ADA COUNTY
Weed, Pest, and Mosquito Abatement
Desiree Keeney; Field Operations Manager

2013 Mosquito Annual Report

Mission Statement

The mission of Ada County Mosquito Abatement District is to control mosquitoes that are both a nuisance and potential vector of disease to Ada County residents.

District's Brief History

Ada County's original Mosquito Abatement District (MAD) was the Three-Mile Creek District established in 1974, which included 12 sq miles between Cloverdale and Cole Roads and Franklin and Columbia Roads. There were several district annexations made over the next few decades, and in 2004 Ada County Board of County Commissioners agreed to incorporate and operate what was then called the Southwest Ada County Mosquito Abatement District. Today, the district is known as Ada County Mosquito Abatement District (ACMAD) and covers 406 sq miles, with the majority of the district covering major residential and urban areas.

ACMAD Management and Staff

Brian Wilbur, Director
Desiree Keeney, Field Operations Manager
Kevin Kostka, Administration Operations Manager
Additional Staff: 5 Fulltime Field Employees, and up to 16 seasonal employees; 1 Fulltime GIS Analyst (shared with Weed and Pest); 4 Fulltime administration staff (shared with Weed and Pest).

Training and Education

Continuing education and training of staff is a primary objective of our program in order to use the best management practices available. This training also contributes for recertification credits through the Idaho State Department of Agriculture to continue to carry a Professional Applicators license in the state of Idaho.

2013 Seminar/Conference/Training	People Sent	Hours	Total
ATV certification	2	4	8
IMVCA Spring Conference	16	16	256
Spring Wake Up in house seminar	13	3	39
AMCA Annual Meeting (Seattle, WA)	1	33	33
NWMVCA Spring Workshop	1	8	8
IMVCA Fall Conference	2	12	24
NWMVCA Fall Conference (Skamania, WA)	2	20	40
SWIWCA Fall Seminar	6	8	48
Organic Advisory Council-FOM Requested as Speaker	1	2	2
Total Hours in Training for 2013:			**579**

Memberships and Affiliations

Ada County Mosquito Abatement District belongs to several associations which increase education to our staff, keep up to date on new methods, and knowledge of potential legislation that will affect our operations and/or residents. The following are our memberships and affiliations:

- Idaho Mosquito and Vector Control Association (IMVCA)
- Northwest Mosquito and Vector Control Association (NWMVCA)
- American Mosquito Control Association (AMCA)

Integrated Mosquito Management

ACMAD follows an Integrated Mosquito Management (IMM) program which helps to enable a better, more sustainable program where ever necessary which is designed to benefit or to have minimal adverse effects on people, wildlife, domestic animals, and the environment. The following are aspects of an IMM: education, cultural, physical and mechanical controls, biological control, and chemical control. We recognize that not all mosquito populations can be controlled using all of these methods and there is no one way to use these practices due to variations in the mosquito population abundance, species diversity, development habitats and environmental conditions. All controls are carefully considered using the above variables by ACMAD as well as cost versus benefits, efficacy, health effects and ecological impacts.

Public Education

Public Education is a primary objective of any Integrated Mosquito Management program. Through public education and outreach we can better inform our residents within the ACMAD about how to protect themselves against mosquitoes and therein potentially lessen the interaction between mosquitoes and people, which helps to control nuisance mosquito interactions and the spread of potential diseases such as West Nile virus (WNv) and other vector borne diseases.

Some public education and outreach that was conducted in 2013:

- ACMAD website and Online Mosquito Tracker
- At the Western Idaho Fair outside the Agriculture Pavilion for Ada County Weed, Pest, and Mosquito Abatement
- Participated in the Eagle Fun Days Parade where thousands of people lined the streets
- ACMAD put up an informational display with brochures and handouts for National Mosquito Awareness week at the Ada County Courthouse (approximately 7998 people entered the courthouse during that week)
- Requested as a speaker to Organic Advisory Council to ISDA mosquito abatement (and noxious weed control)
- Requested as a speaker to spring and fall IMVCA conferences
- As well as the many face to face interactions of field staff when working on a daily basis during the mosquito season, especially during WNv positive outbreaks

Mosquito Surveillance Operations

Ada County Mosquito Surveillance operations started April 29, 2013 and continued through September 27, 2013 for a total of 22 weeks. There were a total of 76 fixed locations throughout Ada County that were trapped at least weekly to survey the mosquito populations in the county. An additional surveillance crew was added because, there was an additional 69 flex trap locations within the county in response to public fog requests for county residents to determine mosquito population problem areas and the presence of West Nile virus. Many of

the flex sites, which may have been set only 2 or 3 times up to 13 times during the season, confirmed there was indeed a mosquito problem in the area, while others showed no problem through trapping (to be discussed later). Surveillance traps that were used were the carbon dioxide (CO^2)-baited CDC light traps, which on average ran for 10 hours a night (using 3-4 lbs of dry ice a night per trap as bait) for a total of 1969 trap nights in 2013. There was only a 3.6% trap failure (down from 7% last year) due to various reasons such as: batteries died, trap vandalism, the trap was too wet and not on in the morning, or field technician error.

There was a total of 870 adulticide treatment requests based on surveillance data (61% increase from 2012) which was determined by thresholds set for vector (5 *Culex* species (*spp*.) count or a positive WNV pool) and nuisance (>25 other species count) mosquito species trapped in a single trap night throughout the county. Some trap locations may have had a variable threshold differing from the above threshold based on trap location, environmental conditions, public treatment requests, and/or species trapped.

In addition to monitoring the mosquito populations within Ada County, ACMAD tests all potential vector mosquitoes for West Nile virus (WNV) in house through the use of a RAMP reader. This allows for immediate response to potential WNv breakouts and control the potential spread of the disease. In 2013, there were 90 **WNV positive pools within 46 trap locations** found in Ada County Mosquito sampled populations, an increase of 4.5 times from 2012. The CDC (Center for Disease Control) reported that there were 40 human cases (1 death) of West Nile Virus (as of December 9, 2013) in Idaho in 2013 (8 in Ada County) and 2318 cases in the nation with 105 deaths (data also shows recent activity into December in Texas and California).

Fig. 1: The following chart shows *Culex pipiens* (CXPI) and *Culex tarsalis* (CXTA) trapped populations over time and number of positive pools by each species.

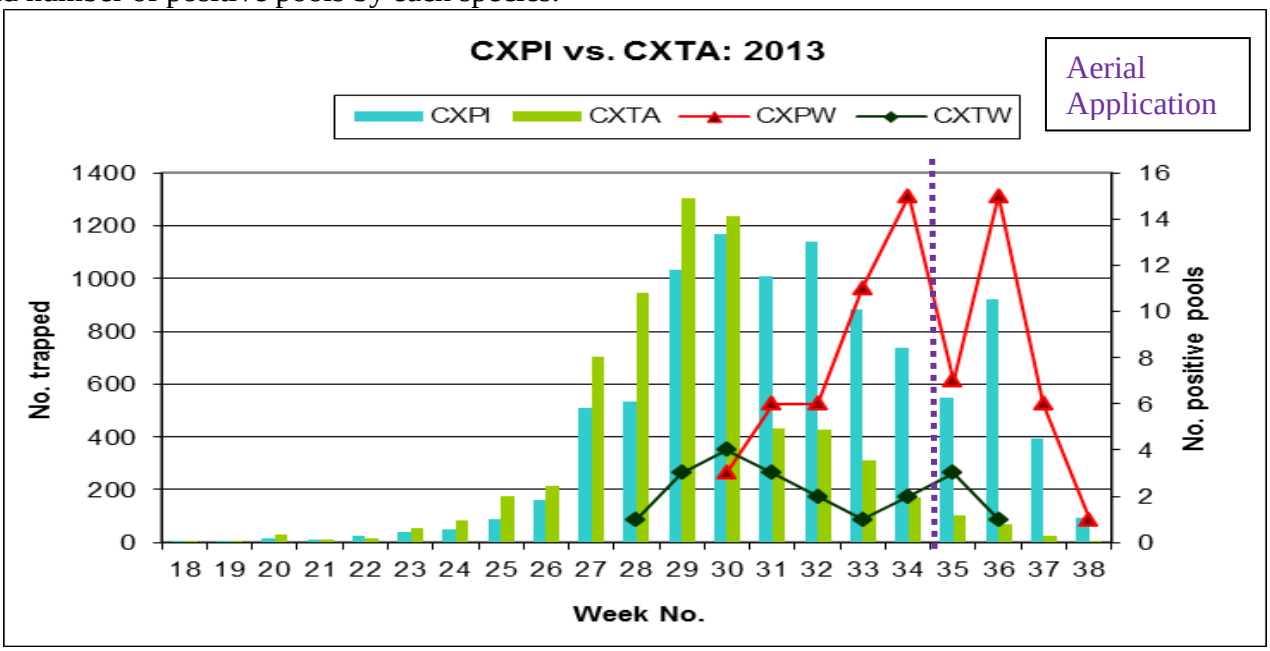
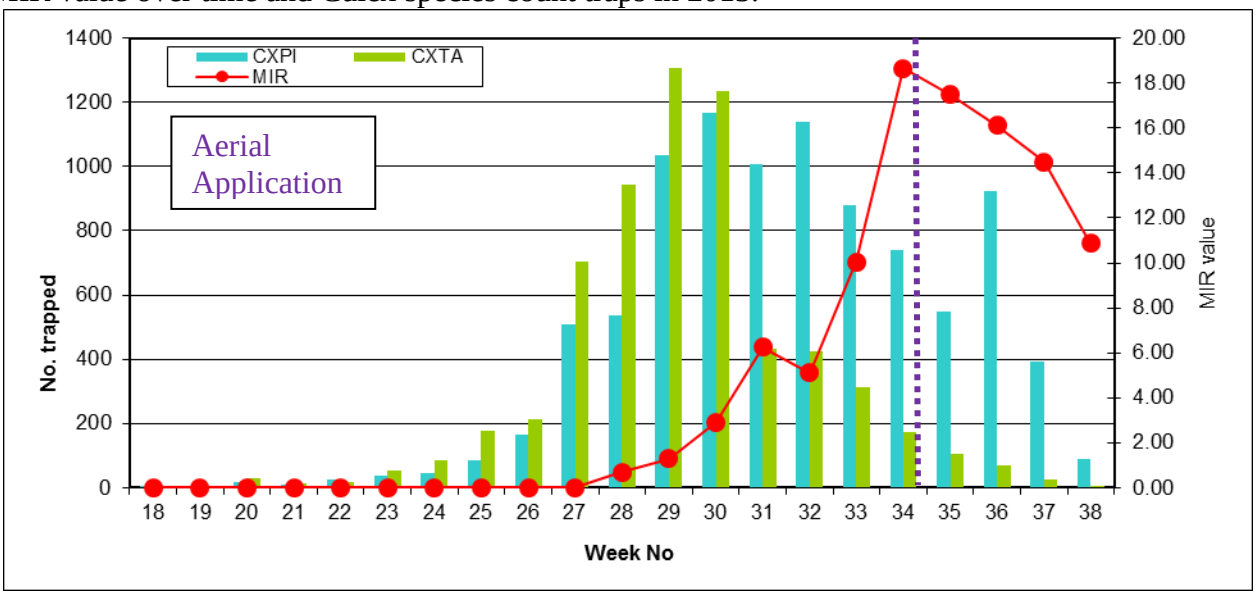


