

# The Truth About Mosquitoes and West Nile virus

While communities have good intentions, many existing policies and programs may be dangerous to children and inadequate by relying too heavily on spraying pesticides to kill adult mosquitoes.

## Not All Mosquitoes Carry West Nile virus

- There are 150 different species of mosquitoes in the U.S. and only a small fraction of those actually transmit disease.
- Mosquitoes go through four stages in their life cycles – egg, larva, pupa, and adult. The complete cycle can take as little as four days or as long as one month, depending on the temperature.
- Only adult female mosquitoes bite animals and require blood meals; males feed on the nectar of flowers.
- West Nile virus (WNV) and St. Louis encephalitis are primarily associated with the *Culex* mosquitoes.<sup>1</sup>
- Adult *Culex* females live between 2-4 weeks or more, depending on climate, species, predation, and a host of other factors. *Culex* mosquitoes are generally weak fliers and do not move far from their larval habitat, although they have been known to fly up to two miles.<sup>2</sup>
- Mosquitoes are most active at 80°F, become lethargic at 60°F, and cannot function below 50°F.<sup>3</sup>

## The Real Threat Of West Nile virus

- Less than one percent of those infected with WNV will develop severe illness, according to the Centers for Disease Control.
- A 2000 analysis of the West Nile outbreak published in the *New England Journal of Medicine* found that risk for severe illness was most closely correlated with increasing age. In the U.S., people older than 50 years and those with weakened immune systems have the highest risk of severe encephalitis.
- Brian Rogers, D.O., MPH, City of Fort Worth Health Authority states "The risk of becoming seriously ill and dying from West Nile is extremely minimal. Fewer than 1 percent of mosquitoes in areas where the virus has been found actually carry the virus."
- According to the Centers for Disease Control, West Nile virus infected .0017% of Mississippi's population, one of the hardest hit states in 2002, and only .008% in the hardest hit county.<sup>4</sup>
- The U.S. Fish and Wildlife Services states, "Contrary to media descriptions of 'the deadly West Nile virus,' [it] is rarely fatal in humans. Less than one percent of people who acquire the disease will experience severe illness. Within this small proportion, the fatality rate is about 3-15%."
- Most people that become infected will have mild symptoms that include fever, head and body aches, skin rash and swollen lymph glands. It may take 3 to 15 days for any of these symptoms to show.
- A person who has been infected with WNV is likely to have life-long immunity to the disease whether or not they showed symptoms.<sup>5</sup>

## Pesticide Spray Programs Are Ineffective

- The Centers of Disease Control and Prevention (CDC) state that spraying adulticides, pesticides intended to kill adult mosquitoes, is usually the least efficient mosquito control technique.<sup>6</sup>
- Adulticiding programs spray pesticides indiscriminately and do not get at the mosquitoes until they have matured and are biting.
- Adulticides do not restrict or control mosquitoes from continue to breed.
- Mosquitoes develop resistance to chemical pesticides over time, which render the chemicals ineffective and have an increased prevalence of the virus within their bodies.<sup>7</sup>
- A 2003 study finds that mosquitoes carrying West Nile virus and malaria are resistant to organophosphate and carbamate insecticides. The study shows that the resistance is a result of a single genetic mutation.<sup>8</sup>
- According to David Pimentel, Ph.D., an entomologist at Cornell University, close to 99.9 % of sprayed chemicals go off into the environment where they can have detrimental effects on public health and ecosystems, leaving 0.10% to actually hit the target pest.<sup>9</sup>
- Ray Parsons, Ph.D., a medical entomologist and assistant director for the Houston, Texas Mosquito Control Division says it is difficult to determine the effectiveness of pesticide spraying because there are currently no accurate means of measuring *Culex* mosquito populations.<sup>10</sup> Therefore, scientists cannot accurately determine what percentage of the population has decreased after spraying.

