by Rachel Massey*

As we saw two weeks ago (REHW #709), West Nile virus (WNV) appeared in the U.S. for the first time in 1999.** WNV was previously unknown in the Western Hemisphere, but it has now spread to seven states, most recently North Carolina.[1] Carried by mosquitoes that can infect humans, this virus often produces no symptoms at all but can sometimes lead to serious illness. In some cities, public health authorities have responded by spraying entire neighborhoods with pesticides intended to kill mosquitoes. These mass pesticide-spraying pose threats to human health and do not necessarily reduce populations of disease-bearing mosquitoes.

Experiences with another mosquito-borne virus, eastern equine encephalitis (EEE), indicate that pesticide sprays do not necessarily achieve the desired effect. For example, a 1997 study looked at trends in populations of CULISETA MELANURA, the mosquito primarily responsible for transmitting EEE among birds. Over a period of eleven years, Cicero Swamp in central New York state was sprayed fifteen times with one insecticide and once with another. Instead of declining, the population of CS. MELANURA grew fifteen-fold during this period. The study suggests that the pesticides may have altered the ecological balance of the swamp, killing organisms whose presence would ordinarily help limit the CS. MELANURA population.[2] In general, spraying can kill fish and other natural mosquito predators, and repeated spraying can produce pesticide-resistant mosquitoes.[3]

Pesticides meant to kill flying insects are often applied as an ultra-low volume (ULV) spray. ULV spray equipment creates tiny pesticide droplets that can remain aloft for long periods and, due to their light weight, readily drift away from the target area. Scientists have estimated that less than 0.0001% of ULV pesticide sprays actually reach the target insects.[4,pgs.18,22] So for every droplet that reaches a mosquito, hundreds of thousands more droplets circulate pointlessly in the environment.

Effective mosquito control uses knowledge of mosquito ecology to minimize opportunities for human exposure. One important tactic is reducing mosquito breeding habitats. CULEX PIPiens, also known as the northern house mosquito, has been the principal though not the only mosquito species transmitting WNV in the U.S. in 1999 and 2000. CX. PIPiens breeds readily in standing water found in places like wading pools, birdbaths, puddles, ditches, and standing surface water from septic systems.[5] Its typical flight range is a quarter to a half mile.[6] This means that a mosquito that bites you on your front porch may well have hatched in your back yard -- and that you and your neighbors can have a direct effect on local mosquito populations.

On a community level, guidelines for effective mosquito control include:
** Do not use "adulticides," or pesticides meant to kill adult mosquitoes.
** Focus on controlling mosquitoes in their immature forms: eggs, larvae, or pupae. Stock ponds and other bodies of water with mosquito-eating fish, and keep waterways clean so that fish and other mosquito predators can survive. In some cases, it is appropriate to use bacterial larvicides or mechanical controls such as vegetable-based oils that smother mosquito eggs floating on the surface of the water.[3] Mechanical control of adults may be an option as well. Traps exist that may attract and kill mosquitoes over areas of up to an acre. (See, for example, www.mosquitomagnet.com).[3]
** On a municipal or county level, set up a system for citizens to report standing water near their homes.[7]
** Establish monitoring programs to pinpoint where mosquito-borne diseases are occurring. Monitoring can rely both on trapping mosquitoes and on "sentinel birds," such as chickens, tested regularly for signs of infection.[3]
** Continuously evaluate the effectiveness of all mosquito control measures.
** Make sure the public knows what people can do at home to minimize mosquito exposure and eliminate breeding sites. Public health education is a good investment of resources and will pay off better than quick-fix expenditures on chemical sprays. *Here are some steps individuals can take around their homes:[8]*
** Get rid of any unnecessary items on your property that can hold stagnant water, such as old tires.
** Empty water from buckets, toys, and containers, and store them in places where they will not collect rain.
** Drill holes in the bottoms of recycling bins and any other containers that must be kept outdoors.
** Drain the water from bird baths, fountains, wading pools, plant pots and drip trays twice a week.
** Check for other ways water may be collecting around your house, such as puddles beneath air conditioners.
** Clean out your gutters and fix gutters that sag or do not drain completely. Check for areas of standing water on flat roofs.
** If you have a swimming pool, outdoor sauna, or hot tub, make sure rainwater does not collect on the cover.
** Clear vegetation and trash from any drains, culverts, ponds or streams on your property so that water drains properly.
** Keep grass cut short and trim shrubs to minimize hiding places for adult mosquitoes.
** Eliminate standing water in your basement.
** To minimize the likelihood of being bitten inside your house, make sure window and door screens fit properly and replace outdoor lights with yellow "bug lights."
** To avoid being bitten outdoors, wear hats, long sleeves and long pants in the evenings, when mosquitoes are most active.

