



BEYOND PESTICIDES

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The Truth About Mosquitoes, Pesticides and West Nile virus **A Beyond Pesticides Factsheet**

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

NOT ALL MOSQUITOES CARRY WEST NILE VIRUS

- There are 175 different species of mosquitoes in the U.S. and only a handful of those are vectors for disease. Only adult female mosquitoes bite and require blood meals; males feed on flower nectar.
- 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.
- West Nile virus (WNV) and St. Louis encephalitis are primarily associated with the *Culex* mosquitoes.¹
- Adult *Culex* females live between 2-4 weeks, 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.² High bite rates usually indicate breeding areas are nearby.
- Mosquitoes are most active at 80°F, become lethargic at 60°F, and cannot function below 50°F.³

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. The vast majority of people (about 80%) who become infected with WNV will show no symptoms and never become sick. Some 20% may experience mild flu-like symptoms within 3 - 15 days.⁴
- 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.”⁵
- 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%.”⁶
- Risk for severe illness is most closely correlated with increasing age and a weakened immune system. From 2001 to 2003 there was a drop in the average age of WNV cases (which include flu-like symptoms), however the median age of fatal cases has not dropped. The rise in cases in younger people is probably due to the heightened detection of milder WNV cases.^{7,8}
- A person who has been infected with WNV may have life-long immunity even if they show no symptoms.⁹

PESTICIDE SPRAY PROGRAMS ARE INEFFECTIVE

- According to the Centers of Disease Control and Prevention (CDC), spraying adulticides, pesticides intended to kill adult mosquitoes, is usually the least efficient mosquito control technique.¹⁰
- Adulticiding programs spray pesticides indiscriminately and do not get at the mosquitoes until they have matured. They also do not restrict, control, or prevent mosquitoes from carrying WNV or continuing to breed.
- 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.¹¹
- Mosquitoes develop resistance to pesticides over time, rendering the chemicals ineffective. A 2003 study finds that mosquitoes carrying West Nile virus and malaria developed resistance to organophosphate and carbamate insecticides as a result of a single genetic mutation.¹²
- After Hurricane Floyd caused a surge in mosquito populations in Florida, state officials took bite counts before and after widespread aerial spraying and found that mosquito populations surged back to pre-spray levels within three days of the treatment.¹³
- Programs usually measure post-spray mosquito populations within 3-5 days. Most do not retest the area to detect the resurgence in populations to pre-spray levels after 7 or more days.
- Residences experiencing high mosquito bite rates typically find mosquitoes breeding on their property.

ADULTICIDING IS NOT SHOWN TO REDUCE WNV INCIDENCE

- In 2003 the city of Boulder, CO did not adulticide and showed an 80% reduction in mosquito populations and lower rates of serious illness per population than surrounding cities where adulticiding took place.¹⁴
- Despite high mosquito counts and large percentages of infected birds, Shaker Heights, Ohio refused to adulticide like its neighboring cities in Cuyahoga County. 2002 results showed the county had 219 cases of WNV with only 2 cases occurring in Shaker Heights.¹⁵

- The counties of Goshen and Plate, WY rely heavily on adulticides and in 2003 counted 80 WNV cases, 8 fatalities and 77 cases, 3 fatalities, respectively. Their neighbor Cheyenne, with 2 times the population and 3 times the landmass, used only larvicides and had 20 cases of WNV and 1 fatality.¹⁶