Figure 1 shows the significance of WNV presence in different species populations over time during 2013. This was a change that is not similar in previous WNV positive years and we are finding more and more of *Culex pipiens*, some of this is due to trap placement selection from resident complaints or human population abundance in more urban areas along with a drought year. We have found a significant increase in this species and the WNV positive pools were primarily within this species (the feeding behavior of this species over time is an important factor). Figure 2 shows the minimum infection rate (MIR) over time in 2013.

Fig.2: MIR value over time and Culex species count traps in 2013.

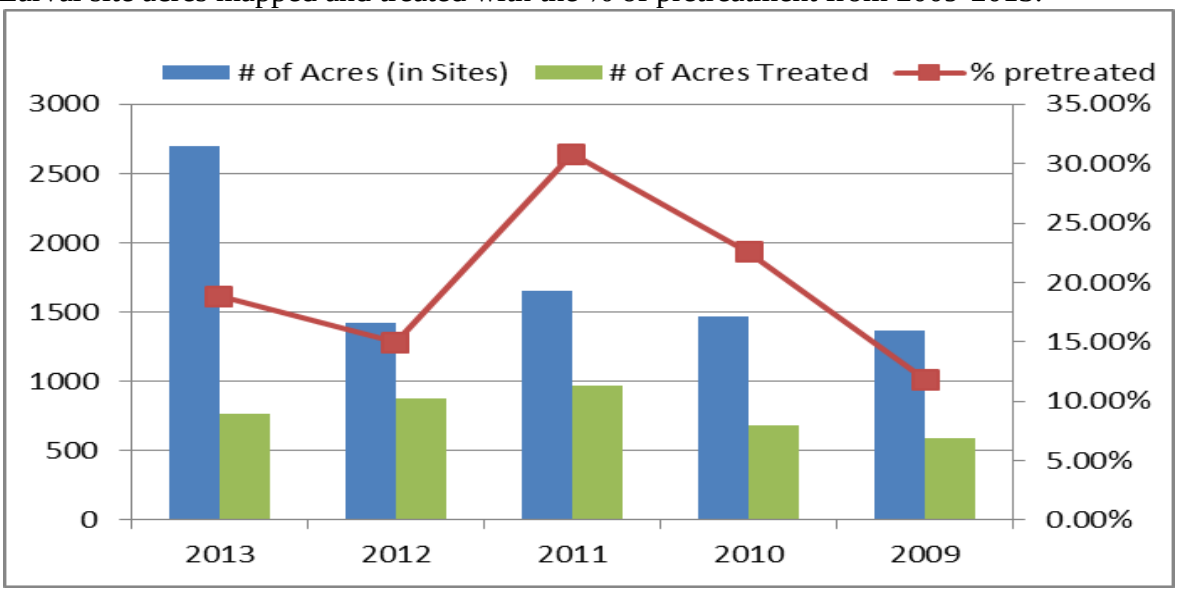


Mosquito Larviciding Control and Operations

Ada County Mosquito Larviciding program started mid-March for hiring of field technicians and in house training, with field training beginning the last week of March and continued through the last week of September. The larvicide crews coordinated multiple 'Maruyama Fest's' (concentrating all larvicide applicators to treat a specific area using backpack-'Maruyama"- applications) in various areas with a large scale need of survey and treatments. There were a total 10 larviciders this year in 10 areas, 2 of which were full time employees.

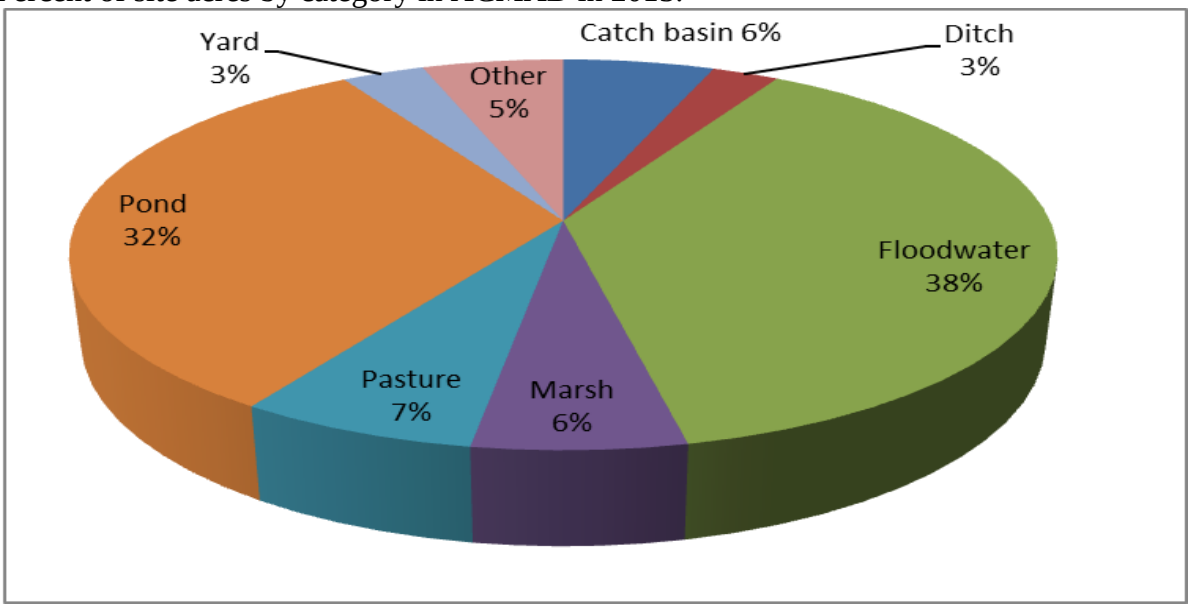
Larval Site Inspections and Treatment Summary:
In 2013, the larvicide crews did a total of 39,331 inspections at 6487 site locations (increase of 46%) recorded within ACMAD and treatments occurred with a frequency of 30% after an inspection. Looking at the total number of inspections, 37% of the time a site was dry when visited; for the season, 20% of sites mapped were dry all year and 31.5% of sites mapped were wet all year. With the increase in both of these statistics, it can be concluded that consistently more sites were dry overall compared to previous years and the sites that ebb and flowed in previous years were consistently wet. Also the new sites mapped this season were in this category of always being wet and were primarily drop inlets (DI's) and *Culex pipiens* larvae were found present in these development sites. There were 403 sites archived throughout the year. There were 10,963 treatments made throughout the year. The larvicide crews also applied 5219 pre-treats at larvicide sites where development habitat was available and/or historically known for larvae. The total acres treated within ACMAD for 2013 season was 653.2 acres (see Fig. 3).

Fig. 3: Larval site acres mapped and treated with the % of pretreatment from 2009-2013.



Looking at the different types of larval site categories we inspect throughout the season, the highest frequency of acres inspected were pond and floodwater types in total acreage (see Fig. 4), however these large acreage sites are not major producers when and if larvae found (typically *Culex* species).

