity, Utah 2016 (positive counts only)

Total West Nile Virus Positive Samples: Utah 2016				
County of Residence	**Human**	**Horse**	**Mosquito**	**Total**
Beaver	-	-	-	-
Box Elder	-	-	3	3
Cache	-	-	-	-
Carbon	-	-	-	-
Daggett	-	-	-	-
Davis	-	-	11	11
Duchesne	1	1	-	2
Emery	-	-	-	-
Garfield	-	-	-	-
Grand	-	-	1	1
Iron	-	-	-	-
Juab	-	-	-	-
Kane	-	-	-	-
Millard	-	-	16	16
Morgan	-	-	-	-
Piute	-	-	-	-
Rich	-	-	-	-
Salt Lake	11	-	135	146
San Juan	-	-	-	-
Sanpete	-	-	-	-
Sevier	-	-	-	-
Summit	-	-	-	-
Tooele	-	-	4	4
Uintah	-	6	43	49
Utah	1	-	-	1
Wasatch	-	-	-	-
Washington	-	-	9	9
Wayne	-	-	-	-

County of Residence	Human	Horse	Mosquito	Total
Weber	-	-	-	-
Hill Air Force Base	-	-	22	22
State Total	**13**	**7**	**244**	**264**

Human Cases of WNV: Utah 2016					
Age Group	**Total**	**% Total**	**Fever**	**Death**	**Neuroinvasive**
< 18	-	-	-	-	-
18-39	1	8%	-	-	1
40-64	9	69%	5	-	4
≥ 65	3	23%	1	1	2
State Total	**13**	**100%**	**6**	**1**	**7**

*UDOH did not conduct sentinel chicken surveillance in 2016. However, some counties still maintained sentinel chicken flocks.

Past Season Comparison

WNV activity in Utah was first detected in 2003. Similar to many initial seasons in other states, activity was muted. One human case was reported for the 2003 season in Utah, in addition to one viremic donor who did not develop symptoms. Horse activity was the main indication of WNV presence in 2003. WNV activity was first identified in northern Utah along the Wasatch Front in 2004, but the majority of activity occurred in extreme southern and eastern areas of Utah, such as Washington and Grand counties. During 2005, activity expanded into more northern regions of the state, and Utah and Uintah counties served as focal points for detected activity. The 2006 season was the most active season. Activity focused along the Wasatch Front in the more populated areas, Salt Lake County and Utah County. With an increase in activity, there was also an increase in fatalities, with Utah experiencing five. The number of cases and fatalities begin to decline in 2007. That same year also showed that the virus was moving into the more northern parts of the state, with the bulk of cases being in Cache and Box Elder counties. Activity during the 2008 WNV season decreased compared to activity detected during the 2007 season. The 2009-2011 seasons showed an even more dramatic decrease in the level of activity. Due to inconsistencies with RAMP testing, in 2009 it was decided that mosquito pools would only be counted if they were confirmed by PCR. This led to a decrease in the number of positive mosquito pools detected throughout the state. The southwestern portion of Utah reported the most animal (mosquito) activity for the 2010-2012 seasons. For the 2013 season, Washington County, in the southwest portion of the state, had the majority of activity, both human and animal. Activity during both the 2014 and the 2015 seasons were centered mostly along the Wasatch Front. This past 2016 season, mosquito activity was primarily along the Wasatch Front, but was also detected in Box Elder, Grand, and Weber Counties.

Table 2: WNV season comparison, Utah 2005-2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Human	70	27	2	2	3	5	7	2	8	13
Horse	18	8	6	3	1	3	7	4	4	7
Bird*	19	3	0	0	0	0	40	2	-	-
Chicken*	74	16	1	1	0	1	2	1	4	-
Mosquito Pools	225	140	284	31	23	21	69	167	281	244
Counties with Detection	19	14	12	5	6	8	9	9	8	8

*Wild bird and sentinel chickens were not part of Utah's active surveillance in 2011-2016. However, the large increase in bird activity was due to an eared grebe and bald eagle die-off in October 2013 – January 2014.

2016 Utah Activity Timeline

The majority of surveillance measures began in June 2016. Additional activity was detected during the week of July 02, 2016 in mosquito pools confirmed by PCR from Uintah County. Activity was detected throughout the summer and into October, with WNV activity included in all formal surveillance measures (horse, human, and mosquito) by August. Utah's first two human cases were reported the week of August 20, 2016. Human, mosquito and equine cases continued to be reported into October. All active surveillance for the 2016 season had ceased by the end of October. However, testing of suspect human and horse cases continues year-round.

