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Mosquito Hunter: An Intern's Perspective in a Public Health Department Mosquito Surveillance Program

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Mosquito Hunter

AN INTERN'S PERSPECTIVE IN A PUBLIC HEALTH DEPARTMENT MOSQUITO SURVEILLANCE PROGRAM

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David Schmidt | Wright State University | January 16th, 2018

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ABSTRACT

As a Special Services Intern at Public Health – Dayton & Montgomery County (PHDMC), I gained first-hand experience as to the daily functioning of a Public Health Department and had the opportunity to work on a special project, the Mosquito Surveillance Program. PHDMC employs professionals in a variety of disciplines, all working towards the goal of protecting the health of the public. One way they accomplish this is through various inspections including restaurant, wellhead, and landfill. Another method to protect the public health is through the capture and testing of mosquitoes, with the goal of preventing the spread of mosquito-borne diseases like West Nile Virus, La Crosse Virus, and, more recently, Zika. There were three types of traps used (Gravid, BG Sentinel, and Gravid Aedes) that were placed daily over a period of approximately four months, resulting in the testing (by the Ohio Department of Health-ODH) of over 432,120 mosquitoes for the 2017 season. Many factors play a role in this number including the effectiveness of a trap location, amount of precipitation, and temperature. When comparing available data from the 2016 season to the 2017 season, it was found that the 2017 season had increased average precipitation, higher numbers of mosquitoes tested, and higher incidences of mosquito-borne diseases.

BACKGROUND INFORMATION

In the summer of 2017, I held the position of Special Services Intern for Public Health – Dayton & Montgomery County (henceforth referred to as PHDMC). This position gave me the opportunity to witness how a public health department functions and the various services it provides. Not only was I working on the mosquito program, but I was also able to shadow Registered Sanitarians in various inspections including landfill, wellhead, and restaurant. During a restaurant inspection, a sanitarian performs various tasks including but not limited to looking for violations in the Ohio Uniform Food Safety Code, taking temperatures of food in various states (cold holding, hot holding, heating), and observing sanitary conditions of employees and their work area. Sanitarians perform inspections on a regular basis, but many times come unannounced or after a complaint is received. Public health departments are there to ensure the safety of employees as well as the consumers (i.e. the public), which is accomplished through inspections. The mission of PHDMC "is to lead and innovate by working with our community to achieve the goals of public health: prevention, promotion, and protection."[1]

The main goal of the Special Services Intern is to conduct and keep data regarding mosquito surveillance. This is a crucial function of the health department, as mosquitoes are vectors ("an insect or other organism that transmits a pathogenic fungus, virus, bacterium, etc.")[2] for many different diseases including Zika Virus and West Nile Virus (WNV). These diseases are easily spread, and mosquito surveillance by health departments plays a critical role in detecting and deploying countermeasures to protect its local populace. For some of these diseases, especially WNV, it is not a

question of *if* the diseases will occur but rather *when* they will show up in the local populace.

In this instance, data from the summer of 2016 and from the summer of 2017 will be utilized to make comparisons between these two mosquito seasons. This includes data on mosquito numbers and what factors contribute to these numbers, like temperature and precipitation.

PROJECT DESCRIPTION

To test for diseases transmitted via mosquitoes, trapping was required. There are many different methods used to trap mosquitoes including but not limited to Gravid Traps, Sentinel Traps (BG), and the not-so-common Gravid Aedes Trap. All three of these methods were used by PHDMC to trap mosquitoes during the 2017 season, while only the Gravid and Sentinel Traps were used during the 2016 season.

The first type of trap, the Gravid Trap (Figure 1), is designed to lure *Culex* female mosquitoes that are looking to lay their eggs. The trap achieves this by recreating the perfect habitat mosquitoes would lay their eggs in: nutrient-rich stagnant water. To attain this, the trap consists of four main parts: a tub for the water, a fan, batteries to run the fan, and a collection net (Figure 2). The stagnant water, or "mosquito brew" lure, is created by mixing together guinea pig feed, alfalfa, and brewer's yeast. A mosquito that is lured in lands on the water to lay her eggs, and a strong current created by the fan sucks her up a tube and into the collection net. The continuous current by the fan prevents the mosquitoes from leaving the collection net, which is optimal because these traps are left out overnight (*Culex* are most active at dawn and dusk). Mosquitoes caught in the Gravid Trap were then frozen to stun them, counted, and sent to the Ohio Department of Health (ODH) for testing. The Gravid Traps were the most common traps used at PHDMC and tested for the presence of West Nile Virus in its vector, the *Culex* mosquito.

Figure 1: Fully constructed Gravid Trap, complete with mosquito brew lure. The pictured trap is ready to be placed in its location for overnight trapping.

Figure 2: Collection nets taken from Gravid Traps upon collection in the morning by PHDMC interns. Both containers house a significant number of mosquitoes, which were then transported to the freezer for stunning and counting.

The next trap, the BG Sentinel Trap (Figure 3), is designed to attract the *Aedes* mosquito, a potential vector for Zika virus. Like the Gravid Trap, this trap consists of four main parts: the body, the fan, a battery to run the fan, and a collection net. However,

unlike the Gravid Trap, the BG utilizes a synthetic chemical lure that imitates the chemicals produced by human skin. Therefore, this trap lures *Aedes* mosquitoes that are on the hunt for a blood meal. To place the trap, one must keep in mind that *Aedes* mosquitoes are active during the day and will not fly very far from where they hatched. One must also know that the trap does not work well in heavy, close understory nor in bad weather (rain and wind), as the chemical lure will not spread. PHDMC laid these traps in the early afternoon and collected them the next morning, froze the collection nets, counted the mosquitoes, and prepared them for shipment to ODH.