Insect repellents can help, but some of them are dangerous. Products containing the pesticide DEET should be avoided. The U.S. Environmental Protection Agency (EPA) acknowledges fourteen cases in which individuals reported seizures associated with exposure to DEET. Twelve were children, three of whom died.[9, pgs. 22-23] DEET can also interact with other chemicals to produce severe toxic effects on the nervous system, and may have played a role in Gulf War Syndrome (see REHW #498). Based on existing information about DEET's health effects, EPA determined in September 1998 that the labels on some DEET-containing products were misleading. Under EPA's new requirements, it is illegal to label DEET-containing products as designed for children or "safe for kids." However, EPA chose to allow a grace period of more than four years during which products with old labels can be sold [9, pg. 41], so stores can still sell products with misleading g safety claims.

Many essential oils derived from plants have insect repellent properties, and some plant-based formulations provide protection from bites.[10] CONSUMER REPORTS magazine says a product called Bite Blocker is effective for 1 to 4 hours.[11] With all insect repellents, it is worth minimizing your exposure. Treat clothing, rather than skin, whenever possible, and wash off repellents with soap and water after returning indoors. *If WNV has not yet appeared where you live, you may want to get ready in case it
appears next year. You can start now to educate your town, city, or county officials about pesticide hazards and encourage them to develop a comprehensive non-chemical mosquito control program. It makes sense to contact these officials during the winter, when they are not under pressure to act quickly.

Find out whether your city or town already has a mosquito control program, and try to identify an individual in your public health department who is responsible for mosquito-borne diseases. Ask whether the department has a written plan for responding if infected birds or mosquitoes are found in your area. This could also be a good opportunity to find out about and work to eliminate “nuisance” mosquito control programs, in which routine spraying is carried out with no public health rationale. Finally, you may wish to raise awareness about the links between global warming and emerging infectious diseases. Because global warming creates opportunities for tropical diseases to spread or move northward, the appearance of WNV in the U.S. may be a harbinger of things to come. If your municipality has a program to reduce emissions of “greenhouse gases” such as carbon dioxide, talking about links to WNV could help jumpstart the program or give it new publicity.

Paul Epstein of Harvard Medical School's Center for Health and the Global Environment argues that the spread of mosquito-borne diseases like WNV is aided by several phenomena associated with global warming, including mild winters, hot summers, and drought. The “globalized” economy and increasing international travel also create new opportunities for exchange of diseases across regions. According to Epstein, back-to-back weather extremes in 1998 and 1999 probably encouraged the proliferation of WNV and the mosquitoes that carry it. In a recent article in SCIENTIFIC AMERICAN he writes, "The mild winter of 1998-99 enabled many of the mosquitoes to survive into the spring, which arrived early. Drought in spring and summer concentrated nourishing organic matter in their breeding areas and simultaneously killed off mosquito predators, such as lacewings and ladybugs, that would otherwise have helped limit mosquito populations. Drought would also have led birds to congregate more, as they sha red fewer and smaller watering holes, many of which were frequented, naturally, by mosquitoes."[12, pg. 54] Later in the summer, heavy rain created new mosquito breeding opportunities. Higher temperatures also tend to increase mosquito activity and accelerate the reproduction and maturation of viruses within their bodies.[12, p.52]

As communities make decisions about WNV, public officials must be prepared to talk frankly about the uncertainties they face. For example, it is not acceptable to provide ample information on risks associated with WNV while withholding parallel information on the toxicity of pesticides used to combat mosquitoes. As always, our ability to make good decisions depends on honesty about scientific uncertainties combined with open public discussion of the full range of alternatives available to us.

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[7] For one example, see http://www.erie.gov/standing_water_form.phtml


