

Will the pools create mosquito breeding habitat?

The restored stream follows a riffle-run-pool-glide pattern, which is seen in healthy streams in stream valleys similar to those found in Reston. Some of the pools do retain water between high storm flows; this is natural and provides habitat for many aquatic and riparian species. In fact, the existing streams also have standing pools of water between storm flows. Unlike the existing streams, however, healthy stream systems with floodplain connections also provide habitat for many mosquito and mosquito-larvae predators which keep the mosquitos in check.

*According to the [American Mosquito Control Association](#), the "bridge vector" (the main transmitter to humans) of the West Nile Virus in this area is the *Culex pipiens*. *Culex pipiens* is an urban species that generally prefers to breed in temporary standing water that is mildly to very polluted, such as tin cans, tires, tarps, and other human-made sources of standing water. While some females may breed in the restored streams, the percentage will not be higher than previously bred in the existing streams and will likely be significantly less than the percentge that breeds around homes and businesses.*

<http://reston.wetlandstudies.info/FAQ.htm#Mosquitos>

Mosquito Risk. Mosquito control can be a concern for stormwater wetlands if they are under-sized or have a small contributing drainage area. Few mosquito problems are reported for well designed, properly-sized and frequently-maintained constructed wetlands; however, no design can eliminate them completely. Simple precautions can be taken to minimize mosquito breeding habitat within constructed wetlands (e.g., constant inflows, benches that create habitat for natural predators, and constant pool elevations - see Walton 2003 and MSSC, 2005).

http://vwrrc.vt.edu/swc/april_22_2010_update/DCR_BMP_Spec_No_13_CONSTRUCTED_WETLAND_Final_Draft_v1-8_04132010.htm

Mosquito Risk. Mosquitoes are not a major problem for larger wet ponds (Santana *et al.*, 1994; Ladd and Frankenburg, 2003, Hunt et al, 2005). However, fluctuating water levels in smaller or under-sized wet ponds could pose some risk for mosquito breeding. Mosquito problems can be minimized through simple design features and maintenance operations described in MSSC (2005).

Wetlands Actually Reduce Mosquitoes

A healthy wetland provides habitat for many unique animals - including the natural enemies of mosquitoes.

According to an [Indiana Department of Natural Resources fact sheet](#), Did You Know?...Healthy Wetlands Devour Mosquitoes, mosquito populations are held in check in healthy wetlands by certain birds, frogs, fish, and insects that feed on mosquito adults and larvae. Wetland restoration projects can decrease mosquito populations by providing proper habitat for such predators.

For example, when Essex County, Massachusetts, restored a 1,500 acre wetland, the mosquito population dropped by 90 percent (Audubon Magazine, November-December 1996). Other

states, such as New Jersey, have also been controlling mosquitoes the "natural way" by eliminating small stagnant breeding depressions and using water management practices to increase mosquito predators. These "natural methods" reduced the cost of mosquito control, over the traditional method of insecticide application, by more than 97 percent.

When designing wetland restoration projects, considerations should be made up-front for mosquito control. This does not mean that projects should contain only deep or open water. On the contrary, projects with both deep and shallow waters that are somehow connected are generally preferable. Keep in mind to design projects with a variety of water regimes to foster the development of a variety of plants and animals that will naturally include mosquito predators, such as dragonflies, damselflies, water striders, backswimmers, predaceous diving beetles, topminnows, and mosquitofish.

Mosquitoes can be further reduced with the erection of birdhouses that will attract insectivorous birds such as purple martins, tree swallows, and prothonotary warblers. The addition of bat boxes is also a good idea. For example, a single little brown bat can consume 1,200 mosquito-sized insects in just one hour.

For more information, contact Billy Teels, Director, U.S. Department of Agriculture, Natural Resources Conservation Service Wetlands Science Institute, at (301) 497-5938 or contact the Indiana Department of Natural Resources at (317) 232-4080.