Figure 3: Fully constructed BG Sentinel Trap. Not seen in the figure is the lure, net, and battery that are located inside the trap and are essential to the collection of mosquitoes.

The third trap used, the Gravid Aedes Trap (GAT) (Figure 4), is aimed at trapping all mosquitoes that lay their eggs in containers filled with stagnant water. It runs without a fan, meaning that it passively traps mosquitoes under their own power. The mosquitoes are lured in using the same "mosquito brew" as the Gravid Trap, but, unlike the Gravid Trap, are caught by using lining oil on the sides of the container. This oil coats the wings and, along with the design of the trap itself, prevents them from flying away and out of the container. As this was the first year PHDMC had attained these traps, they were used mainly to compare the effectiveness of all traps available.

Figure 4: Fully constructed Gravid Aedes Trap, placed in a shaded area to maximize effectiveness of and increase number of mosquitoes caught.

From the above descriptions of the traps used, one can tell that all three traps had vastly different functions but had the same goal: the trapping and testing of mosquitoes. The efficiency of trapping mosquitoes varied depending on the trap type, weather, and location of the trap. Testing was accomplished by the Ohio Department of Health, who sent weekly reports back to PHDMC containing information regarding whether the shipped mosquitoes tested positive or negative for a particular disease (e.g. WNV or Zika). From this data, PHDMC was able to plan ahead and protect the public (pamphlets in Appendix C) from the spread of mosquito-borne diseases.

RESULTS

As we have seen, there is not one method to trapping mosquitoes; rather there are many that depend on outside factors including precipitation, temperature, and trap location to effectively capture and test mosquitoes. To evaluate these factors, we used data from the Ohio Department of Health (ODH) for the summer of 2016 and the summer of 2017. With this data, we compared the severity of mosquito seasons and the factors that contributed to that severity.

On a weekly basis, Public Health – Dayton & Montgomery County (PHDMC) prepped and shipped captured mosquitoes to ODH for testing and recording. The results were emailed back to PHDMC, who could then take the appropriate measures to protect the public. Two examples of the emailed results from ODH are in Appendix D, and will be referenced extensively in the following paragraphs.

The two forms located in Appendix D contain a multitude of information from the years 2016 and 2017 regarding mosquito-borne diseases. The first category of interest is "mosquitoes tested" which is a count of all the mosquitoes received from Ohio Local Health Departments (LHD) and tested by ODH. In 2016 the number tested was 402,187 mosquitoes, while in 2017 the number was much higher at 432,120. This could be attributed to many factors including the methods used by the LHD, the use of different forms, and the weather. Use of the same methods year to year in any organization is not feasible, therefore continuous change and adaptation is needed to best protect the public. This was true at PHDMC, where new traps were purchased for 2017 and various locations (see Appendix A) to place those traps were selected. Another new feature used by PHDMC in 2017 were common forms for data collection designed and

produced by the Ohio Department of Health (ODH), which made organization of data easy and accessible (see Appendix B).

However, one factor that PHDMC could not change was the weather. Appendix E contains climate graphs from the National Weather Service for the years 2016 and 2017, which display the temperature, precipitation, and snow for Dayton, Ohio. When studying the figures, it becomes apparent that the precipitation from 2017 is on a larger scale than 2016: the 2017 precipitation data increases by a factor of 6 with a maximum of 54 inches while the 2016 precipitation data increases by a factor of 5 with a maximum of 45 inches. Averaging the data from both years in Figure 5[3] below provides a promising comparison:

Figure 5[3]: An average of climate data from Dayton, Ohio for the years 2016 and 2017.

2016	**AVERAGE PRECIPITATION (INCHES)**		**MEAN TEMPERATURE (° F)**
MAY	2.95		75
JUNE	3.60		69
JULY	2.97		76
AUGUST	3.74		77
TOTAL	13.26	**AVERAGE**	74.25
2017			
MAY	6.50		68
JUNE	7.43		75
JULY	4.80		72
AUGUST	3.03		69
TOTAL	21.76	**AVERAGE**	71

From the figure above, 2016 clearly had a higher average temperature during mosquito trapping season but a lower average precipitation, whereas 2017 had higher precipitation but lower temperature. Due to the higher rainfall amounts, ponds and swamps (stagnant water) where mosquitoes lay their eggs were filled with water more often leaving mosquitoes to reproduce more rapidly. This increased reproductive rate led to higher numbers of individuals and an increased chance of catching mosquitoes.

The increased number of mosquitoes also led to a higher risk of them being infected by disease. This is portrayed by the number of mosquitoes that tested positive for various diseases listed in Appendix D, i.e. West Nile Virus or La Crosse Virus. In 2016, West Nile Virus was positive in 489 mosquito samples with 14 human cases. However, in 2017 that number increased to 2,234 positive mosquito samples with 27 human cases. This increasing trend also occurs in the other non-travel associated mosquito-borne diseases including Jamestown Canyon virus, St. Louis Encephalitis, and Eastern equine encephalitis.

