ADA COUNTY MOSQUITO ABATEMENT DISTRICT
COMPREHENSIVE PLAN
For
MANAGING MOSQUITOES
IN ADA COUNTY, IDAHO

Adopted: February 2009

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Prelude

Mosquito transmitted diseases have existed in the Americas since long before European settlement. Eastern Equine Encephalitis, Western Equine Encephalitis, and St. Louis Equine Encephalitis viruses are examples of such long-term threats. With the coming of the Europeans to the New World, additional diseases, such as malaria, dengue and yellow fever were added to the mix of vector-born diseases. Most people today are unaware that malaria extended throughout the United States and into southern Canada in the 1800's. Before the widespread use of motor vehicles, Equine Encephalitis viruses caused major epidemics in the horse population that resulted in substantial economic losses.

In recent years, a variety of new and exotic disease problems have been encountered. Vectors, such as mosquitoes, transmit many zoonoses, such as West Nile virus (WNv). WNv spread rapidly after its introduction to the United States, being first confirmed on the east coast in 1999 and distributing across the country to the west coast in only 5 years. Given increasing trends in globalization, travel and commerce, it is likely that other exotic diseases will be transported to and become established in the United States in the future.

The cost of vector-born disease prevention is normally less than the cost of control after an epidemic begins. Not only is emergency vector control expensive, but there is also the added cost to treat disease cases that might otherwise have been prevented. The average cost per patient hospitalized with WNv infection in Louisiana in 2002 was $51,826. Ada County had three cases of WNv paid for through indigent services in 2006, which cost tax payers over $150,000.00. The cost of WNv to the U. S. equine industry may be in the billions of dollars. These numbers fail to address the additional emotional cost to the families of victims of mosquito-transmitted disease, the changed quality of life of the victims and other similar issues. In addition to the impact on human and equine health, these viruses frequently have a major impact on wildlife, including threatened and endangered species. In 2002 alone, it is estimated that more than 2 million birds died from WNv infection in The United States.

The abrupt arrival of West Nile virus in Idaho demonstrates that mosquito control is an important public health function. The challenge that mosquito abatement districts face is to develop and maintain an effective vector control plan.

In Ada County, the original Mosquito Abatement District (MAD) was the Three-Mile Creek District. It was established in 1974 with the mission to control mosquitoes that are both a nuisance and a potential health threat. This first-generation district included 12 square miles between Cloverdale and Cole Roads on the west and east, and Franklin and Columbia Roads on the north and south. Over the next several decades there were numerous district annexations that expanded the boundaries and changed the name. In early 2004, the Ada County Board of County Commissioners agreed to incorporate and operate what was then called the Southwest Ada County Mosquito Abatement District. Today, the Ada County Mosquito Abatement District (ACMAD) includes 406 square miles of Ada County and encapsulates most major residential and urban centers (Figure 1).

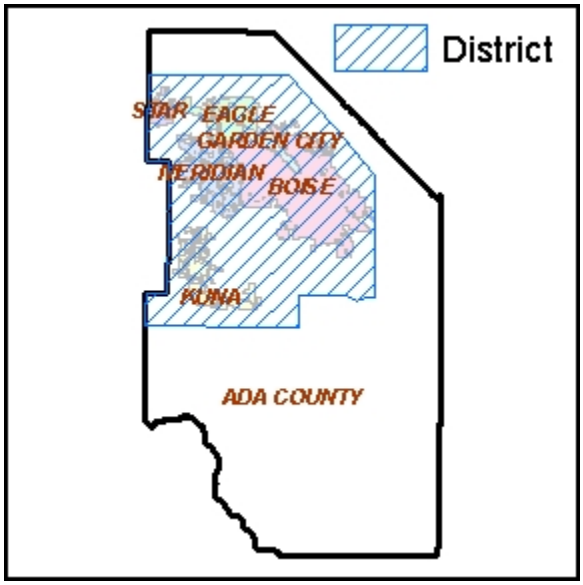

Figure 1 – The current Mosquito Abatement District boundary.

Statement of Purpose

The ACMAD Comprehensive Plan provides a framework for the structured implementation of a program to effectively control mosquitoes in Ada County. It also offers the public and other interested agencies and organizations a detailed look at our mosquito abatement strategies. Additionally, elements within this plan will help the department determine goals and objectives, prioritize activities, and isolate program areas that need restructuring. Finally, evaluation of this plan will help assure the appropriate and responsible usage of tax funds to provide an efficient and balanced program.