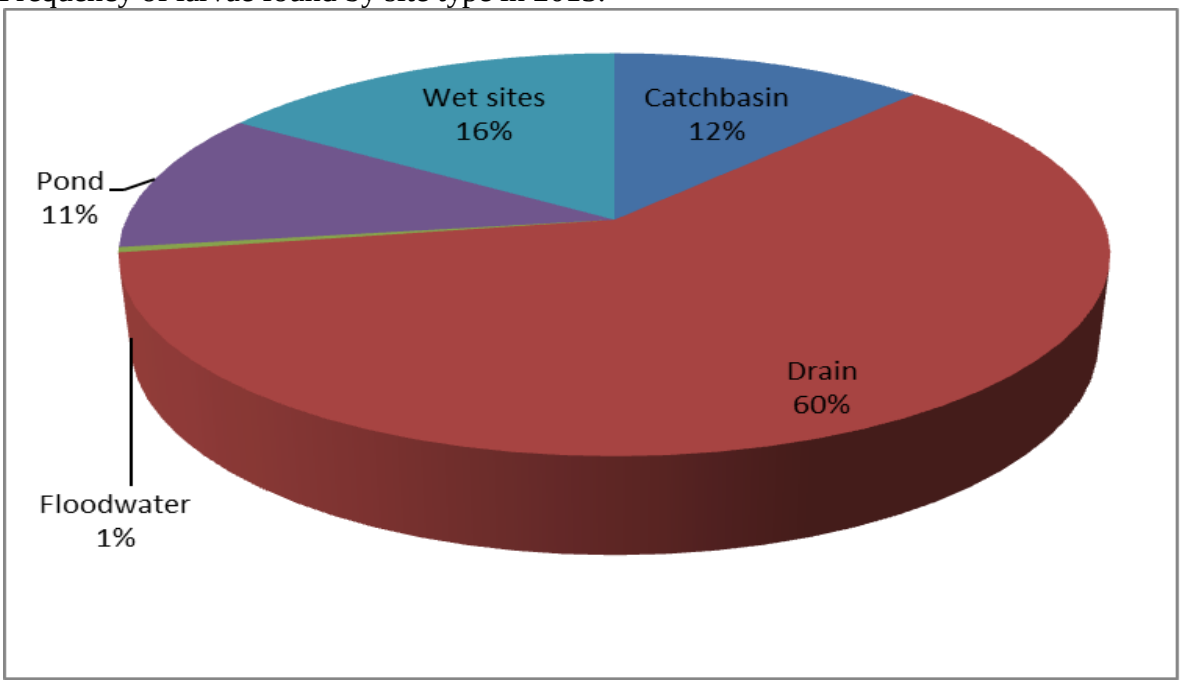
Fig. 4: Percent of site acres by category in ACMAD in 2013.



Larvae Development Habitat Summary:
This year with the presence of WNv, larviciders were actively in the field thoroughly sweeping areas around positive site locations locating mosquito development sources specifically for *Culex spp*. Many new storm drains were mapped, and when treated, there was a direct drop in the adult populations trapped near these problematic development sources. The storm drain locations also resulted in more *Culex* larvae found (this is typical of storm drains, with the species predominately *Culex pipiens*). There were a total of 205 documented remediated sites; there were more that were not documented due to consistency of documentation, which will continue to be a priority in the future in order to show mechanical controls using an IMM practice.

Between the categories of larval sites, 60% of larvae were found in storm drains (drains and DI's), 12% were found in catch basins, 11% in Ponds, 16% of larvae were found in other wet sites (i.e. roadside ditches, swimming pools, yards, etc.), and 1% in floodwater sites (see Fig. 5). **This is interesting due to less water available in standard sites that we have historically monitored (catch basins) and found larvae present and these sites have decreased significantly by 16% larvae found this year (either due to drought year or pretreatments). Additionally there was a significant increase of 31% in drains/DI's, which is one of the main development sites for *Culex pipiens*.** See Appendix C for larvae frequency and distribution map.

Fig. 5: Frequency of larvae found by site type in 2013.



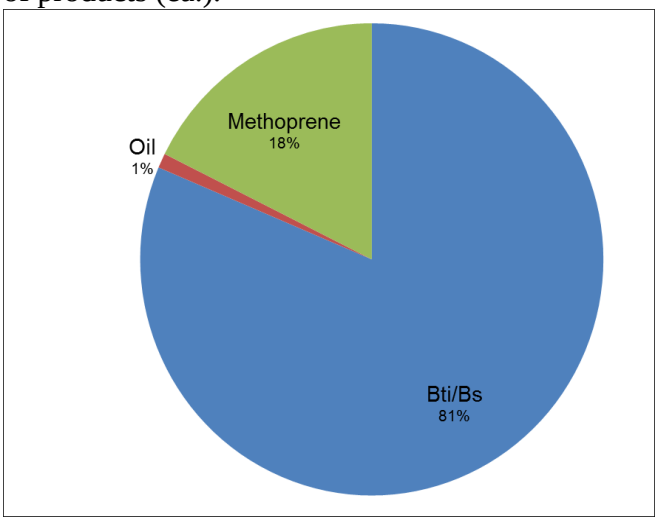
This is significant because it shows us the most common development sources where larvae were found in 2013 which contributes significantly to the mosquito populations.

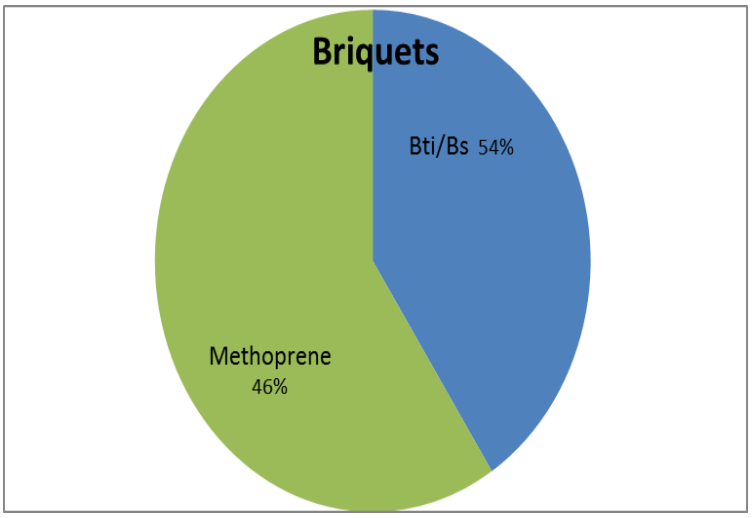
When we look at just new sites created this year, the majority of sites created when larvae was found present were in drop inlets (DI's) (78.8%). **The significance of this confirms the importance of concentrating our efforts to find more DI's and treat them as an integral part of our mosquito control efforts within Ada County.**

Larvicide Public Service Requests:
The public service requests for a larval inspection (138 work orders) were reduced this year from last (n_{2012}=232). The reduction may be attributed to the drought year and limited surface water visible even though multiple media attempts were made for public awareness.

Larvicide Product Summary:
Product used in larviciding is predominately biological control products of *Bacillus thuringiensis israelensis* (Bti) or *Bacillus sphaericus* (Bs), natural occurring bacteria, and methoprene, an insect growth regulator, with less than 1% of other chemical controls used. These products are specific to mosquito larvae and black fly larvae without impacting non-target beneficial species.

Fig. 6: Larvicide product summary used (oz.) for the 2013 field season (from applicator records) and Briquets of products (ea.).





Mosquito Adulticiding Control and Operations

The Mosquito Adulticiding Program started late May. There were 2172 work orders requested in 2013 and 40.1% of these were requested from the surveillance lab (870). This increase in number of requests from the lab for adulticiding is ideal and based on surveillance trap data and not completely public complaints. Many of the public complaints this year were verified through surveillance trapping. Some of the lab requests were due to the 85 WNV positive trap night locations, the rest were based on mosquito population thresholds (see Fig.7 and 8). See Appendix A for Adulticiding applications distribution map along with WNV positive surveillance site locations.

Fig. 7: Adulticide requests by general location throughout Ada County in 2013.

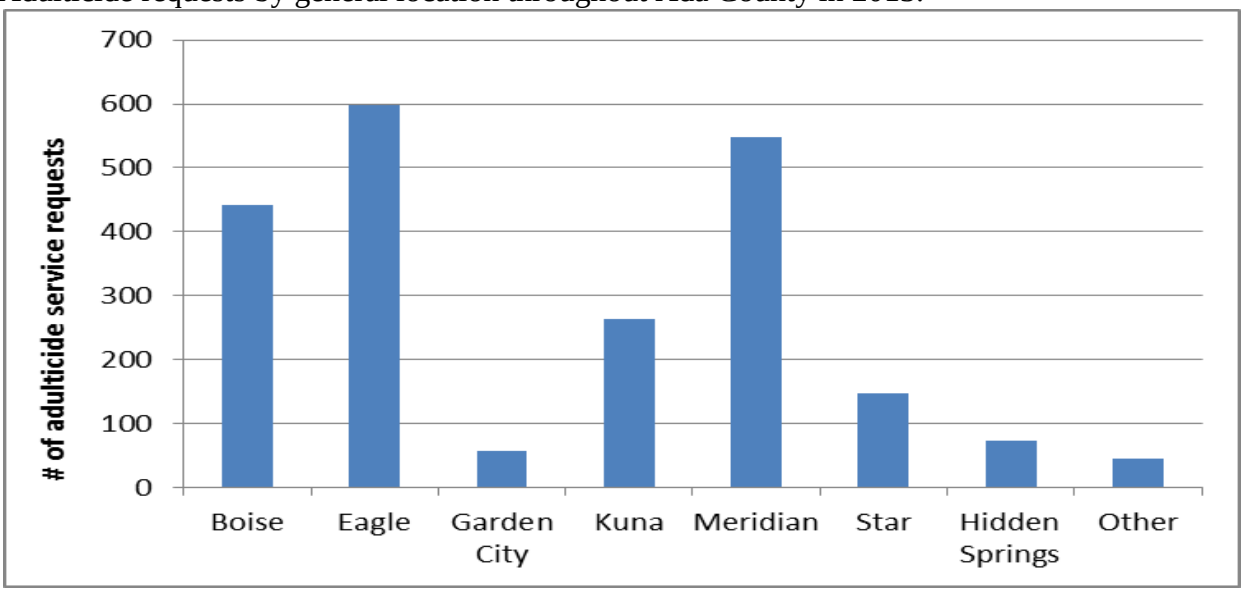
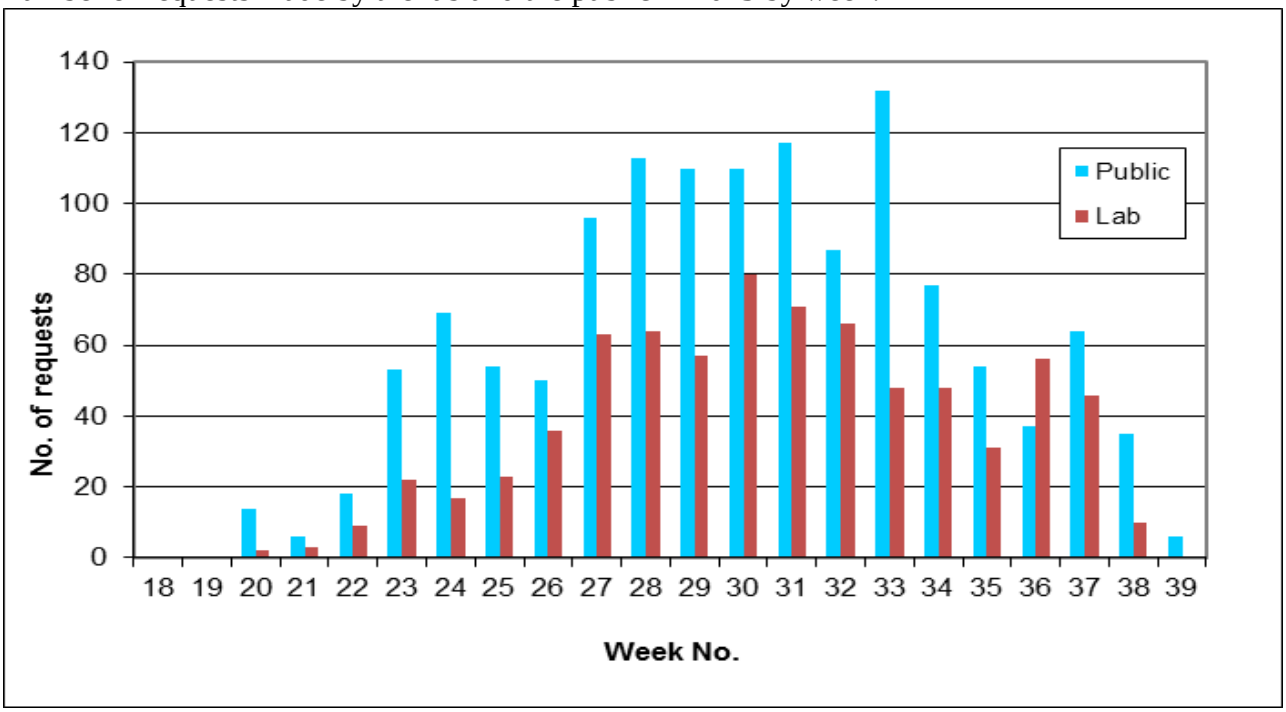