## Pesticide Spray Programs Affect Public Health and the Environment

- The U.S. EPA warns that “no pesticide is 100 percent safe.”<sup>11</sup>
- A study conducted by the National Research Council found that pregnant women, infants, and children have a greater risk of getting sick from pesticides.<sup>12</sup>
- According to the New York State Department of Health, more people were reported to have gotten sick from pesticide spraying than from exposure to WNV in 2000.<sup>16</sup>
- Adulticides present considerable risk to all living things, and kill beneficial insects and natural mosquitoes predators,<sup>17</sup> such as dragonflies, damselflies, and beetles, potentially increasing the number of mosquitoes.
- Additionally, mosquitoes that survive the spraying may become resistant, longer-lived, more aggressive, and have an increased prevalence of the virus within their bodies.<sup>18</sup>
- Brian Rogers, D.O., MPH, City of Fort Worth Health Authority states that Fort Worth has a high rate of Asthma Chronic Obstructive Pulmonary Disease and other respiratory disorders and therefore believes that “Spraying for mosquitoes would harm more people than it would help.”
- New York State Department of Health, during or after a widespread aerial or ground spraying of adulticides, states that adverse health outcomes might include acute asthma attacks, other respiratory problems, and/or dermatological problems.<sup>19</sup>
- Synthetic pyrethroids, used widely across the country for mosquito control, are neurotoxic and have been linked to cancer. Children with respiratory problems, such as asthma, are particularly vulnerable to these pesticides and will suffer disproportionately from exposure.
- On June 26, 2001, *The Post Star* reported that 37 young ball players and spectators at a softball game in upstate New York were sent to the hospital after being poisoned by a pesticide being sprayed behind the ballfield to control mosquitoes that could be carrying the West Nile virus. According to Moreau Emergency Squad Captain Andre Delvaux, the Tree Care by Stan Hunt Company was applying Fyfanon ULV, a pesticide containing the organophosphate malathion, near the baseball field while a game was in progress.
- A recent study by Duke University researchers found that combined exposure to DEET (N,N-diethyl-m-toluamide) and permethrin could lead to motor deficits and learning and memory dysfunction.<sup>20</sup>
- In 1998, EPA rejected “child safety” claims for DEET products and requires all to be removed from existing products.<sup>21</sup>
- DEET is quickly absorbed through the skin and has caused effects ranging from large blisters to brain damage in children, with three deaths in the last 40 years tied to exposure.

**Synthetic pyrethroids**, which include **resmethrin (Scourge)** and **sumithrin (Anvil)**, are adulticides patterned after pyrethrum, yet have been chemically engineered to have greater toxicity and longer breakdown times.<sup>13</sup> Additionally, almost all synthetic pyrethroid mosquito products are combined with synergists, which increase potency and compromise the human body's ability to detoxify the pesticide.

**Symptoms of exposure** include: dermatitis and asthma-like reactions, nasal stuffiness, headache, nausea, incoordination, tremors, convulsions, facial flushing and swelling, and burning and itching sensations.<sup>14</sup> Synthetic pyrethroids are endocrine disruptors and have been linked to breast cancer.<sup>15</sup> Deaths due to exposure have resulted from respiratory failure. People with asthma and pollen allergies should be especially cautious. Breakdown times range from a few hours in direct sunlight, to several months in damp, dark environments.

**Organophosphates**, which include **malathion (Fyfanon)**, **naled (Dibrom)** and **chlorpyrifos (Mosquitomist)**, are a highly toxic class of pesticides that affect the central nervous, cardiovascular and respiratory systems. **Symptoms of exposure** include: numbness, tingling sensations, headache, dizziness, tremors, nausea, abdominal cramps, sweating, incoordination, blurred vision,<sup>22</sup> difficulty breathing, slow heartbeat, unconsciousness, incontinence, convulsions and fatality.<sup>23</sup> Some organophosphates have been linked to birth defects and cancer. Breakdown times range from a few days in direct sunlight, to several months in damp, dark environments.

### Safer Mosquito Management Strategies

- The first step in managing mosquitoes should be to remove any and all potential breeding areas – anyplace that water collects and is slow moving or standing water.
- If mosquitoes do breed, larviciding (killing mosquitoes in their larvae stage) allows control measures to be used in targeted areas, while mosquito larvae are still concentrated in breeding pools and before adult mosquitoes spread throughout the community.
- Use herbal repellents that contain cedarwood, garlic, lemongrass, frankincense, cinnamon, geranium, eucalyptus, basil, rosemary, cloves, peppermint, lemon balm (citronella), onions, feverfew, thyme, neem oil, and/or merigold.
- Prevent mosquito populations by maintaining window screens and keeping doors closed; removing or regularly draining all water-retaining objects such as tin cans, buckets, holes in trees, clogged gutters and down spouts, old tires, birdbaths, trash can lids and shallow fishless ponds. Stock permanent water pools, such as ornamental ponds with mosquito larvae eating fish. Fix dripping outside water faucets. Enhance the drainage of flood canals, irrigation ditches and fields; keep street gutters and catch basins free of debris and flowing properly.
- Monitoring includes checking ponds and sources of water for signs of mosquito larvae.
- *Bacillus thuringiensis var. israelensis* is one of the most popular and most effective least hazardous biological controls. It is a bacterial strain that, when sprayed into larval pools, is ingested by feeding larvae and kills them. (Mosquito Dunks™ can be bought at local lawn and garden stores or on-line at [www.realgoods.com](http://www.realgoods.com) or [www.groworganic.com](http://www.groworganic.com). The dunks are safer for birdbaths, rain barrels, ponds, ditches, tree holes, roof gutters, etc. – anywhere water collects.)
- The Mosquito Magnet, a machine much like a gas grill, burns propane gas that sends out a plume of carbon dioxide, which attracts mosquitoes that are then sucked in and killed. One magnet can control adult mosquitoes over an acre of land, though different levels of success have been reported. (See [www.mosquitomagnet.com](http://www.mosquitomagnet.com) or call American Biophysics Corp at 877-699-8727.)
- Vegetable based horticultural oils are effective in killing larvae in water and sinking egg rafts on the surface. They also can kill non-target organisms including some mosquito predators that breathe from the surface.