Activities described in this plan cover routine operating procedures. Idaho Code (Title 39 Chapter 28 Section 39-2808) provides for additional and cumulative remedies above routine procedures to prevent, abate and control the spread of mosquitoes and/or other vectors affecting the health, safety and welfare of Idahoans. Pursuant to Idaho Code (Title 46 Chapter 10), if all efforts by the district have not stopped an event posing a threat to the public, a government agency may initiate cooperative operations with other state or federal agencies by means of an "Emergency Declaration". This declaration gives the district access to additional resources and allows for more extensive efforts to maintain the health, safety, and welfare of our residents.

Introduction

Worldwide there are approximately 3,000 species and subspecies of mosquitoes. Of these, about 170 are found in North America and 51 in Idaho. These pests affect people's work recreational activities, impact our agricultural economy, and threaten citizens with diseases they may carry. Most of the 51 species of mosquitoes found in Idaho can be classified as ***unimportant*** in that they may be pests in certain ecological conditions, but are generally uncommon or rare. A few species are classified as ***less important*** as they may be disease vectors, but are only abundant under certain ecological conditions. Ada County Mosquito Abatement is most interested in species classified as ***important***, namely those that are abundant, widely distributed, serious pests or competent disease vectors.

The mission of ACMAD is to provide a healthy, mosquito-controlled environment for the citizens of the Mosquito Abatement District. Strategic priorities provide public safety, security and excellent health and public services. To reach this mission and achieve these goals, our agency utilizes an Integrated Pest Management (IPM) approach. IPM is a decision-making process that uses all available pest management strategies (education, cultural l, mechanical, biological, and chemical controls). Utilizing an IPM approach helps determine what combination of control strategies will reduce the mosquito populations to an acceptable level with the least impact to the environment.

- Education is the first and most successful management strategy in IPM. Mosquito control programs need the support of an informed public. When trained, residents can successfully recognize, treat, or remove potential breeding sites in their neighborhoods. By learning about the different types of mosquitoes, landowners are better prepared to understand the various control strategies and we can-work together more effectively. As we complement each other's activities, we maximize the mosquito abatement effort within the district.
- Cultural controls deal with changing a person's habits to reduce or avoid contact with mosquitoes. Examples are wearing long sleeves to avoid being bitten, or taking a walk at a different time when mosquitoes are less active.
- Mechanical controls involve physically changing land or structures to reduce breeding sites. Changing the water in a birdbath, or removing a shallow pond of standing water are examples of mechanical processes that eliminate breeding sites.

- Biological control consists of introductions of natural enemies of mosquitoes that kill the larvae or adults. *Bacillus thuringiensis israelensis*, or *Bti*, is a biological control used to kill mosquito larvae by disrupting their digestive system.
- Chemical controls are generally the last choice for mosquito abatement. Sometimes aerial control is necessary to effectively reduce flying mosquitoes from large geographical areas.

Mosquito Population Management

Of the fifty-one mosquito species found in Idaho, twelve have been identified in Ada County through surveillance activities. These twelve species are divided into two major types; pond and floodwater mosquitoes. The distinction between these two types of mosquito species is very important because the methods to monitor and control them are different. Likewise, control methods are also different for larval and adult stage mosquitoes.

Mosquito breeding sites are dynamic and in constant change. For example, in wet years more pond sites show up than in dry years. Land use changes can also alter the sites and types of mosquitoes present in an area. An example of this is the development of a subdivision from an agricultural field which may either remove the breeding site or create urban ponds. As such, sites are constantly being re-assessed, and field crews are always on the watch for newly created sites.

Life Stage Management Strategies

Larvaciding, or abatement of mosquitoes as larvae in bodies of water, is the first line of defense and is a major emphasis in our program. Larvicides, or the products used to control mosquitoes in the larval stage, may be either biological or chemical in nature, and are intended to either stunt the growth or kill mosquito larvae, thereby preventing their hatching or development into adults. Management of mosquito larvae is handled differently depending on the type of mosquito (pond or floodwater). This is discussed in more detail in the following sections.

Adulticiding, or the abatement of mosquitoes as flying adults, is an important control method in protecting public health, but is used only when conditions are warranted. Adulticiding can be conducted by air but most commonly is a ground based application of insecticide using an Ultra Low Volume (ULV) fogging machine mounted on a small truck. Floodwater Mosquito adults are the major thrust of the adulticiding program. These mosquitoes commonly hatch and mature simultaneously thus producing large numbers of nuisance mosquitoes. Most complaint calls for mosquitoes can be traced to this type of mosquito.