<https://www.dnr.mo.gov/env/swmp/IndianaWNV.htm>

INCITE

(incite)

Out of Control

The specter of West Nile virus has given new urgency to the annual assault on mosquitoes. But what are the real costs of this chemical warfare?

By Ted Williams

Other bloodsucking insects merely annoy, but mosquitoes insult. By night, these slow, decadent flies whine around our heads, always vanishing when the light goes on. By day, they don't even pay us the respect of evasive action, content to be smeared across our exteriors in stains of protoplasm rather than curtail their orgies. Stay your hand, bear the sting, and watch as she deliberately probes with her six stilettos, injects anticoagulant, swills your blood until her abdomen resembles a ripe aneurysm, voids on your skin, and, finally, raises a hind leg in doglike salute.

Little wonder that any effort called "mosquito control"--regardless of results--tends to elicit enthusiasm. For a large element of the public there is something deeply satisfying in the sight and sound of a spray truck grinding along a suburban street, belching organophosphates or synthetic pyrethroids into the gathering twilight. In the 1980s, when I served on the Grafton, Massachusetts, Mosquito Advisory Board, a local mosquito-control official informed me that he and his waggish crew had filled their truck with pure H₂O and sprayed a town with water vapor. Residents reported dramatic relief.

Such is the mindset that makes mosquito-control bureaucracies flourish and grow. Publicly funded mosquito-control programs, usually organized by county or region, exist in 41 states. In the United States mosquitoes can infect humans with such diseases as St. Louis virus and West Nile virus, but usually they don't. So it's the pathogen-free "nuisance" insect that is the bread and butter of

mosquito controllers.

The mission of their professional group, the American Mosquito Control Association (AMCA), is the "enhancement of health and quality of life." But because mosquito controllers are trained, funded, and profoundly influenced by the pesticide industry and those tied to it, their definition of "quality of life" differs substantially from that of, say, a pediatrician. According to the AMCA's technical adviser, Joe Conlon, the greatest challenge U.S. mosquito controllers face is the decreasing availability of pesticides, especially organophosphates. The AMCA, he says, is fighting the attempt by the Environmental Protection Agency (EPA) "to take organophosphates away from us."

In recent issues of the AMCA's newsletter, columnist Peter H. Connelly, who works for Aventis (which produces permethrin, a synthetic pyrethroid), warns about the plot by "environmental extremists" to scare the public about pesticides and the plot by the Feds to ban pesticides. "The EPA," he writes, "believes that all pesticides are bad." Still, Connelly reports that business prospects for America's mosquito controllers are very bright: "We are possibly entering a period of industry growth unprecedented since the midwestern U.S. St. Louis virus outbreak of the 1970s."

Driving the current boom is West Nile virus, which showed up in New York City during the summer of 1999. Basically, it's a bird disease, and while its danger to humans should not be trivialized, neither should it be exaggerated. If you get the virus, it can be as dangerous as, say, the flu--which means it can kill you. In 1999 West Nile virus killed seven New Yorkers; in 2000 it killed two. The vast majority of people who get it recover with no damage.

West Nile virus had been studied for 61 years, but this was its debut in North America, and health officials panicked. The Centers for Disease Control (CDC) urged preemptive air strikes with organophosphates and synthetic pyrethroids. County officials who

procrastinated were informed by the CDC that if the mosquito-control unit didn't get cranked up PDQ and someone died of the disease, the CDC would let it be known that those officials had chosen to ignore its advice. If you found a dead bird that tested positive for West Nile, you needed to spray around it in a two-mile radius, the CDC announced.

The Audubon Society, which had worked with New York State to hatch a reasonable response plan, was horrified. "The only peer-reviewed professional science on this issue says there is no correlation between use of adulticides [pesticides for adult mosquitoes] and reducing disease," declares Bill Cooke, director of government relations for Audubon New York. "What we have are B.S. field studies put out by the pesticide companies. Decisions were being made on junk science. *Spray a two-mile radius around a dead bird? Where's the data? Don't tell me to spray 12.5 square miles because you've got a dead bird that might have flown 50 miles that day!*"

In New York City there weren't enough regular mosquito controllers to do the job, so new ones had to be trained, sometimes in less than a day. In 1999 Mayor Rudolph Giuliani ordered the city blitzed with malathion, a nerve toxin that kills or harms a broad spectrum of life, including insects, fish, mammals, and birds. Last year Giuliani's poison of choice was a cocktail of sumithrin and piperonyl butoxide, a chemical known to cause cancer in lab animals.