PESTICIDE SPRAY PROGRAMS AFFECT PUBLIC HEALTH AND THE ENVIRONMENT

- The U.S. EPA warns, “no pesticide is 100 percent safe.”²¹
- National Research Council found that pregnant women and children have a greater risk of getting sick from pesticides.²²
- In NYC in 2000 more people were reported to have gotten sick from pesticide exposure from spraying than from WNV.²³
- Adulticides kill beneficial insects and natural mosquito predators, such as dragonflies, damselflies, and beetles, potentially increasing local populations of mosquitoes.²⁴
- Mosquitoes that survive pesticide sprays may become resistant, longer-lived, more aggressive, and have an increased prevalence of the virus within their bodies.²⁵
- Brian Rogers, Ft. Worth Health Authority states that, “Spraying for mosquitoes would harm more people than it would help.”²⁵
- New York State Department of Health states that adverse outcomes during or after an aerial or ground spraying of adulticides might include acute asthma attacks, other respiratory problems, and/or dermatological problems.²⁶
- Synthetic pyrethroids are neurotoxic and have been linked to cancer. People (particularly children) with respiratory problems, such as asthma, are especially vulnerable to these pesticides and will suffer disproportionately from exposure.
- Washington, DC cites both lack of efficacy and asthma concerns among reasons for its no-spray policy.²⁷
- In 1999, malathion spraying was found responsible for the death of over 2,000 fish on Staten Island.²⁸
- On June 26, 2001, *The Post Star* reported that 37 young ball players and spectators at a softball game in upstate New York were hospitalized after being poisoned. According to Moreau Emergency Squad Captain Andre Delvaux, a pesticide containing the organophosphate malathion, was being sprayed to control potential WNV carrying mosquitoes near the baseball field while a game was in progress.
- Studies published in 2001 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.²⁹
- In 1998, EPA rejected “child safety” claims for DEET products and required all such claims to be removed from existing products.³⁰
- On June 3, 2001 the Associated Press reported that in New York more than 50% of dead crows collected in response to West Nile virus died from exposure to pesticides and lead, rather than from West Nile virus.³¹
- In 2000, five spray operators filed a complaint against New York City claiming they became sick due to improper training and prolonged exposure while spraying adulticides.³²
- A 1999 Mount Sinai School of Medicine study examined four pyrethroid pesticides, including sumithrin, and concluded, “[E]ach pyrethroid compound is unique in its ability to influence several cellular pathways. These findings suggest that pyrethroids should be considered to be hormone disruptors, and their potential to affect endocrine function in humans and wildlife should be investigated.”³³
- Commercial fishermen in Maine filed a \$125 million lawsuit claiming that the dramatic decrease in the lobster harvest was due to the spraying of an adulticide containing malathion.³⁴
- Reports of inappropriate and/or illegal spraying practices are common. Children are known to follow spray trucks for entertainment. Other practices include fogging during daylight hours, during wind speeds higher than 10 mph, and in no-spray zones. Proper integrated pest management is often ignored.³⁵

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.¹⁷ Almost all synthetic pyrethroid mosquito products use synergists like piperonyl butoxide (PBO), a petroleum distillate, which increases potency and compromises the body's ability to detoxify the pesticide. Petroleum distillates are carcinogenic and linked to birth defects and other illnesses. Animal studies have shown children to be more sensitive than adults and that exposure may inhibit neonatal brain development.¹⁸ Pyrethroids are highly toxic to fish and honey bees, even in low doses.

Symptoms of exposure include: dermatitis and asthma-like reactions, eye and skin irritation and flu-like symptoms.¹⁹ Synthetic pyrethroids are endocrine disruptors and have been linked to breast and prostate cancer.²⁰ People with asthma and pollen allergies should be especially cautious. Exposure has resulted in deaths from respiratory failure. Breakdown times range from a few hours to several months.

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,³⁶ difficulty breathing, slow heartbeat, unconsciousness, incontinence, convulsions and fatality.³⁷ Some organophosphates have been linked to birth defects and cancer. Breakdown times range from a few days to several months, depending on conditions.