### Communities That Have Adopted Safer Mosquito and WNV Management Programs

- The City of **Lyndhurst, Ohio**, a suburb of Cleveland, passed a landmark ordinance on July 7, 2003 prohibiting the spraying of pesticides "in an effort to help control the spread of the West Nile virus." The City's action follows a community forum in which a panel of experts discussed the hazards and the lack of efficacy associated with the spraying of adulticides. The City Council stated, "[T]here is substantial belief that the more effective way of controlling the mosquito population is by larvicide treatment and thorough education of the City's residents regarding methods and procedures to minimize exposure to the virus." In adopting the ordinance, the Council found that "the risk/benefit analysis conducted by experts clearly indicates that the dangers of WNV are minimal and affect a very small segment of the population and that the long-term health and environmental risks of spraying with synthetic pesticides poses a much greater risk."<sup>24</sup> (A copy of the policy can be found at [www.beyondpesticides.org/mosquito](http://www.beyondpesticides.org/mosquito).)
- In **York County, Virginia**, officials are distributing fish that eat mosquito larvae and pupae to residents in order to decrease pesticides used for mosquito control, according to *The Virginia Gazette*. Several thousand of these fish, *Gambusia holbrooki*, or mosquito fish, have been bred by the county's fishery as part of its mosquito prevention program. So far, county officials have provided 50 to 60 fish to residents and stocked retention ponds and other areas with standing water large enough for the fish to survive. In order to control mosquitoes that breed in small containers such as birdbaths, old tires, and buckets, local officials are sending out an information card to all its residents on the necessity of preventing mosquito breeding grounds.
- In **Dallas, Texas**, the City Council's Health, Environment and Human Services Committee adopted a mosquito control plan in 2003, which calls for more public education and allows the use of pesticide sprays as a last resort and on the approval of the council members, according to the *Dallas Morning News*. Preventing mosquito breeding grounds and killing mosquito larvae with natural bacterium, *Bacillus thuringiensis*, is the heart of the new plan. A West Nile virus infected bird, mosquito, or horse is not a trigger to spray pesticides, but a trigger to increase outreach to community residents. The policy also establishes a city fine of up to \$2,000 for any property owner who ignores stagnant water.

- **Washington, DC** health officials continue their no spray policy stating that pesticide spraying is inappropriate in a heavily populated area with many asthma patients according to a Washington Post article. Instead, officials are focusing on prevention through larviciding and public education.
- According to the **Ft. Worth, Texas** Department of Public Health, city officials there have not sprayed for mosquitoes since 1991. Health officials say there are many reasons including the questionable effectiveness of insecticides and the negative impacts they pose to the environment. Brian Boerner, director of Environmental Management, states that, "the spraying of chemicals also has the potential of contaminating our waterways, killing the beneficial fish and organisms that feed on mosquito larva, adding harmful volatile organic chemicals to the atmosphere-a precursor chemical to ozone formation- and providing a potential inhalation or ingestion hazard to residents who are in affected areas shortly after spraying occurs."
- In February 2003, **Seattle, Washington** adopted an Integrated Pest Management Plan for Mosquito Control, which outlines the City's general approach to managing the risks to human health and the environment from mosquito-borne diseases and mosquito control options. According to the plan, "The premise of the plan is that the most effective and appropriate techniques for the City to use to manage these risks are to reduce mosquito bites by providing education and personal protection advice to City employees and to reduce mosquito breeding habitat on City property. When determined appropriate, the City will consider using larvicides to control mosquitoes on City-owned property."
- **Nassau County, New York** uses predacious fish in salt-water marshes throughout the county.<sup>25</sup>

<sup>1</sup> Centers for Disease Control and Prevention, Division of Vector-Borne Infectious Diseases. West Nile Virus: Entomology. <http://www.cdc.gov/ncidod/dvbid/westnile/insects.htm>; CDC Answers Your Questions About St. Louis Encephalitis. [http://www.cdc.gov/ncidod/dvbid/arbors/SLE\\_QA.htm](http://www.cdc.gov/ncidod/dvbid/arbors/SLE_QA.htm).

<sup>2</sup> Floore, T. 2000. Mosquito Information. The American Mosquito Control Association.