Chemical application occurs near dawn or dusk, when adult mosquitoes are most active and beneficial insects are inactive. Application areas are determined by complaint calls, requests from the larvicide crews during the day, and from surveillance information. In the event of an outbreak of a disease, such as happened in 2006 with West Nile virus, a contingency plan for aerial application of adulticides could be initiated to supplement ground applications.

Management of Larval Stage Pond Mosquitoes

Urban development and construction in Ada County is continuously changing land use removing some of our identified breeding sites and creating new sites. Our staff is regularly watching for new site locations and mapping them. Permanent pond sites are areas that fill and hold water after a rain or irrigation. Generally they permit multiple successive generations. Populations of this type of mosquito increase at a slower rate than the floodwater mosquitoes, resulting in fewer complaints about their biting. Since these sites are permanent to semi-permanent we can routinely monitor, trap, and control species at these sites and determine if WNv is present.

Field crews monitor pond sites in different areas of the county to determine the need for larvicide applications. If dipper samples find larvae present, the site is treated with chemical or

biological controls. The applicator that performs the inspection determines what the best treatment practice should be and makes the appropriate applications. All inspection and treatment information is recorded digitally and stored in centralized databases. Each breeding site in the county is issued a 'Next Survey Date', which is determined by the length of time the applied treatment will be effective on the mosquito larvae found in the pond.

Important pond mosquitoes in Ada County are *Anopheles freeborni*, *Coquillettidia perturbans*, *Culiseta inornata*, *Culex pipiens*, and *Culex tarsalis*. Most pond mosquitoes lay raft-like egg masses; the exception is the genus *Anopheles*, which lays eggs singly, directly on the water's surface. Pond mosquitoes typically overwinter as adults in dark sheltered areas such as animal burrows, man-made shelters, basements, etc. When they begin flying in the spring, they lay their eggs and when conditions are ideal eggs can develop into adults in 7-14 days.

Pond mosquito breeding sites are variable. Pond mosquitoes generally lay a single brood, but are more commonly known to be multi-brooded (meaning they can lay several egg raft masses throughout their life cycle). Some species stay very close, within 1 mile, of their breeding site, while others will travel great distances (*Culex tarsalis* have been found to travel up to 15 miles from a breeding source). Pond mosquito populations usually start small and then increase over the mosquito season. They are usually most active between dusk and dawn, at the same time that human populations are more active during the summer months. Some pond mosquito species have the potential to carry diseases, such as malaria and West Nile virus. Due to this, we are particularly concerned with the control of pond mosquitoes and a large program focus is placed on larvaciding and surveillance in these areas.

Management of Larval Stage Floodwater Mosquitoes

Floodwater mosquitoes typically hatch as a result of flooding. For example, snowmelt, irrigation of pastures or residential yards, etc. Fields and pastures usually have numerous depressions that can breed floodwater mosquitoes. These areas are not mapped or monitored as they are too difficult to specifically locate. Unlike the pond mosquitoes, floodwater mosquito's reproduce only when a flood event occurs, either naturally or artificially through irrigation.

Mosquito traps can be set in flood mosquito areas, but may not catch any mosquitoes until flooding occurs. Typically, floodwater mosquitoes are not treated with larvacides because of the large number of very small sites over vast areas. Large areas require large amounts of product and are cost prohibitive

Important flood water species found in Ada County are *Aedes vexans*, *Ochlerotatus dorsalis*, *Ochlerotatus nigromaculis*, *Ochlerotatus sticticus*, *Ochlerotatus flavescens*, *Ochlerotatus increpitus*, and *Ochlerotatus sierrensis*. Flood water mosquitoes typically lay eggs singly on damp soil above the water level. These mosquitoes can overwinter as eggs, and when flooding occurs and the temperatures are warm, they can hatch within minutes or days. A floodwater mosquito egg can survive for years, (*Aedes vexans* eggs can survive up to 3 years) until a flood event occurs.

Flood water mosquitoes may deposit eggs once, or multiple times through their life cycle, and have been known to migrate large distances. They are usually active during the day, swarming in the shade, and from dusk into the early evening. These species are known to be vicious biters and swarms of certain species (such as *Ochlerotatus nigromaculis*) can make human activities come to a standstill.