Fig. 8: Number of requests made by the lab and the public in 2013 by week.



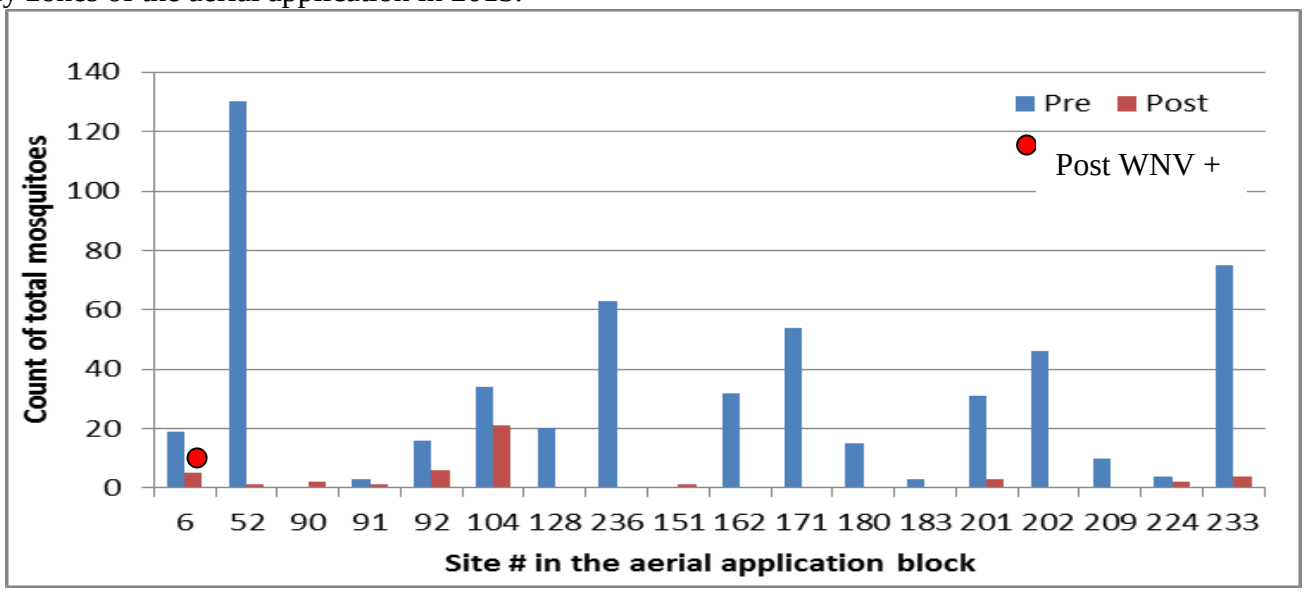
Adulticide Treatment Summary:
Total road miles treated for the 2013 field season was 2239.2 (increase of 58% from 2012 due to WNV positive locations). **Of these lane miles, 645.1 miles were from around WNV positive locations after a site was positive and treated for adult mosquito control.** The adulticide product used was a water-based product which is target specific to kill adult flying mosquitoes and black flies by using ultralow volume micron-size droplet technology.

When looking at the effectiveness of the adulticide treatment on adult mosquito populations at specific site locations, with trapping before and after a treatment, the results were positive. Looking at the preliminary numbers of mosquitoes trapped prior to treatment was generally higher, and then after treatment, there was an observable decrease in the mosquito trapped samples within the same week. A random sample of 13 sites over 6 weeks that were treated within the same week after surveillance traps were collected showed 85% of the time the counts were significantly lower and all sites that had WNV positive prior to treatment came back as negative after treatment in this sample. *While the sample number is low, due to timing, statistical analysis on efficiency of adulticide applications is still undergoing at the time of this report.

Aerial Adulticiding Application 2013

Aerial application of adulticide treatment of naled was completed at the end of week 34 on August 22, 2013. Approximately 23,000 acres were treated in the northwest part of Ada County in Star and Meridian and parts of Eagle. Figure 9 shows the pre and post counts of mosquitoes within the treatment area. There was a total reduction in total mosquito numbers of 92% and within just *Culex* species it was 87% in the spray area, if we look at these same sites and not count the no spray locations or immediately adjacent to no sprays (Site 6 & 91, 104) within the aerial spray block there was a 95% reduction in both (Total counts: n_{pre}=555; npost=46). No sites within the treatment area had WNV reoccurrence for at least 2 weeks. Appendix D shows the map of the treatment area and the spray blocks of deposition of the product and path of the plane.

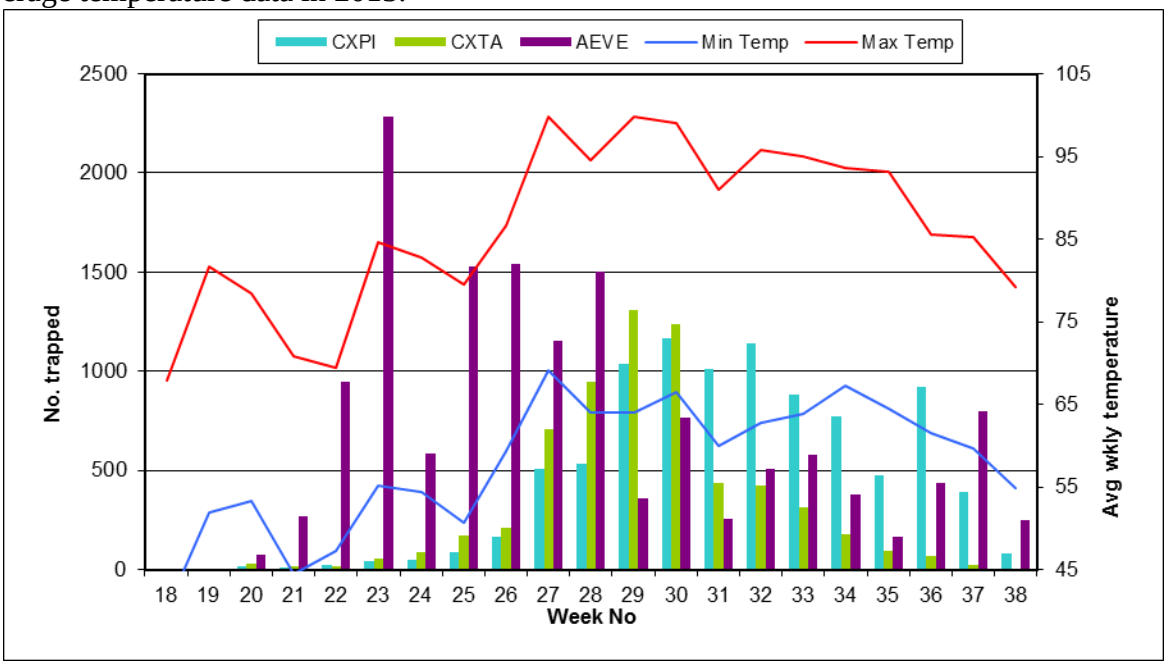
Fig. 9: Surveillance locations pre and post aerial application including two sites (#6, #91 and #104) that were in no spray zones of the aerial application in 2013.