SAFE & EFFECTIVE MOSQUITO MANAGEMENT STRATEGIES

- The first step in managing mosquitoes is personal protection and source reduction. Use natural-based repellents and wear long-sleeves and pants if outside during dawn and dusk to avoid getting bitten
- Remove all potential breeding areas – any place with standing or slow-moving water. Remove, puncture or regularly drain 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. Fix dripping outside water faucets and sprinklers. Monitor ponds and sources of water regularly for signs of mosquito larvae.
- Maintain window and door screens, and keep closed around dawn and dusk when mosquitoes are most active.
- Stock permanent water pools or ponds with fish that eat mosquito larvae and pupae, like *Gambusia holbrooki*.
- Least-toxic larvacides (killing mosquitoes in the larval stage) allow control measures to be targeted and kill mosquitoes before they become active, biting adults.
- *Bacillus thuringiensis var. israelensis* (Bti) is one of most effective and least hazardous biological larval controls. It is a bacterial strain that, when sprayed or dropped into larval pools, is ingested by feeding larvae and kills them. (Mosquito Dunks™ can be bought at local garden stores or on-line. They are safer for birdbaths, ditches, tree holes, roof gutters, etc. – anywhere water collects.)
- Vegetable based horticultural oils are effective in killing larvae in water and sinking egg rafts on the surface, but can also kill non-target organisms including some mosquito predators that breathe from the surface.
- Use natural-based repellents instead of DEET and reapply often. *Bite Blocker* has a soy-base, others such as *Beat It Bug Buster* and *Avon's Skin-so-Soft* use an herbal-base. Herbal repellents can contain cedarwood, garlic, lemongrass, frankincense, cinnamon, geranium, eucalyptus, basil, rosemary, cloves, peppermint, lemon balm (citronella), onions, feverfew, thyme, neem oil, and/or merigold.
- Mosquito traps and attractants are effective, though different levels of success have been reported. These machines send out plumes of carbon dioxide to attract mosquitoes that are then sucked in and killed.³⁸
- The CDC recommends the formation of local WNV community task force with representatives from government, civic, business, health, and environmental sectors to achieve buy-in within the society.³⁹

COMMUNITIES THAT HAVE ADOPTED SAFER MOSQUITO AND WNV MANAGEMENT PROGRAMS

- **Lyndhurst, Ohio**, passed a landmark ordinance in 2003 prohibiting the spraying of pesticides for WNV. During a Task Force sponsored forum, a panel of experts discussed the hazards and low efficacy of adulticides. The Council stated, “[T]here is substantial belief that the more effective way of controlling the mosquito populations is by larvacide treatment and thorough education...” Concluding that, “[T]he 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.”⁴⁰
- **Washington, DC** health officials continue their no-spray policy stating that pesticide spraying is inappropriate in a heavily populated area with asthmatics. Instead, officials focus on larval control and public education, with education materials distributed in four languages. The Department of Health is also implementing a Tire Round-Up program for residents to discard old tires, a major breeding site for mosquitoes.²⁷
- In **York County, Virginia**, officials distribute the mosquito eating fish, *Gambusia holbrooki*, to residents in order to decrease pesticide use for mosquito control. Several thousand of the fish have been bred by the county's fishery as part of its mosquito prevention program.⁴¹
- In **Dallas, Texas**, the City Council's Health, Environment and Human Services Committee adopted a mosquito control plan in 2003 that calls for more public education and allows the use of pesticide sprays only as a last resort and upon approval of the pertinent council member.⁴²
- **Ft. Worth, Texas** has not sprayed for mosquitoes since 1991. In 2003, Ft. Worth had 3 WNV cases and no deaths. Brian Boerner, Director of Environmental Management, states, “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.”⁴³
- **Nassau County, New York** joins others in using predacious fish in hard to reach salt-water marshes.⁴⁴
- **Marblehead, MA** has a WNV Response Plan that requires a town hall meeting before any adulticides are used (and only if there's been a locally-acquired human death).⁴⁵
- In 2003, **Boulder, Colorado** focused on larviciding, surveillance and public education without the use of adulticides and offered free WNV information workshops for neighborhood groups and distributes free samples of Mosquito Dunks, a least-toxic larvacide product, for use in stagnant water.¹⁴
- In preparation for WNV, **Lane county, OR** have an easy to read public educational flyer that is put in local newspapers and distributed with utility bills early in the season.⁴⁶
- In 2003, **Seattle, Washington** adopted an Integrated Pest Management Plan for Mosquito Control, which identifies public education, personal protection, and breeding source reduction on public property as, “...the most effective and appropriate techniques for the City to use.”⁴⁷