SUMMARY

No two mosquito seasons are the same. This became apparent during my time as an intern at PHDMC the summer of 2017, where I was in the field daily collecting mosquito traps and entering data to be shipped to ODH. The data we received back from ODH provided the information needed to compare it with last year's, 2016's, data. From this comparison, it became evident that these two seasons were very different: 2017 was characteristic of higher precipitation and lower temperatures, an increased number of mosquitoes caught/tested, and an increased number of cases of most mosquito-borne diseases.

RECOMMENDATIONS

As with any study, there are areas that can be improved upon for future reference and research. In the following paragraphs, there are a few suggestions I recommend based on my experience as an intern at PHDMC over the summer of 2017. The first few suggestions regard two types of traps used at PHDMC: the Gravid Trap and the Gravid Aedes Trap. Regarding the Gravid Trap, I found it to be the best overall trap to use for collecting mosquitoes. It consistently functioned in the way it was designed, and was easy to use despite the odorous mosquito brew lure. However, the one downside with this trap is the limited battery life: I could not tell you how many D batteries we went through to power the traps every night, five days a week, for approximately four months. Therefore, I would recommend a more sustainable approach: the use of rechargeable batteries like the ones used in the BG Sentinel Traps. The 12V batteries, when fully charged, last 12 hours and reduce waste by being reuseable. This would cut costs over time and provide more consistent results (batteries would not be dying left and right, as was the case with the D batteries).

The next suggestion regards the Gravid Aedes Trap, which does not require a fan or batteries to function. However, this trap was only used during my time at PHDMC a total of eight times with poor results upon each collection. The traps worked well to capture insects, especially flies, but there was not one instance where it caught a mosquito. There were no collection tubes sent to ODH because there were no mosquitoes caught. I would recommend further experimenting with the traps and, if that still does not work, use of a different method or trap.

The next few suggestions concern how data is organized for records/archives and sent to ODH. While organizing the data for this report, I found it difficult to compare

statistics from the summer of 2016 and the summer of 2017 due to the use of two different forms, where data was placed in various spots within an Excel sheet. This made it hard to effectively find what I was looking for, and made the process of organizing the data and writing up the report longer. Therefore, I would recommend the use of a common data collection form which will make it easier to compare data between seasons. A common form was created by ODH for the 2017 season, but it was unclear if it will be used again in the 2018 season.

As with any research, there are areas that could benefit from further research and reporting. For example, why were there so many cases of Zika during the 2016 season but not as many in the 2017 season? (see Appendix D) Or why were there deaths from West Nile Virus in the 2016 season and not in the 2017 season, if the 2017 season was characterized by higher numbers of mosquitoes and increased incidence rates of mosquito-borne diseases? Questions like these have the potential to be answered by further studies and work in the public health field.

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[5] McDermott, Timothy. "Final Ohio Arbovirus Report 2017." *B.I.T.E. Biting Insect Team Education*, The Ohio State University, 14 Nov. 2017, u.osu.edu/zika/2017/11/

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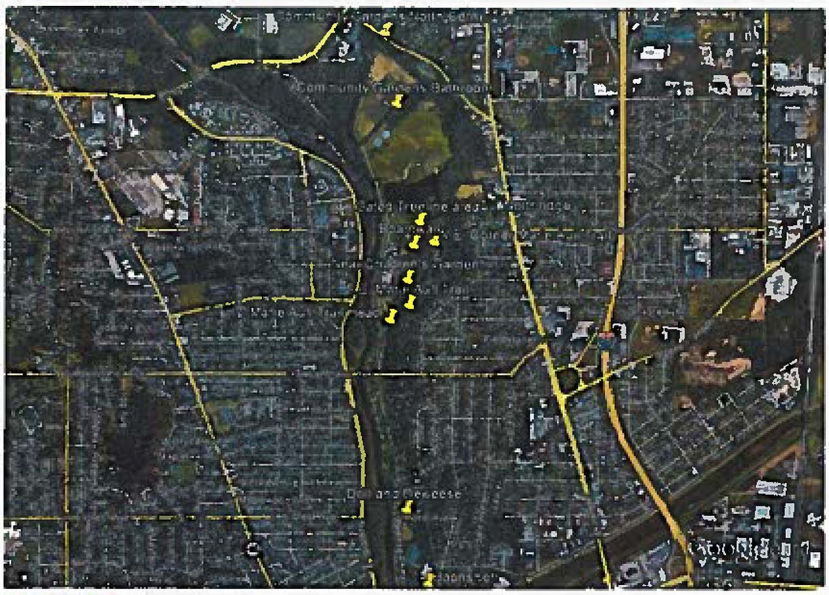
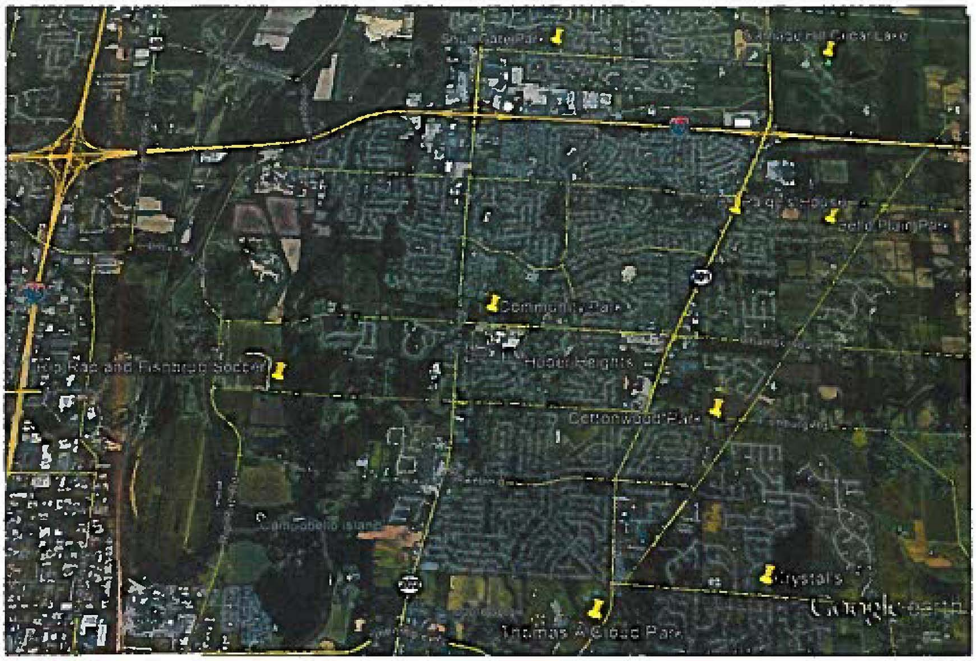
APPENDIX