Mosquito Population Dynamics

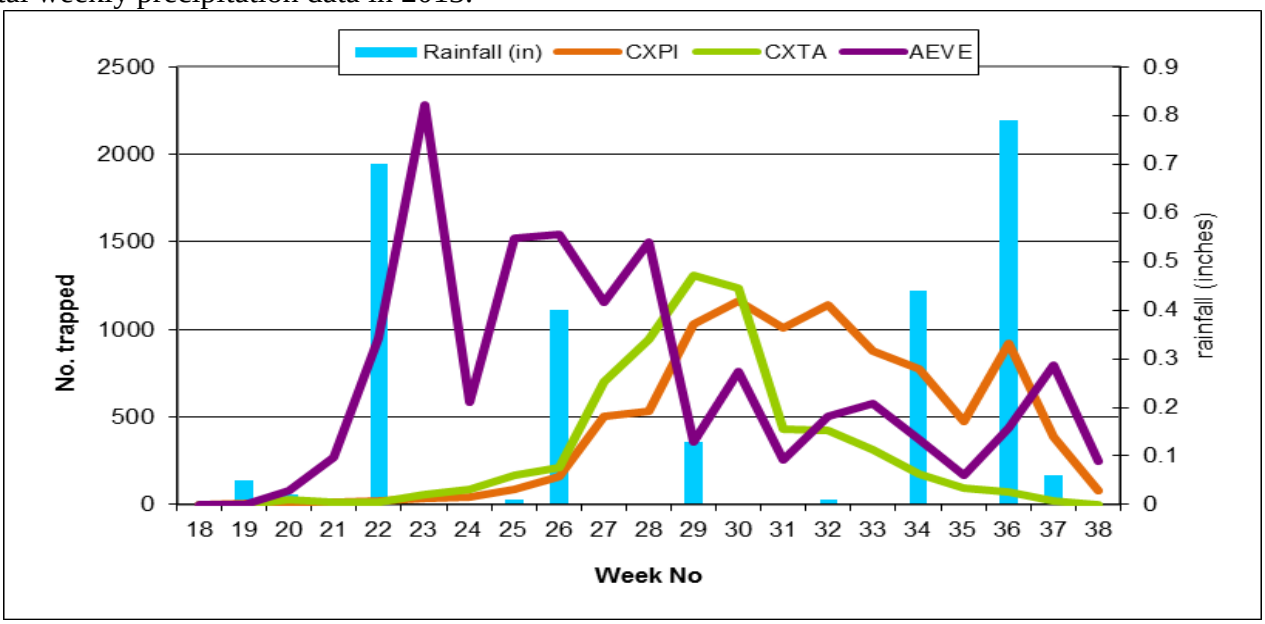
Mosquito Surveillance and Climate Data:
Figure 10 shows the distribution of *Culex* species and *Aedes vexans* (most common nuisance species in Ada County) in the 2013 surveillance field season. This season the peak time of *Culex* species was during weeks 29 and 30 which is consistent with previous years; however *Cx. pipiens* maintained throughout August while *Cx. tarsalis* counts dropped significantly between week 30 and 31. Peak *Culex* activity occurs when average nightly temperatures are averaging 60-70+°F, and then slows down when nightly average temperatures reach 52-54°F. The new flex sites this year trapped more *Culex spp*. (n_{flex}=8110) of mosquitoes than the fixed sites (n_{fixed}=7500) but trapped less nuisance spp. than our fixed locations (n_{flex}=6261; n_{fixed}=12,911). This can be explained by trap placement for new flex sites primarily surveying for *Culex* development locations and high human abundance as well as WNV potential locations and trying to find unknown development sources around these sites. Additionally fixed sites have been thoroughly mapped and monitored in previous years and the locations of some of these sites are in more floodwater habitats (though this is not largely the case, just significant areas of concern for nuisance mosquitoes and public complaints).

Fig. 10: Weekly summary of both fixed and flex sites of *Culex pipiens*, *Culex tarsalis*, and *Aedes vexans* counts with average temperature data in 2013.



In the 2013 field season, the spring was warm and the summer was hot with very little precipitation and no flooding (Fig.11). In fact it was it was a record year for heat and no precipitation all summer with only a total of 2.61 inches of rain from April until September. We can see from figure 11 that directly following a rainfall even we see nuisance species peak within a week or two while average nightly temperatures seem to be more significant to *Culex* populations.

Fig. 11: Weekly summary of both fixed and flex sites of *Culex pipiens*, *Culex tarsalis*, and *Aedes vexans* counts with total weekly precipitation data in 2013.



Mosquito Species Composition Data:
No new species were recorded in 2013, but most other species were trapped as consistent with previous years' data (*Aedes vexans, Culex pipiens, Culex tarsalis, Ochlerotatus nigromaculis, Ochlerotatus dorsalis, Ochlerotatus increpitus, Ochlerotatus melanimon, Anopheles freeborni, Culiseta incidens, Culiseta inornata,* and *Coquillettidia pertrubans)*. There were a few different nuisance species (*Culex restuans, Ochlerotatus sierrensis, Ochlerotatus spencerii idahohensis*) that we did not see this season and which can be attributed to no floodwater from the river, reduced water usage on flooded pastures due to limited water access, and no snowmelt species due to limited snowmelt both in the mountains and in the valley.

With the increase in flex sites within the mosquito surveillance program, there was an increase of mosquitoes sampled, for a total of 34,881 mosquito species, of that 15,625 were *Culex spp.* (44.8%). On an average trap night, there was an average of 17.7 total mosquitoes trapped and respectively 7.9 *Culex spp*. trapped. Looking at fixed and flex data, the predominant species trapped were *Aedes vexans* (41%) early on in the season, *Culex pipiens* (27%), and *Culex tarsalis* (18%) (See Fig. 12). If we only look at fixed locations between this season and 2012 the populations counts were significantly lower this year ($n_{Total2013}$=20,411 and $n_{Culex2013}$=7500; $n_{Total2012}$=30,143 and $n_{Culex2012}$=14,932).

Fig. 12: Total species composition data for the 2013 field season at both fixed and flex sites.