- ¹ Centers for Disease Control and Prevention, Division of Vector-Borne Infectious Diseases. West Nile Virus: Entomology. 2004. <http://www.cdc.gov/ncidod/dvbid/westnile/insects.htm>. (July 1, 2004) and CDC Answers Your Questions About St. Louis Encephalitis. 2003. http://www.cdc.gov/ncidod/dvbid/arbore/SLE_QA.htm. (July 1, 2004)
- ² Floore, T. 2004. Mosquito Information. The American Mosquito Control Association. <http://www.mosquito.org/info.php> (July 1, 2004)
- ³ Rutgers Entomology. 2001. FAQ's on Mosquitoes. <http://www.rci.rutgers.edu/~insects/mosfaq.htm>. (July 1, 2004)
- ⁴ Center for Disease Control. 2004. WNV Factsheet. What you need to know. http://www.cdc.gov/ncidod/dvbid/westnile/wnv_factSheet.htm (July 2, 2004)
- ⁵ Lunsford, Jessica. 2003. The truth about west nile virus. *Pesticides and You* 23 (1): 9-10.
- ⁶ US Fish and Wildlife Service. 2003. Division of Environmental Quality. Pesticide Issues: Fighting the west nile virus- Prevention works best. <http://contaminants.fws.gov/Issues/westnile.cfm> (July 2, 2004)
- ⁷ CNN.com/HEALTH. August 16, 2002. CDC predicts West Nile upswing. <http://www.cnn.com/2002/HEALTH/08/15/cdc.west.nile/> (July 2, 2004)
- ⁸ Hayes, Ned. 2004. CDC Division of Vector-Borne Infectious Diseases. "Summary of West Nile Virus Activity in the United States, 2003." http://www.cdc.gov/ncidod/dvbid/westnile/conf/pdf/Hayes_1_04.pdf (July 2, 2004)
- ⁹ West Nile Virus Questions and Answers on Survey. New York City Department of Health. March 21, 2000. <http://www.ci.nyc.ny.us/html/doh/html/wnv/wnvqa.html>. (July 1, 2004)
- ¹⁰ 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/wnvguidelines2001.pdf> (July 1, 2004)
- ¹¹ Pimentel, D. 1995. "Amounts of Pesticides Reaching Target Pests: Environmental Impacts and Ethics." *J. of Ag Environ. Ethics* 8(1):17-29.
- ¹² Weill, M., et al. 2003. "Insecticide Resistance in Mosquito Vectors." *Nature* 423(6936): 136-137.
- ¹³ News and Observer. 1996. State alters mosquito plans. 9/21/96
- ¹⁴ City of Boulder WNV Surveillance and Control Plan, 2003 Season. <http://www.beyondpesticides.org/MOSQUITO>
- ¹⁵ Lynch, J. June/July 2004., Cuyahoga County Board of Health and Ryan Sullivan, Shaker Heights WNV Task Force. Personal Communication.
- ¹⁶ Lee, R. April 2004. Director Environmental Management, City of Cheyenne and Larimer County. Personal Communication.
- ¹⁷ Gooselin, R. 1984. *Clinical Toxicology of Commercial Products*. Williams and Wilkins. Baltimore, MD.
- ¹⁸ Cantalamessa, F. 1993. Acute toxicity of two pyrethroids, permethrin and cypermethrin, in neo-natal and adult rats. *Archives of Toxicology* 67: 510-513. and Imamura L, et al. 2002. Neonatal exposure of newborn mice to pyrethroid (permethrin) represses activity-dependent c-fos mRNA expression in cerebellum. *Archives of Toxicology* 76(7): 392-397.
- ¹⁹ Extension Toxicology Network. 1994. "Pyrethroids." Pesticide Information Profiles. U.S. EPA and Oregon State University. <http://extoxnet.orst.edu/pips/pyrethri.htm>. (July 2, 2004)
- ²⁰ 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) and Alavanja, M.C.R., et al. 2003. Use of agricultural pesticides and prostate cancer risk in the agricultural health study cohort. *American Journal of Epidemiology* 157: 800-814.
- ²¹ U.S. EPA. 2002. Questions and Answers: Pesticides and Mosquito Control. Department of Prevention, Pesticides and Toxic Substances. <http://www.epa.gov/pesticides/factsheets/pesticides4mosquitos.htm>. (July 2, 2004)