A- TRAP LOCATIONS

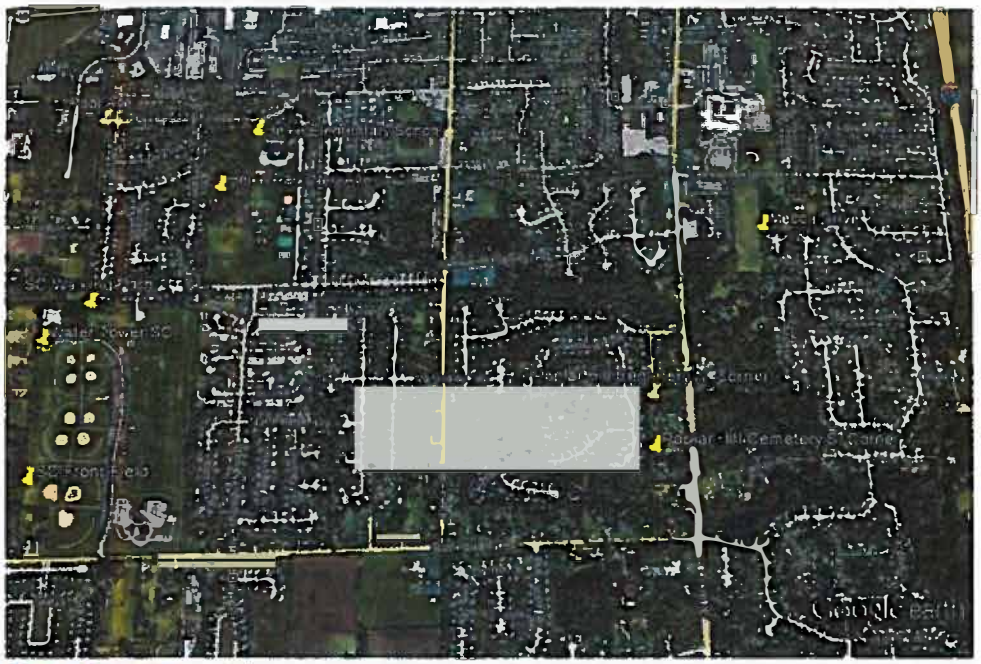


Wegerzyn Gardens

Trotwood



Huber Heights



Vandalia

2017 Mosquito Trap Location Details (report with first collection)

To be completed by ODH
Date Received:
Collection #:

Agency #: 5700 Agency Name: Public Health- Dayton and Montgomery County

County: Montgomery Contact Name: Tom Hut Phone Number: (937) 225-4439

Location #	Latitude	Longitude	Nearest Street Address	City	Location Type[1]	Notes
001	39.485400	-84.122000	4756 Frederick Pike	Dayton	Urban Public Place	WGC back bike trail
002	39.485500	-84.122000	4660 Frederick Pike	Dayton	Urban Public Place	WGC first curve on bike trail
003	39.483800	-84.122300	1301 E Siebenthaler Ave	Dayton	Urban Public Place	WGC community garden gate
004	39.482100	-84.121100	1301 E Siebenthaler Ave	Dayton	Urban Public Place	WGC [illegible]
005	39.481700	-84.121100	1301 E Siebenthaler Ave	Dayton	Urban Public Place	WGC [illegible]/orange trail
006	39.481400	-84.121200	1301 E Siebenthaler Ave	Dayton	Urban Public Place	WGC left corner patio
007	39.481000	-84.121400	1301 E Siebenthaler Ave	Dayton	Urban Public Place	WGC wood pile
008	39.480400	-84.121600	1301 E Siebenthaler Ave	Dayton	Urban Public Place	WGC Marie Aull trail
009	39.471300	-84.120800	2600 Deweese Pkwy	Dayton	[illegible]	[illegible] barn
200	[illegible]	-84.120300	3015 Pilgrim Rd	Dayton	Residential	Karla's house, [illegible]

2017 Mosquito Field Collection Record (report with every collection)

To be completed by ODH:
Collection #:
Date Received:
Date Posted:
Pool #:

Agency #: 5700 Agency Name: Public Health- Dayton and Montgomery County

County: Montgomery Contact Name: Tom Hut Phone Number: (937) 225-4439

Location #	Trap Type[4]	Attractant(s)[2]	Date Trap Placed	Time of Day Trap Placed[3]	Date Trap Collected	Time of Day Trap Collected[3]	# of Tubes	Notes
001	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	0	
002	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	1	
003	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	0	
004	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	1	
004	BG Sentinel Trap	BG Lure	06/12/2017	Afternoon	06/13/2017	Morning	1	
005	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	1	
006	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	0	
007	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	1	
008	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	1	
009	Gravid Trap	Organic Brew	06/12/2017	Afternoon	06/13/2017	Morning	1	
200	BG Sentinel Trap	BG Lure	06/12/2017	Afternoon	06/13/2017	Morning	1	

Protect Your Health

Most of us recognize mosquitoes as a familiar summertime pest. But, did you know that those same mosquitoes can sometimes make us ill? Mosquitoes can transmit the viruses that cause West Nile Virus, LaCrosse Encephalitis, St. Louis Encephalitis and other viral illnesses to humans at the same time they "bite", sometimes causing illness in the bite victim.

Why do mosquitoes "bite"? The female mosquito needs protein to help develop eggs. The female uses the blood taken from its victim during a "bite" as a protein source to help in egg development. The blood meal can be taken from any mammal (including humans) or birds.

Mosquito-borne disease happens when an infected mosquito takes a blood meal from a bird and passes the infection to the bird. Birds act as virus incubators and for a short time can become a reservoir for the virus. If a mosquito takes a blood meal from a bird during the time when the virus is at a high level the mosquito may become infected and can pass that infection on.

These viruses can only be transmitted by a mosquito; ***they are not transmitted by people or animals.*** It is important to note that very few mosquitoes ever become infected and if they do, there is only a remote chance that they will successfully transmit a virus to a bite victim.

We can do many things to reduce the number of mosquitoes around us as well as to reduce the number of places where mosquitoes breed. Mosquitoes need quiet water to lay their eggs and for the eggs to develop into adult mosquitoes.

No water = no mosquitoes.

See the other side to learn how you can help reduce the number of mosquitoes around your home and in your neighborhood. **If you have any questions, call Public Health - Dayton & Montgomery County at 937-225-4362.**

Public Health

Control Mosquitoes

Things you can do outside your home:

- Get rid of old tires, cans, buckets or other water holding containers.
- Keep your trash cans covered at all times.
- Change water in birdbaths, wading pools & plant pots at least weekly.
- Clean out roof gutters & down spouts.
- Fill in or drain low spots in your yard.
- Repair leaky pipes & outdoor faucets.
- Fill in tree holes & hollow stumps.
- Keep your lawn & shrubbery trimmed.
- Keep ditches, drains and culverts clear & free-flowing.
- Maintain private sewage disposal system in good working condition.
- Don't overwater your lawn or garden.
- Repair damaged screens on windows and doors.

Ways you can protect yourself:

- Avoid exposure to mosquitoes. Stay inside at dusk & dawn, when they are most active.
- Wear light-colored clothing, with long sleeves & long legged slacks.
- Avoid physical exertion, especially when mosquitoes are most active.
- Use colognes and perfumes sparingly.
- Use mosquito repellents. Read the label and use sparingly in the weakest formulation that does the job, particularly on children.

Public Health

Public Health — Dayton & Montgomery County

Zika Virus Fact Sheet

Transmission

Mosquito bites

Mother to child

Sexual contact

Blood transfusion

A mosquito becomes infected when it bites a person already infected with Zika. That mosquito can then spread the virus by biting more people.

Women should avoid getting pregnant for six months from the time that they or their partners have had a ZIKA virus infection, or traveled to an area with a chance of Zika infection. Practice safe sex methods (such as using condoms) for six months with any partners who have had Zika infection or traveled to an area with a chance of Zika infection.

Symptoms

Fever

Rash

Joint pain

Red eye

Muscle pain

Headache

Many people infected with Zika won't have symptoms or will only have mild symptoms. The most common symptoms are fever, rash, joint pain, or red eyes. Other symptoms include muscle pain and headache. Symptoms can last for several days to a week. People usually don't get sick enough to go to the hospital.

Prevention

Avoid mosquitoes

Wear light-colored clothes with long sleeves and pants

Mosquito repellent

Remove standing water

Practice safe sex

Avoid travel to Zika-infected areas

Protect yourself and your family from mosquito bites all day and night, whether you are inside or outside.

Risk of Birth Defects

Zika infection during pregnancy can cause a fetus to have a birth defect of the brain called microcephaly. Other problems have been detected among fetuses and infants infected with Zika virus before birth, such as defects of the eye, hearing deficits, and impaired growth. There have also been increased reports of Guillain-Barré syndrome, an uncommon sickness of the nervous system, in areas affected by Zika.

Treatment

Rest

Get plenty of rest to help speed your recovery.

Drink fluids to prevent dehydration

Drinking water is the best way to prevent dehydration.

Medicine

Take medicine such as acetaminophen to reduce fever and pain.