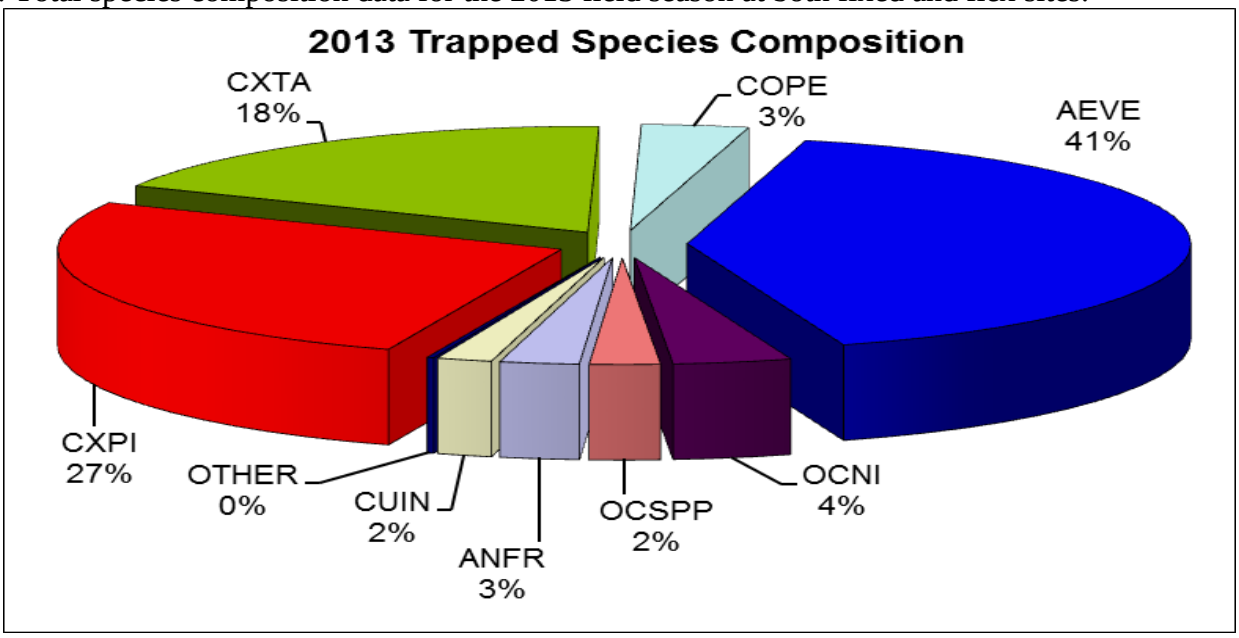
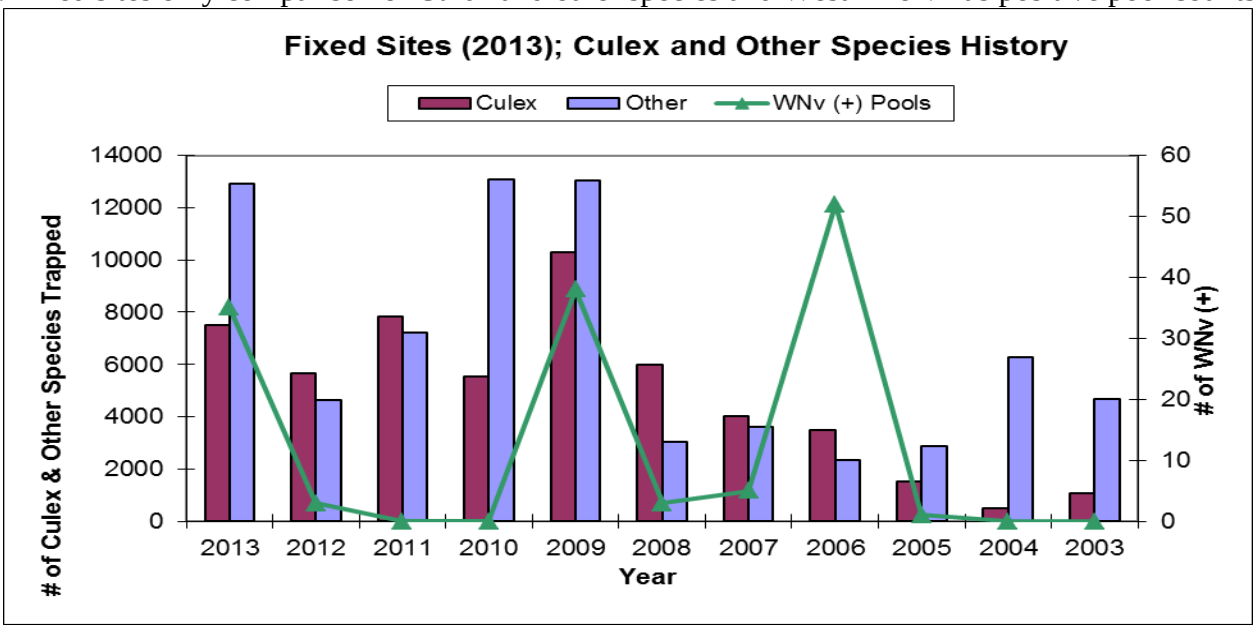
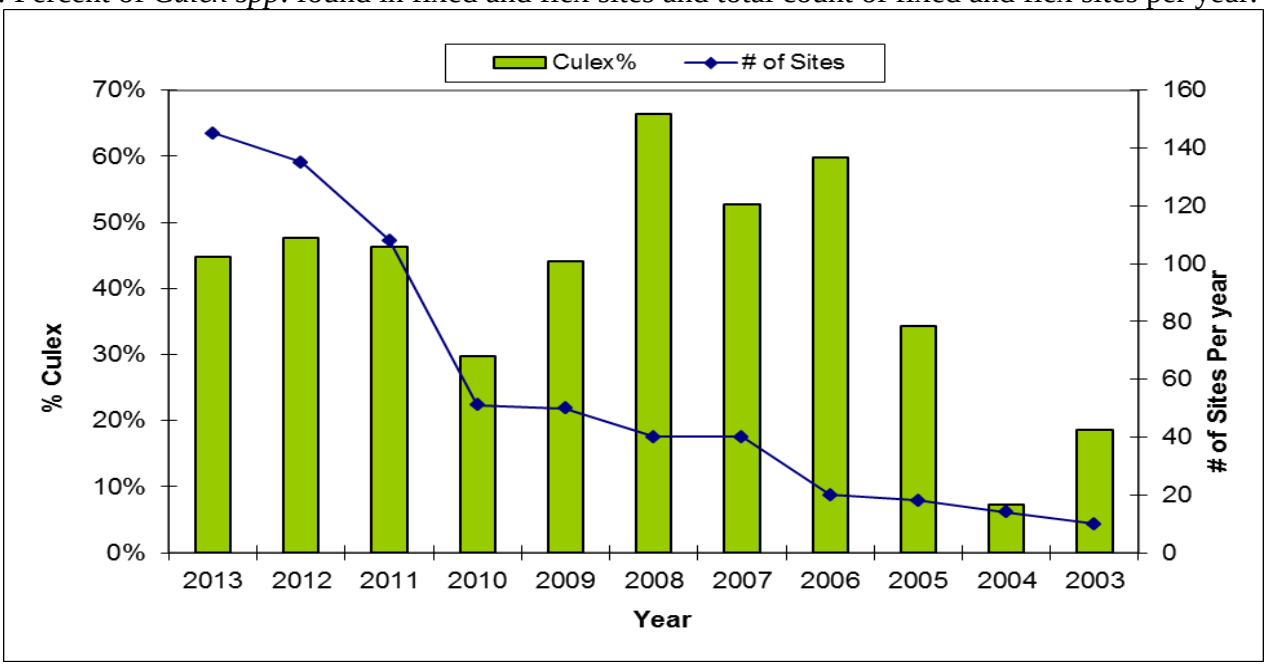


Fig. 13: Fixed sites only comparison of *Culex* and other species and West Nile Virus positive pool counts.



In 2013, there was a small decrease in *Culex spp.* found in comparison to other species even with an increase in site locations (see Fig. 14). W***hile we are trapping a lot of other species, our Culex controls on larvae are working due to the increase in larvae found this year (20% more frequent), not in flood larval sites, but Culex preferred larval sites and the adult Culex spp. percent are still lower than total mosquitoes trapped.*** The factors that also must be considered are site placement (rural vs. urban/suburban), why a site was placed in a location (most flex sites were in response to public service requests for adulticiding which typically are a response to nuisance mosquitoes), average minimum temperatures, precipitation, degree days, and % of larvicide pretreatments and treatments at *Culex spp*. development sites.

Fig. 14: Percent of *Culex spp*. found in fixed and flex sites and total count of fixed and flex sites per year.

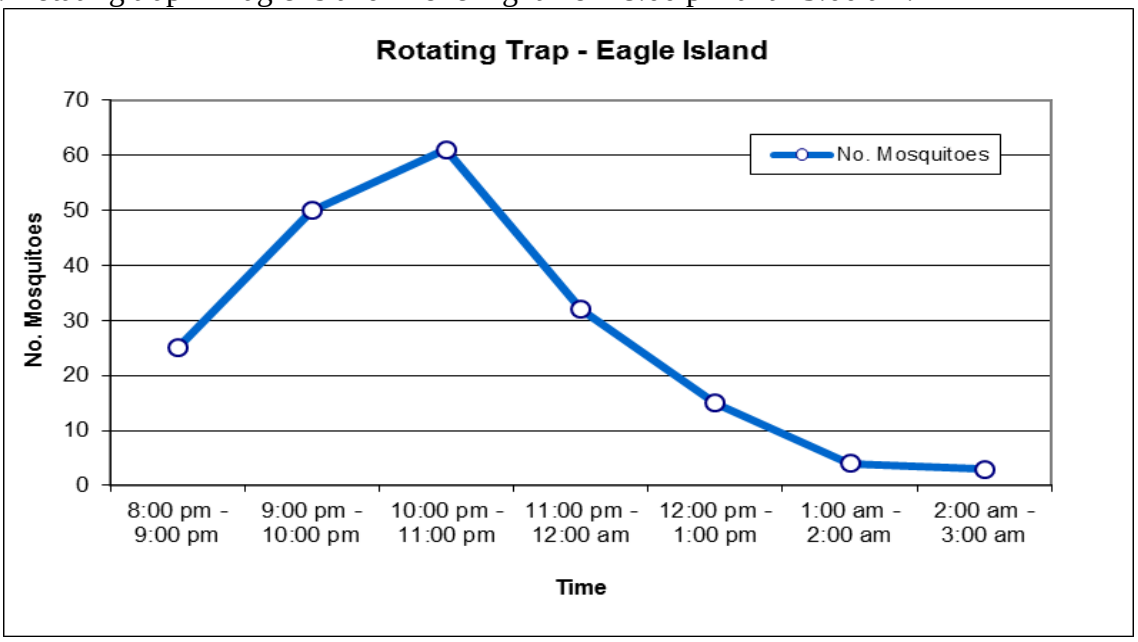


Projects and Field trial summaries

Rotating trap project: Eagle Island

This year we set a rotating trap on June 3rd, 2013 in Eagle Island State Park early on to determine when the best time to use an adulticide treatment would be and be the most effective on the populations causing nusiance issues to neighboring communities. Figure shows the ideal peak time early on in June to treat is between 8:30 pm and 10:30 pm. All of these mosquitoes were *Aedes vexans*. We will continue to do this project in 2014 in different areas and at different times later in the year. We will also set out over a period of days to determine population dynamics over times in areas of concern.

Fig. 15: Rotating trap in Eagle Island in one night from 8:00 pm until 3:00 am.



Storm drains and Drop inlets and residual treatments project:

Historically there have been areas with high counts of *Culex pipiens* in sites and consistently some surveillance sites trap counts would not be impacted no matter the adulticiding efforts. We found that over the last few seasons we are finding more and more mosquito larvae in these drains and DI's (specifically *Cx. pipiens*) and so we sent out all larviciders in the first week of April around these sites and find and pretreat these drains with a long term residual (150-180 days) of methoprene, *BTi/Bs* or spinosid once and then not to treat again all season. The results of this project were very positive, and most of these sites were completely controlled all year. It allowed for us to continue finding new sites without having to make duplicated efforts every month or 45 days and opened up more time for larviciders to continue finding mosquito development sources and decrease the amount of products used to control mosquitoes over time. Figure 16 shows 2012 surveillance trap locations counts and then 2013 counts and overall there was significant decreases in mosquito numbers. Figure 17 shows an example of one specific surveillance site over the last 4 years. More information on this project can be found in the project write up.

Fig. 16: Different sites chosen for project comparison of 2012 and 2013 totals.