Figure 2
Reported positive WNV tests, Utah 2016

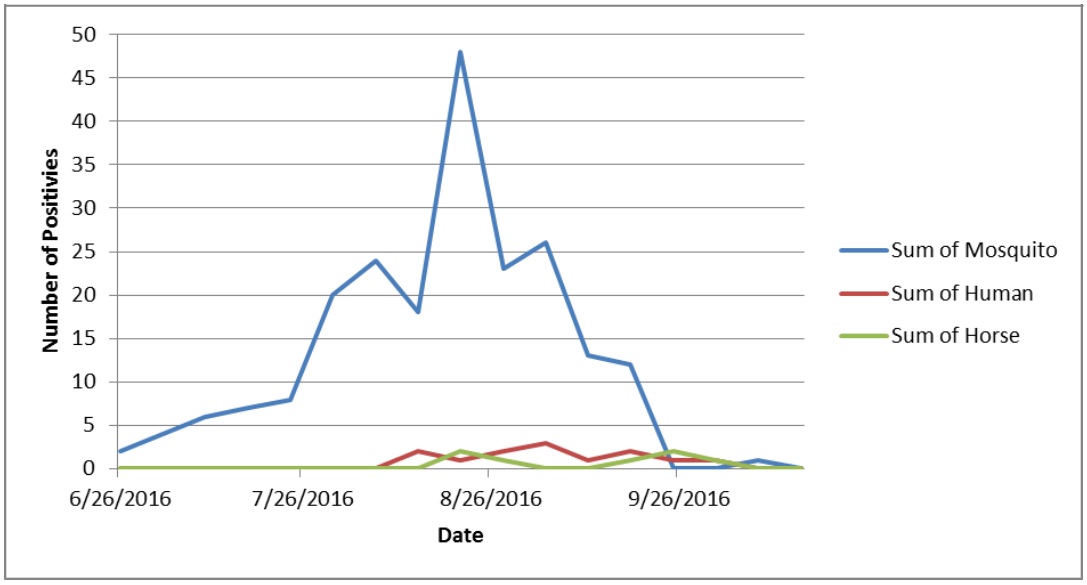


Figure 2 represents human and mosquito pool positivity over time. This graph represents the activity in Utah from June – October 2016.

Human Surveillance

Human surveillance occurs primarily through reporting of results from major laboratories that indicate acute infection. LHDs were immediately notified in these instances for the initiation of case investigations. Due to issues with testing kits from a major reference laboratory from the 2008 season, it was again determined that all human samples would be confirmed at UPHL. Additionally, major blood banks servicing Utah screened donations for the presence of WNV.

There were no individuals identified as infected with WNV through blood donation screening.

Table 3: WNV clinical comparison of human cases, United States vs. Utah, 2016

	Utah	United States
Case Number	13	1,662
Fatalities	1	84
Percent Fatalities	7.7%	5.05%
Percent Neuroinvasive Disease	53.9%	52.8%

Table 4: WNV, clinical and demographic comparison of human cases, Utah 2007-2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Case Number	70	28	2	2	3	5	7	2	8	13
Fatalities	2	0	0	0	0	1	0	0	0	1
Percent Male	51%	79%	50%	100%	66%	60%	57%	100%	75%	54%
Median Age (years)	50	41	NA*	NA*	NA*	70	61	NA*	55	60
Age Range (years)	3-89	4-79	NA*	NA*	NA*	22-87	20-85	NA*	18-90	18-90