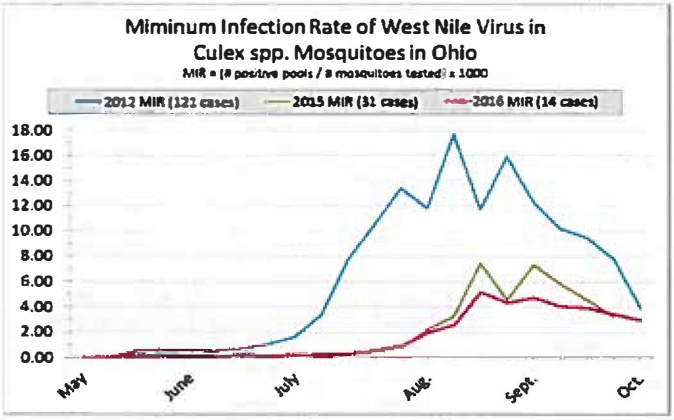
Do not take aspirin

Do not take aspirin or other non-steroidal anti-inflammatory drugs.

www.phdmc.org/zika (937) 225-5700

2016[4]

West Nile Virus numbers at a glance*		Notes
Ohio Counties with WNV activity reported	32	
Human cases	14	3 females and 11 males, ages 4-84 years (median 67 years) from Clermont (1), Cuyahoga (3), Franklin (2), Hamilton (1), Licking (1), Marion (2), Medina (1), Noble (1) and Sandusky (1) counties
Human deaths	2	
Asymptomatic blood donors	4	1 female and 3 males, ages 17-55 years (median 44 years) from Licking (1), Ross (1) and Wayne (2) counties
WNV veterinary cases	5	Equine from Pickaway (1), Stark (1) and Tuscarawas (3) counties
Mosquitoes tested so far	402,187	Collected in 64 counties, pooled into 12,684 samples
WNV positive mosquito samples	489	Clermont (1), Cuyahoga (16), Defiance (4), Delaware (5), Franklin (241), Gallia (1), Guernsey (1), Hamilton (2), Hancock (5), Henry (1), Lake (47), Licking (29), Lorain (10), Lucas (25), Mercer (1), Montgomery (7), Noble (1), Pickaway (3), Portage (11), Putnam (1), Richland (1), Ross (1), Scioto (2), Stark (6), Summit (60), Tuscarawas (2), Union (2) and Washington (3) counties



"Other Arboviruses" numbers at a glance*		Notes
La Crosse Virus Human cases	6	2 females and 4 males , ages 7-51 years (median 11.5 years) from Guernsey (1), Mahoning (2), Scioto (1), Stark (1) and Union (1) counties
Jamestown Canyon Virus Human cases	0	
St. Louis Encephalitis Human cases	0	
Eastern equine encephalitis Human cases	0	
Eastern equine encephalitis Veterinary cases	0	
Travel associated mosquito borne disease cases*		Notes
Chikungunya** Virus Human Cases	2	1 female and 1 male, ages 8-41 years with travel history to India (2)
Dengue Human Cases	6	5 females and 1 male ages 31-60 years (median 47 years) with travel history to Brazil (1), Colombia (1), Dominican Republic (2) and India (2)
Zika** Human Cases	70	45 females and 25 males ages 12-78 years (median 33 years) with travel history to Latin America, the Caribbean and Pacific Islands . 1 case did not travel but was sexually transmitted/partner had a travel history documented above.
Malaria Human Cases	45	17 females and 28 males, ages 3-72 years (median 35 years) with travel history to African countries (42), Dominican Republic (1), Pakistan (1) and Madagascar (1).

* updated Oct. 21, 2016

**Ohioans traveling to areas where local transmission is occurring should be aware of this ongoing situation and make every effort to avoid mosquito bites. Additional information can be found from the CDC (www.cdc.gov/chikungunya, www.cdc.gov/zika/geo/index.html) and the Pan American Health Organization (www.paho.org/chikungunya, www.paho.org/zika).