<sup>3</sup> Rutgers Entomology. 2001. FAQ's on Mosquitoes. <http://www.rci.rutgers.edu/~insects/mosfaq.htm>.

<sup>4</sup> Centers for Disease Control. 2002. Morbidity and Mortality Weekly Report, West Nile Virus Activity – United States, August 8-14 and Mississippi, July 1- August 14, 2002. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5132a4.htm>.

<sup>5</sup> West Nile Virus Questions and Answers on Survey. New York City Department of Health. March 21, 2000.

<sup>6</sup> Centers for Disease Control and Prevention. 2001. Epidemic/Epizootic West Nile Virus in the United States: Revised Guidelines for Surveillance, Prevention, and Control. Atlanta, GA. <http://www.cdc.gov/ncidod/dvbid/westnile/resources/wnv-guidelines-apr-2001.pdf>.

<sup>7</sup> Sugg, W. et al. 2001. *Overkill: Why Pesticide Spraying May Cause More Harm Than Good*. Toxics Action Center. West Hartford, CT.

<sup>8</sup> Weill, M., et al. 2003. "Insecticide Resistance in Mosquito Vectors." *Nature* 423(6936): 136-137.

<sup>9</sup> Pimentel, D. 1995. "Amounts of Pesticides Reaching Target Pests: Environmental Impacts and Ethics." *Journal of Agricultural and Environmental Ethics* 8(1):17-29.

<sup>10</sup> Parsons, R. 2001. Assistant Director for Mosquito Control, Harris County Mosquito Control Division. Telephone interview. September.

<sup>11</sup> U.S. EPA. 2000. Questions and Answers: Pesticides and Mosquito Control. Department of Prevention, Pesticides and Toxic Substances.

<sup>12</sup> National Research Council. 1993. Pesticides in the Diets of Infants and Children. National Academy Press. Washington, DC.

<sup>13</sup> Gooselin, R. 1984. Clinical Toxicology of Commercial Products. Williams and Wilkins. Baltimore, MD.

<sup>14</sup> Extension Toxicology Network. 1994. "Pyrethroids." Pesticide Information Profiles. U.S. EPA and Oregon State University. <http://ace.orst.edu/cgi-bin/mfs/01/pips/pyrethi.htm>.

<sup>15</sup> Vera Go, J., et al. 1999. "Estrogenic Potential of Certain Pyrethroid Compounds in the MCF-7 Human Breast Carcinoma Cell Line." *Environmental Health Perspectives* 107(3).

<sup>16</sup> New York City Health Information. 2001. West Nile Virus Surveillance and Control: An Update for Health Care Providers in New York City. New York City Department of Health 20(2). <http://www.nyc.gov/html/doh/pdf/chi/chi20-2.pdf>.

<sup>17</sup> Howard, J. et al. 1997. "Impact of Naled (Dibrom 14) on the Mosquito Vectors of Eastern Equine Encephalitis Virus." *Journal of the American Mosquito Control Association* 13(4): 315-325.

<sup>18</sup> Sugg, W., et al. 2001. *Overkill: Why Pesticide Spraying May Cause More Harm than Good*. Toxics Action Center. West Hartford, CT.

<sup>19</sup> New York State Department of Health. West Nile Virus Response Plan, Appendix B Surveillance of Possible Health Effects from Pesticide Exposure. May 2000.

<sup>20</sup> Abou-Donia, M., et al. 2001. "Subchronic Dermal Application of N,N-Diethyl m-Toluamide (DEET) and Permethrin to Adult Rats, Alone or in Combination, Causes Diffuse Neuronal Cell Death and Cytoskeletal Abnormalities in the Cerebral cortex and the Hippocampus, and Purkinje Neuron Loss in the Cerebellum." *Experimental Neurology* 172:153-171.

<sup>21</sup> U.S. EPA. 1998. Reregistration Eligibility Document Facts: DEET. Office of Prevention, Pesticides and Toxic Substances. EPA-738-F95-010. April.

<sup>22</sup> Extension Toxicology Network. 1994. "Malathion." Pesticide Information Profiles. U.S. EPA and Oregon State University. <http://ace.orst.edu/cgi-bin/mfs/01/pips/malathio.htm>.

<sup>23</sup> U.S. EPA. 1999. Recognition and Management of Pesticide Poisonings. 5<sup>th</sup> edition. Office of Prevention, Pesticides, and Toxic Substances.

<sup>24</sup> Beyond Pesticides. 2003. "Ohio City Adopts Landmark Law to Stop Pesticide Spraying for West Nile Virus." *Daily News*. Washington, DC. July 14.

<sup>25</sup> Turrillion, G. 2002. Director of Mosquito Control Program in Nassau County, NY. Personal Communication. March.