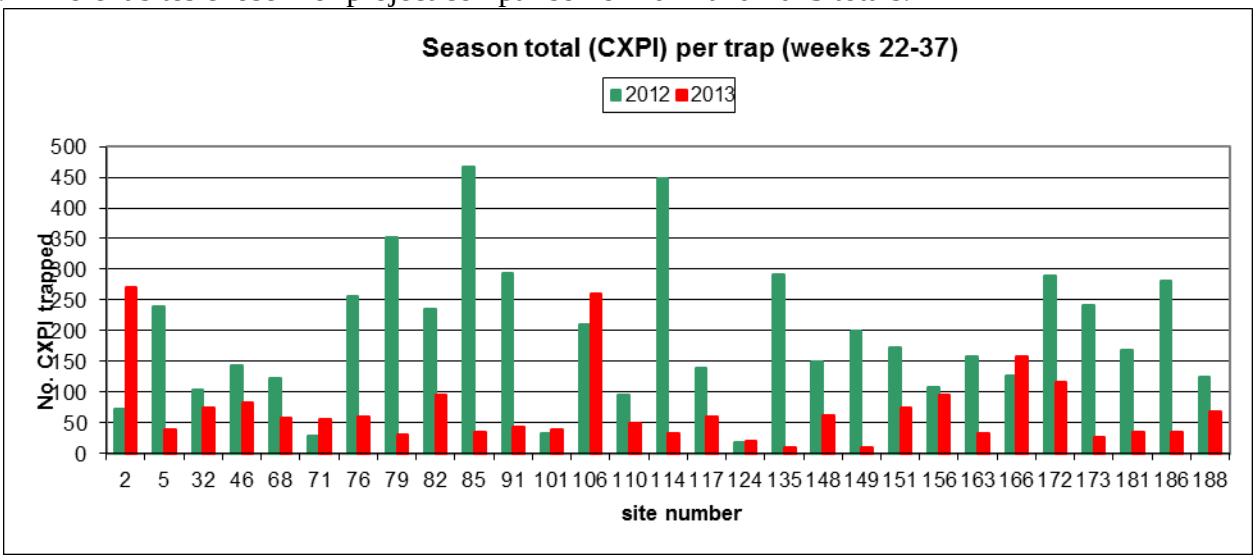
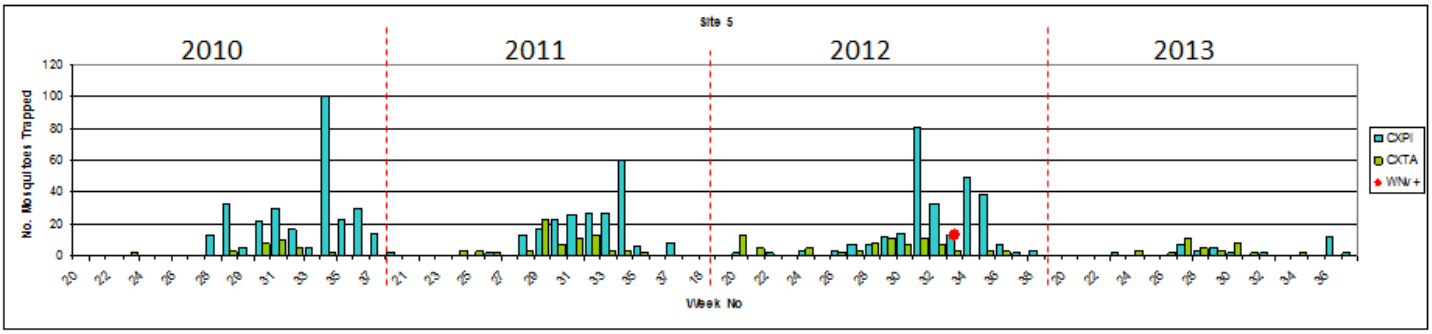


Fig. 17 : Surveillance site #5 in Eagle with 4 year history showing *Culex pipiens* and *Culex tarsalis* totals only, 2013 is the only year with pre treatment of drop inlets.



Controlled release granular in flooded pastures project:

We also tried to put down a new formulation of product in Eagle Island and some other pastures that have historically been flooded. These products are a wet/dry flood larval control and can last up to 5 floods depending on product and length of water present. We picked two fields in Eagle Island of similar size and placed two different products in it working with Clarke and Valent Biosciences for a field trial. The Natular G30 (Clarke) seemed like it would work, but due to the lower water available this year and no flooding by the river, the site was never consistently wet enough to complete the trial. The other field that had MetaLarv SPT (Valent Biosciences) seemed to be wet more frequently or held water where we could dip and find larvae, however the larvae did not emerge (as this is an insect growth regulator-methoprene). Ideally these two new formulations of products may be ideal in these sites where more water is used in normal years and frequent flooding.

Conclusion

In summary, the year was a high WNV positive year and required more aggressive efforts to control the potential spread and frequency of WNV. We did implement a greater number of surveillance trap locations in order to increase our mosquito population surveys, WNV activity monitoring locations, and complete NPDES PGP requirements. We continued to implement activities with "Maruyama Fest's" in areas of high concern or too large for one person to complete in a timely and effective manner.

With the cool spring temperatures, minimal rain early in the season and then getting hot so quickly and staying hot this season with low water, it was considered a drought year. Due to this and historical data it was predicted early on to be a potential high WNV year due to the nature of vector species, the early onset of WNV in neighboring counties and states, and disease cycle.

This year we did a large scale drop inlet/storm drain project that we increased our monitoring and development site creations around historically known surveillance trap sites with high *Culex pipiens* present and treated those sites with a long term residual product that allowed for one treatment all year as long as flushing action was minimal and we could continue finding new sites that were problematic. As suspected, these sites are a large undertaking due to mass numbers of DI's and frequency of larvae found in these locations in 1000's per drain, however they are relatively easy to treat when known. This year these locations were are prime sources of *Culex pipiens* and was reflected when new surveillance sites were created with populations trapped and WNV present in these areas. The DI's and storm drains are typically in very high human populated areas: neighborhoods, parks, parking lots, schools, and urban areas. This is significant and will shape how we will continue to monitor mosquito populations and larviciding efforts in response to control *Culex pipiens* and as they were a major vector for WNV in 2013 in Ada County while in previous years, it was found to be *Culex tarsalis*, which is still a primary vector especially early on in the season.

When public service requests did come in a cluster in certain areas (or WNV was found), concentrated efforts with new surveillance trapping locations (flex sites) were coordinated to observe the problem and potential WNV presence areas. Many times these complaints were confirmed and more adulticiding efforts were concentrated in the area as well as the larvicider responsible in that area did an increased ground survey for mosquito development locations. One site was set additionally after a larvicide field technician found a dead bird and that very night there was WNV found in the mosquito pool. With the flex sites, we also located more areas of concern for nuisance and potential vector mosquitoes as well as 'hot spots' for WNV that were not confirmed before. Many of these sites will be made fixed locations in the next field season.

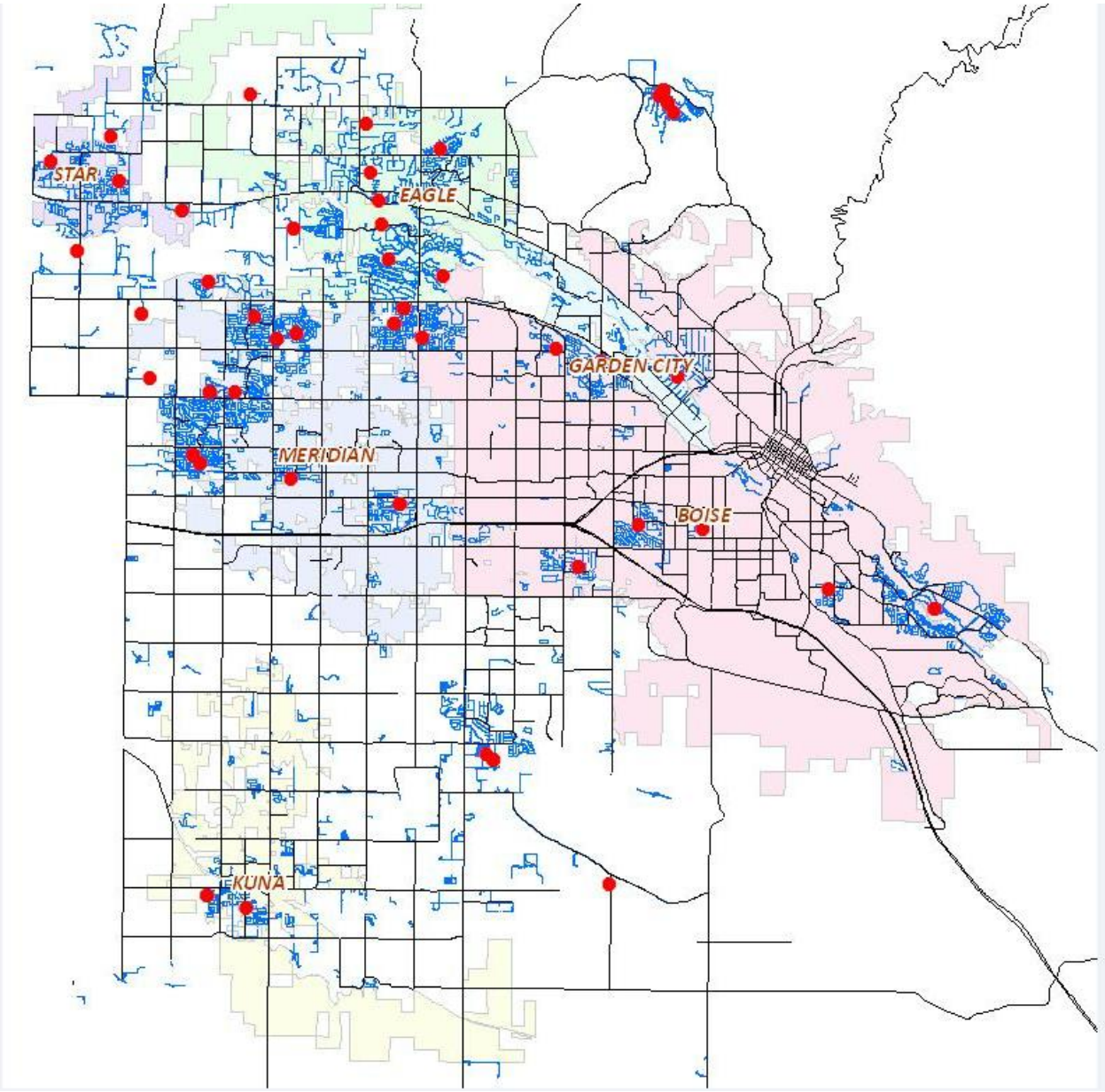
Other times the surveillance flex trap location resulted in no significant mosquito problems, thus allowing us to not treat some of those areas to reduce the impact to the environment, continue education to the public, and concentrate our efforts in more problem areas. Some reasons for these clustering effects of public service requests are homeowner association meetings directing homeowners to all call within the next day or two to week or two; another reason is that other nuisance insects are mistaken for mosquitoes (i.e. midges, flies); another is individuals' thresholds for nuisance mosquitoes, i.e. 1 mosquito flying or biting may be an issue to a single individual, while other individuals' thresholds are 5 or 20 mosquitoes present; another reason is due to use of the land by individuals or groups before or after an event, i.e. weddings, sporting events, entertainment events, etc. These are just some reasons we see clustering of public service requests that may be considered as non-threshold level abatement that we monitor and will continue to do so in future efforts.