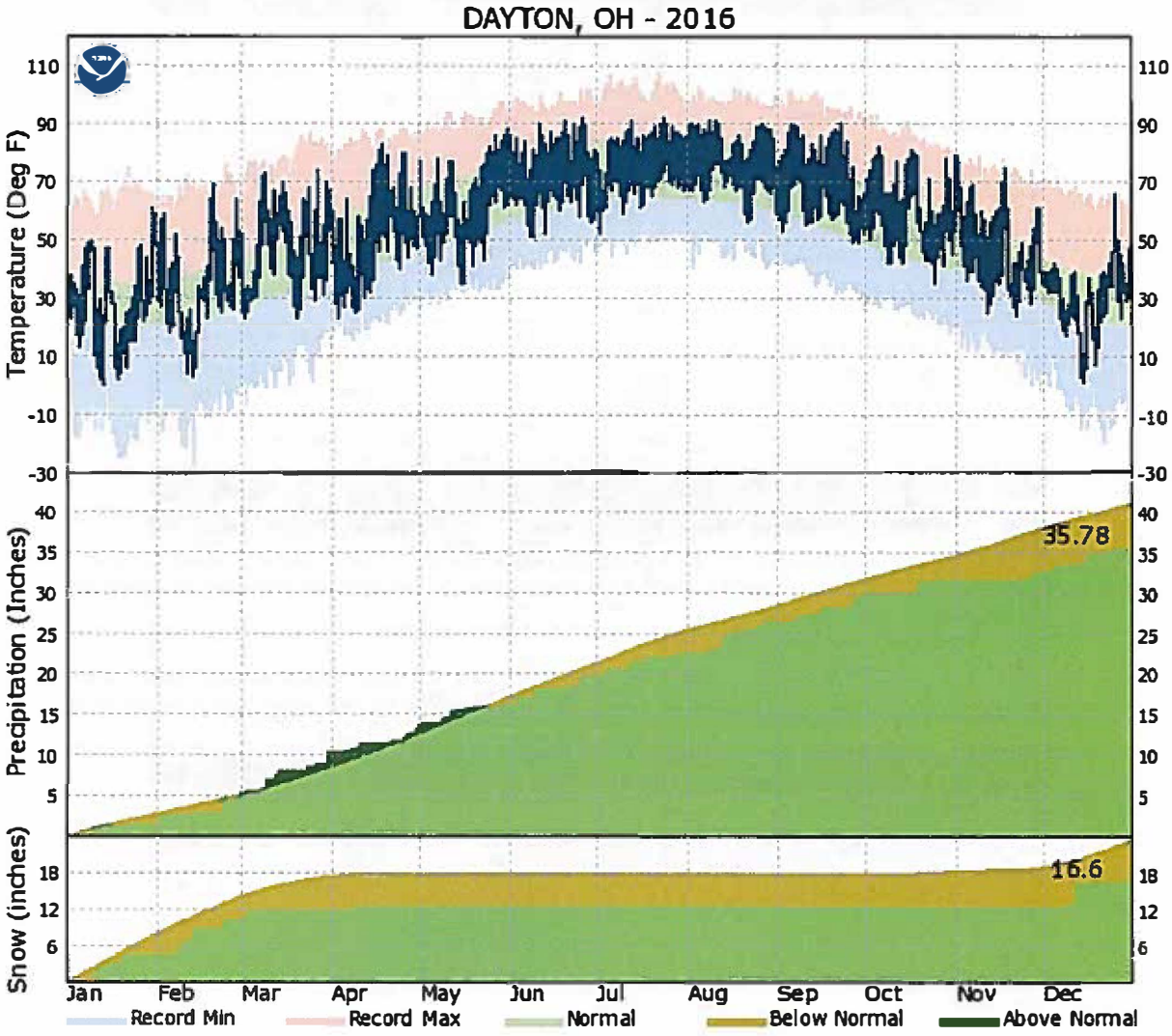
2017[5]