Trapping and Surveillance

The abrupt introduction of West Nile virus to Idaho in 2006 necessitated an emergency declaration for public health reasons, and demonstrated the importance of having a mosquito surveillance program in place. An effective program will aid in predicting emergency situations, allowing an opportunity for vector management to intercede before a situation becomes critical. The

ACMAD routinely uses Center for Disease Control and Prevention (CDC) traps baited with carbon dioxide to monitor mosquito numbers and species. Historically, up to twenty trapping sites had been utilized across Ada County. Once per week, a trap is set at each location in the evening (Monday through Thursday) between the hours of 7 and 11 pm. The next morning, all set traps are collected between the hours of 5 and 9 am. The contents of each trap are sorted, and all mosquitoes collected are counted by species (Figure 2). These data are entered into a database and compared with historical records to provide the context of the current mosquito season and to help plan necessary control efforts. The mosquito species that are competent vectors for disease (in the case of WNv this would include *Culex spp*.) are sorted and separated into pools containing 50 mosquitoes or less. These mosquito pools are tested for WNv using Rapid Analyte Measurement Platform (RAMP) equipment at ACMAD. Sample results exceeding state defined thresholds are automatically considered WNv Positive. If a sample returns a value less than the states defined threshold, they are considered 'temporarily positive for WNv' and are sent to the Idaho Bureau of Laboratories for more in depth disease sampling and final confirmation.

These surveillance practices were designed as proactive measures to locate areas of disease concentration. Additionally, an ecologist was added to the ACMAD staff in 2007 to help facilitate the surveillance process. In 2007, the number of trap sites was increased to 40, setting and picking up 10 traps per night (Monday – Thursday). These changes increased the amount of information available to help determine and address problems before they reach endemic proportions. Expanded trapping resulted in the discovery of a new mosquito species, *Ochlerotatus sierrensis*; which had not previously been identified in Ada County. The greatest advantage of these changes has resulted in a more effective adulticiding program which enables ACMAD to determine when to apply what product and intensify our control efforts when required. Increased data also provides a clearer understanding of when large scale aerial applications are necessary.

In 2009 we will increase our trap numbers to 50 traps per week (10 traps per night; Sunday evening through Thursday), allowing for analysis Monday through Friday. Currently, the traps are located where there are higher populations of *Culex* species. The purpose of the 10 new trap locations is to not only increase *Culex* species observations, but increase the surveillance of developing floodwater mosquito populations in areas where floodwater mosquitoes are known to be prevalent.

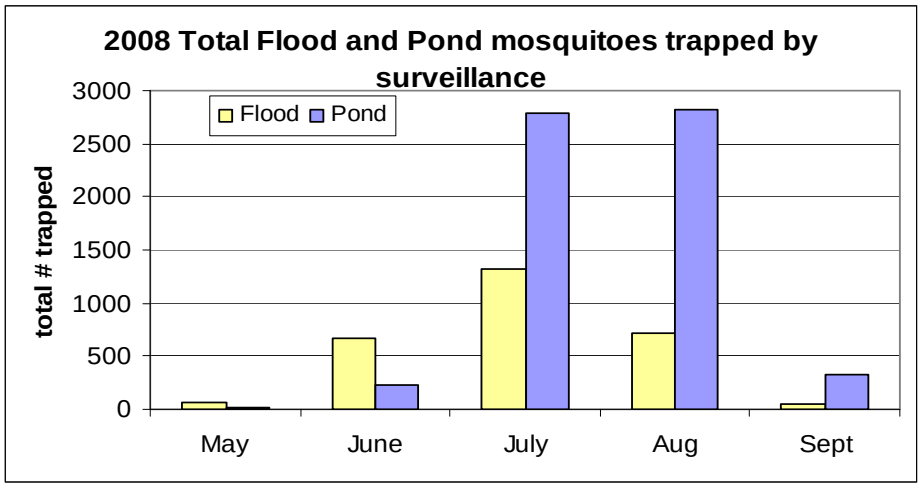

Figure 2 – Summary of mosquito trapping efforts in 2008

Mapping and Monitoring

ACMAD maintains a Geographic Information System (GIS) that contains a digital inventory of all known pond breeding sites. When sites are found they are mapped using Global Positioning Systems (GPS) technology. Office digital processes automatically manage site inspection requirements (determined by NSD) and applicator area assignments. Maps and reports can be printed on the fly for field crews or team leaders as needed, and field crews have current digital maps on PDAs with them in the field at all times.

Acknowledgements

Information on mosquito species and their biology was compiled from the following text and is used with the permission of Donald R. Brothers, author of "Mosquitoes of Idaho: An Introductory Guide to Understanding Them, Their Importance, and the Control Process." This publication is available in Ada County libraries or on the Internet at www.idahoparks.org/assets/contents/docs/Mosquitoes_of_Idaho.pdf.