- ²² National Research Council. 1993. *Pesticides in the Diets of Infants and Children*. National Academy Press. Washington, DC.
- ²³ 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>. (July 2, 2004)
- ²⁴ Howard, J. et al. 1997. "Impact of Naled (Dibrom 14) on the Mosquito Vectors of Eastern Equine Encephalitis Viris." *Journal of the American Mosquit Control Association* 13(4): 315-325.
- ²⁵ Sugg, W., et al. 2001. *Overkill: Why Pesticide Spraying May Cause More Harm than Good*. Toxics Action Center. West Hartford, CT.
- ²⁶ New York State Department of Health. West Nile Virus Response Plan, Appendix B Surveillance of Possible Health Effects from Pesticide Exposure. May 2000. <http://www.health.state.ny.us/nysdoh/westnile/final/appendixb.htm>. (July 2, 2004)
- ²⁷ District Of Columbia, Department Of Health. 2003. *Arbovirus Surveillance and Response Plan*. <http://www.beyondpesticides.org/mosquito/>
- ²⁸ Beyond Pesticides. 2000. Chemical Watch Factsheet: Malathion. July 2000.
- ²⁹ 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.
- ³⁰ U.S. EPA. 1998. Reregistration Eligibility Document Facts: DEET. Office of Prevention, Pesticides and Toxic Substances. EPA-738-F95-010.
- ³¹ Beyond Pesticides. 2001. "More Birds Dying from Pesticides and Other Toxics than West Nile Virus." Daily News. Washington, DC. June 4.
- ³² Saulny, Susan. 2001. "Workers Say Chemicals Used in Mosquito Spraying Made Them Ill." *New York Times*. January 25.
- ³³ Environmental Health Perspectives, March 1999. Vol. 107, no. 3, pages 173-177.
- ³⁴ Southampton Press. 2000. "Lobstermen Suing Pesticide Makers," September 7.
- ³⁵ Beyond Pesticides. 2002. "New York Times Photo Shows Children Drenched with Pesticides Sprayed for Mosquitoes." *Daily News Photostory*. Washington, DC. September 20.
- ³⁶ Extension Toxicology Network. 1996. "Malathion." Pesticide Information Profiles. U.S. EPA and Oregon State University. <http://ace.orst.edu/cgi-bin/mfs/01/pips/malathio.htm>. (July 2, 2004)
- ³⁷ U.S. EPA. 1999. *Recognition and Management of Pesticide Poisonings*. 5th edition. Office of Prevention, Pesticides, and Toxic Substances.
- ³⁸ Quarles, William. 2003. Mosquito Attractants and Traps. *Common Sense Pest Control Quarterly*, Volume XIX, No. 2.
- ³⁹ Centers for Disease Control and Prevention. 2003. 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/wnvguidelines2003.pdf> (July 1, 2004)
- ⁴⁰ Beyond Pesticides. 2003. "Ohio City Adopts Landmark Law to Stop Pesticide Spraying for West Nile Virus." *Daily News*. Washington, DC. July 14.
- ⁴¹ York County Environment and Development Services. Div. Drainage and Mosquito Control. <http://www.yorkcounty.gov/eds/fishhatchery.htm> (July 2, 2004)
- ⁴² Beyond Pesticides. 2003. "Virginia and Texas Towns Find Alternatives for West Nile Virus Control." *Daily News*. June 12, 2003.
- ⁴³ Ft. Worth Public Health Department, Mosquito Prevention and Control. <http://www.fortworth.gov/health/HP/mosqinees.asp> (viewed July 6, 2004)
- ⁴⁴ Turrillion, G. 2002. Director of Mosquito Control Program in Nassau County, NY. Personal Communication. March.
- ⁴⁵ Town of Marblehead, MA West Nile Virus Protocol and Response Plan. 2002. <http://www.beyondpesticides.org/mosquito> (July 6, 2004)
- ⁴⁶ Northwest Coalition for Alternatives to Pesticides. July 2004. Personal Communication.
- ⁴⁷ City of Seattle. Office of Sustainability and Environment. February 20, 2002. Integrated Pest Management Plan for Mosquito Control. <http://www.cityofseattle.net/environment/Documents/WNV%20IPM.pdf> (July 2, 2004)