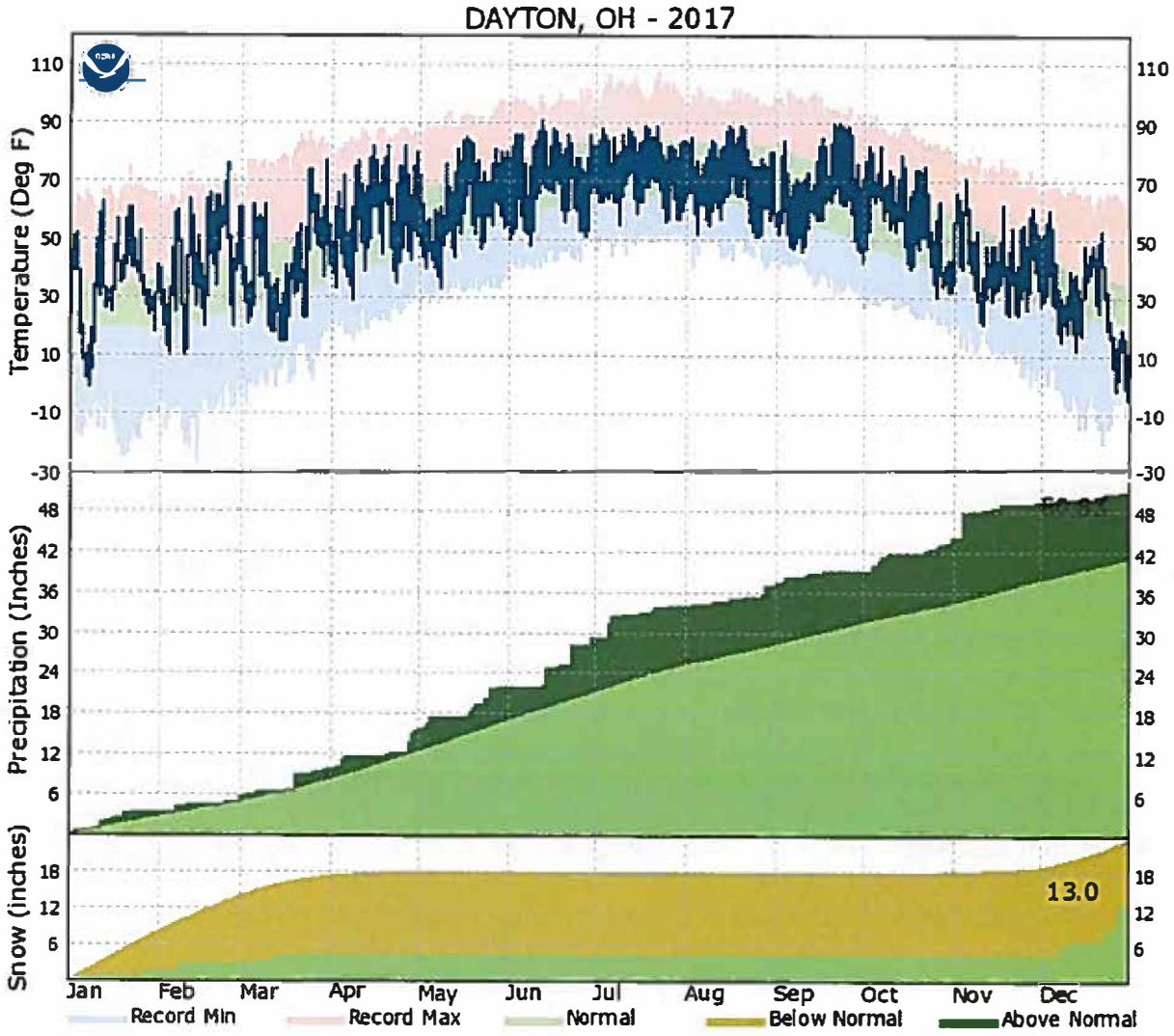
West Nile Virus **		Notes
Mosquitoes tested	432,120	Collected in 68 counties, pooled into 16,040 samples
WNV positive mosquito samples	2,234	Ashland (12), Ashtabula (6), Athens (6), Butler (1), Clark (11), Columbiana (4), Coshocton (2), Crawford (6), Cuyahoga (20), Delaware (21), Fairfield (3), Franklin (713), Greene (20), Hamilton (102), Hancock (27), Henry (3), Hocking (22), Huron (1), Jackson (3), Knox (6), Lake (91), Lawrence (1), Licking (79), Lorain (79), Lucas (170), Madison (1), Mahoning (4), Marion (1), Medina (13), Meigs (13), Montgomery (71), Pickaway (28), Portage (185), Richland (50), Ross (12), Scioto (4), Stark (37), Summit (352), Tuscarawas (18), Warren (1), Washington (3) and Wood (32) counties
WNV Veterinary Cases	11	11 equine cases in Ashtabula (1), Columbiana (1), Holmes (1), Logan (2), Trumbull (1), Tuscarawas (1) and Wayne (4) counties with onsets 8/24 - 9/15/17
WNV Asymptomatic Viremic Blood Donors	8	5 females, 3 males ranging in age from 19-67 years (median: 50 years) from Fairfield (1), Franklin (2), Hamilton (1), Holmes (1), Medina (1), Mercer (1) and Stark (1) counties
WNV Human Cases	27	16 females, 11 males ranging in age from 35-82 years (median: 59 years) from Butler (1), Clark (1), Clermont (2), Cuyahoga (5), Defiance (1), Franklin (1), Greene (1), Hamilton (3) Huron (1), Lake (1), Logan (1), Lucas (2), Meigs (1), Portage (1), Richland (1), Stark (1), Summit (1), Tuscarawas (1) and Van Wert (1) counties with onset of symptoms 7/24 - 10/2/17
Ohio Counties with WNV activity reported	49	Include counties with WNV positive mosquitoes, equine WNV cases, human WNV cases and human WNV viremic asymptomatic blood donors
Other locally aquired mosquito-borne diseases **		**Notes**
La Crosse virus - Human Cases	4	2 females, 2 males ranging in age 4-65 years (median: 9 years) from Delaware (1), Knox (1), Muskingum (1) and Preble (1) counties with onset of symptoms 6/16 - 7/17/17
Jamestown Canyon virus – Human Cases	2	1 female, 1 male ranging in age 2-7 years (median 4.5 years) from Holmes (1) and Wayne (1) counties with onset of symptoms 8/20 - 9/10/17
Unspecified California serogroup virus – Human Cases	10	4 females, 6 males ranging in age 0-17 years (median 8.5 years) from Allen (1), Ashland (2), Holmes (1), Medina (1), Ross (1), Summit (2), Trumbull (1) and Williams (1) counties with onset of symptoms 7/4 - 8/29/17
Eastern equine encephalitis virus - Veterinary Cases	1	1 equine case, a 7 year old gelding, in Ashtabula County with and onset of neurologic disease on 7/25/17, euthanized
Travel associated mosquito-borne diseases **		**Notes**
Chikungunya Human Cases*	3	2 females, 1 male ranging in age from 16-39 years (median 37 years) with travel to India and Mexico with onset of symptoms 3/28 - 8/24/17
Dengue Human Cases	3	1 female, 2 males ranging in age from 17-60 years (median 27 years) with travel to Asian countries with onset of symptoms 1/11 - 2/25/17
Zika Human Cases*	4	2 males, 2 females ranging in age from 12-59 years (median 34.5 years) with travel to Caribbean islands with onset of symptoms 1/3 - 6/2/17
Malaria Human Cases	52	21 females, 31 males ranging in age from 1-77 years (median 30 years) with travel to African countries, Afghanistan, Guatemala and Papua New Guinea

*Ohioans traveling to areas where local transmission is occurring should be aware of this ongoing situation and make every effort to avoid mosquito bites. Additional information can be found from the CDC (www.cdc.gov/chikungunya, www.cdc.gov/zika/geo/index.html) and the Pan American Health Organization (www.paho.org/chikungunya, www.paho.org/zika).

**Updated 10/27/17

E- CLIMATE GRAPHS[6]




DAYTON, OH - 2017
Temperature (Deg F)
110
90
70
50
30
10
-10
-30
Precipitation (Inches)
48
42
36
30
24
18
12
6
Snow (inches)
18
12
6
13.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Record Min
Record Max
Normal
Below Normal
Above Normal

F- ACKNOWLEDGEMENTS

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