Aerial application with an adulticide was made this year at night in late August in response to WNV positive pools in high human population areas. Immediately following the treatment and within the treatment flight zone there was a reduction of 87-95% of mosquitoes and no WNV for at least 2 weeks. While directly next to the

treatment area in a no fog zone post application night there was a positive pool. It would be important that in future years and considerations of areas for aerial application of adulticide that it is increased to potentially and historically known problematic areas of WNV and that the application is done sooner to stop the spread earlier than in late August. Ideally and based on previous years of historically known WNV years and counts and documented evidence of highest impact of aerial application in high WNV years that an application would be better in the first or second week of July.

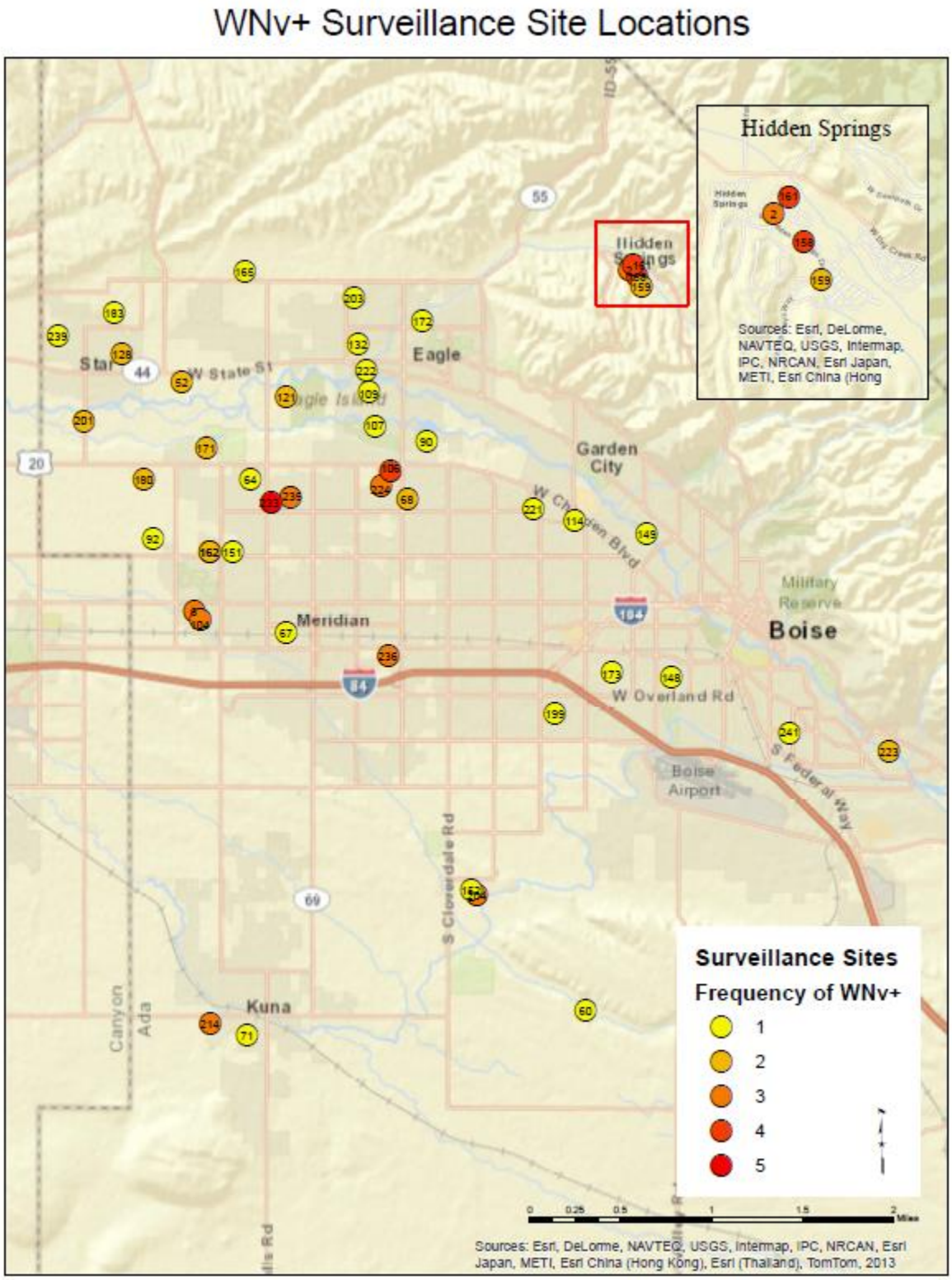
Appendix A

Map of surveillance locations with WNV and adulticide treatments in blue 2013.



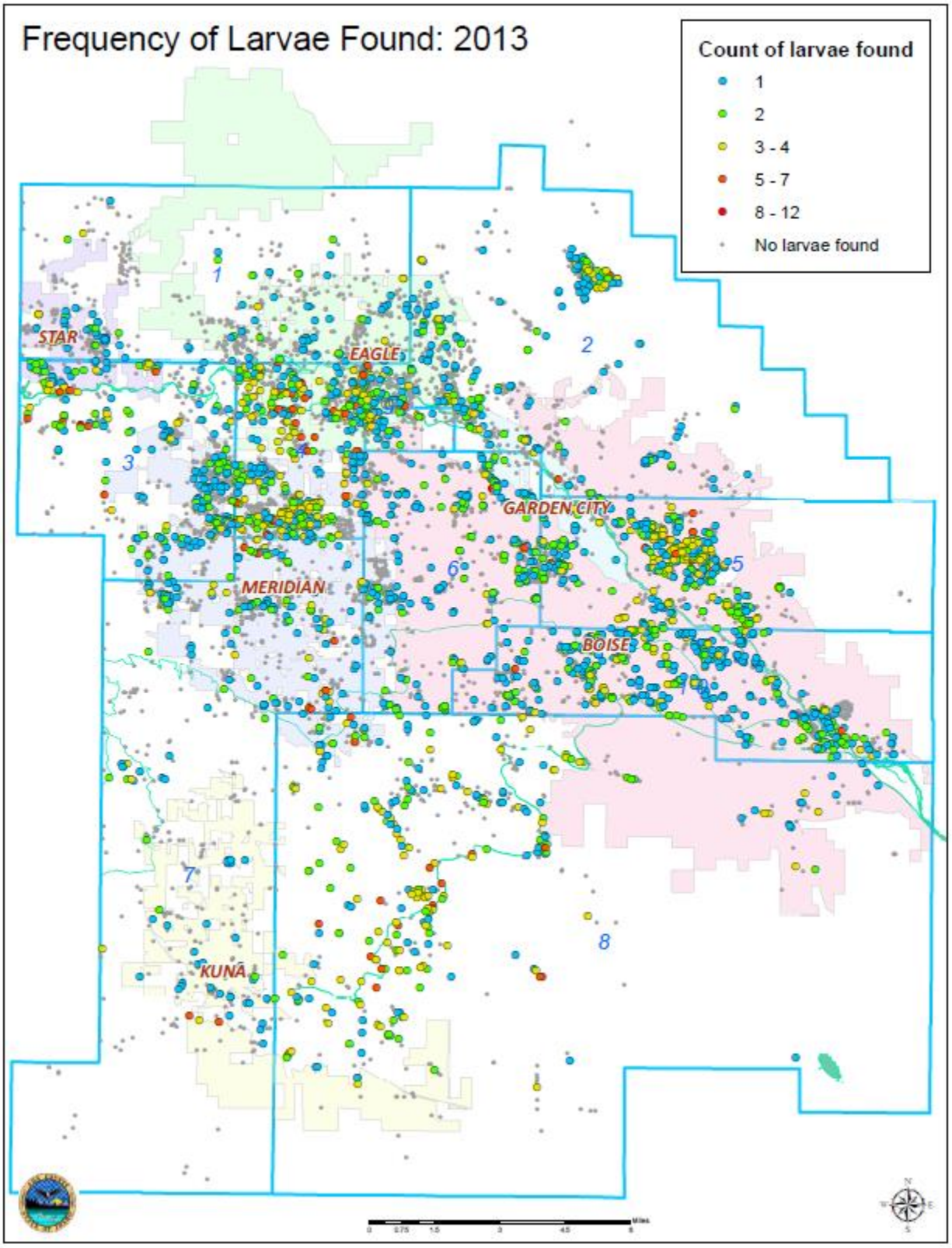
Appendix B

Frequency of WNV in surveillance trap locations in 2013



Appendix C

Map of larvicide site locations and frequency of larvae found throughout ACMAD in 2013.



Appendix D

Aerial Application Map in 2013