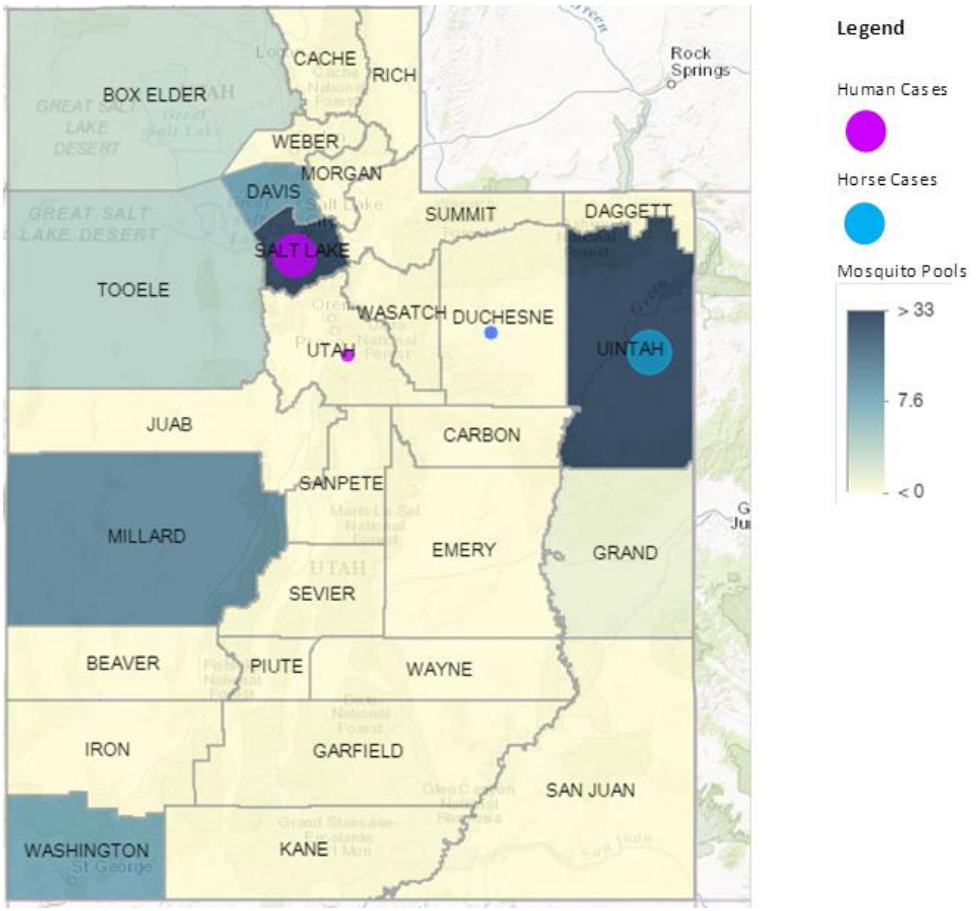
*Not available: data suppressed due to small number of reported cases in this year

Table 5: Utah in comparison to surrounding states, as reported to CDC ArboNet, 2016

	Neuroinvasive disease cases		Non-neuroinvasive disease cases		Total cases		Deaths	
State	**Case Count**	**Rate per 100,000 person years**	**Case Count**	**Rate per 100,000 person years**	**Case Count**	**Rate per 100,000 person years**	**Case Count**	**Rate per 100,000 person years**
Arizona	56	0.82	20	0.29	76	1.11	5	0.07
Colorado	58	1.06	88	1.61	146	2.68	8	0.15
Idaho	3	0.18	5	0.30	8	0.48	0	0
Montana	3	0.29	3	0.29	6	0.58	1	0.09
New Mexico	6	0.28	0	0	6	0.28	1	0.05
Utah	7	0.23	6	0.20	13	0.43	1	0.03
Wyoming	7	1.19	3	0.51	10	1.71	0	0

Table 5 compares Utah to surrounding states. Utah experienced thirteen human cases with one fatality. Utah's human cases were shown to be much lower than the total number of human cases that occurred in Arizona and Colorado due to their increased amount of mosquito activity.

Figure 3: Reported positive WNV tests, Utah 2016



Mosquito Surveillance
Personnel from MADs across the state performed the primary functions of trapping mosquitoes at various locations in their district. Trapped mosquitoes were identified and sorted into "pools" based on species. Each mosquito pool contained 50-100 individual mosquitoes, and were shipped to the UPHL for PCR testing.

In 2016, a total number of 244 mosquito pools tested positive for WNV by PCR testing including 26 Counties and Hill Air Force Base. This year, Hill Air Force Base started reporting positive mosquito pools collected and tested by the Air Force Public Health Command. The first positive pool was detected the week of July 2nd and the last detected during the week of October 15th. Positive mosquito pools were found in eight counties and on Hill Air Force Base. Figure 3 shows the distribution of positive mosquito pools for WNV per county.

Horse surveillance
The UDAF coordinated surveillance of equine disease related to WNV infection. Veterinarians across the state were encouraged to submit samples from suspect equine cases to the UVDL-Logan for testing. Results of these serum tests were reported by the UDAF to the UDOH with appropriate notification occurring for positive cases. The majority of samples submitted for testing were from domestic, privately owned horses with symptoms indicative of infection and no history of vaccination. Pamphlets and periodic updates about disease awareness were distributed to veterinarians and horse owners through the Utah Veterinary Alert Listserver.

The first horse infected with West Nile Virus was reported by UDAF during the week of August 7th in Uintah County. Up to that date, 30 mosquito pools were detected in Uintah County. One horse was found in Duchesne County also infected with West Nile Virus that detected no positive mosquito pools in the 2016 year. A total of 7 horses were found to be infected with West Nile Virus, many of which did not have a prior vaccination history.

Wild bird surveillance
Due to budget constraints, routine wild bird surveillance was discontinued for the 2016 season.

Sentinel chicken surveillance
Due to budget constraints, routine sentinel chicken surveillance was discontinued for the 2016 season.

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