Children, people carrying groceries, and pregnant women--including the wife of *Audubon's* editor--were sprayed with no warning. Some required hospitalization. "You have to virtually, you know, drink this stuff [sumithrin] in order to have side effects," the mayor assured the public via the *New York Daily News*. People who objected were guilty of "zealous advocacy" and oblivious to "the importance of human life."

So deadly is malathion to aquatic life that the EPA forbids its use over water; but since this was "a public health emergency," city officials got the Department of Environmental Conservation to waive the

regulation.

Unlike most native birds, butterflies can thrive in a megalopolis. In New York City, for instance, you can see 80 species--not just migrating through the city but actually living there. So as part of the Pipe Dream Project (the North American Butterfly Association's nationwide effort to bring back pipe-vine swallowtails), Steven Coates of Brooklyn planted pipe vine in his backyard in the spring of 2000. Brooklyn is near the extreme northern range of the pipe-vine swallowtail, and Coates had never seen one in the area, but to his astonishment he found three egg clusters on his pipe vine in July. About 48 hours after the eggs hatched, the city sprayed. Next morning, all Coates's caterpillars were dead.

We see many more butterflies in Grafton today than we did 10 years ago, and while we can't prove cause and effect, it seems more than coincidental that we dismissed the Central Massachusetts Mosquito Control Project 10 years ago. But why are we also seeing a lot *fewer* mosquitoes? Tufts University professor Sheldon Krimsky, pesticide risk-assessment adviser to the Massachusetts Department of Public Health's Working Group on West Nile Virus, offers this explanation: "The pesticides kill the predators of mosquitoes, so when the mosquitoes return, as they always do, they may return to a much more supportive environment. . . . The mosquito-control people will make you think that without their programs there will be havoc, that the mosquitoes will just take over. They walk around with anecdotal information--'We kill 40 percent of the mosquitoes,' etc.--but they have nothing published. They are spraying neurotoxins and carcinogens around. If you're doing this, it had better be justified. It hasn't been."

Moreover, Krimsky and other public-health authorities warn that routine, pesticide-based mosquito projects, ongoing in most states, may *impede* real disease control, should it ever become necessary, by creating chemical resistance in local

mosquito populations.

Grafton joined the Central Massachusetts Mosquito Control Project in 1976 largely because urban emigrants who had built their houses near or in swamps were outraged when they got bitten by mosquitoes. We severed ourselves from the project in 1991 because of its expense, its danger to nontarget organisms, including people, and its gross ineffectiveness. But in March 2001 project personnel blew back into town, terrifying the Boards of Health and Selectmen with stories about this new mosquito-borne killer virus called West Nile. They would protect Grafton residents from the epidemic, they said, and all we'd have to do was pay them \$96,000. "If we save only one person, it will be worth it," proclaimed one selectman. "Don't shake your head, young lady," boomed another at master bird bander and environmental educator Sue Finnegan, who a decade earlier had almost single-handedly persuaded the town to fire the mosquito controllers. Once again Finnegan and other knowledgeable residents tried to warn the town fathers that routine nuisance-mosquito control wouldn't save anyone from anything, even itchy skin; but this time they were basically told to shut up. Then, with no public participation, the Board of Health placed the item on the warrant for a vote at the town meeting in mid-May.

There wasn't much time to reeducate the town, but at the request of the Grafton Conservation Commission I began collecting information on what we'd be getting for our \$96,000. What diseases would they be protecting us from? I asked the Central Massachusetts Mosquito Control Project superintendent, Ken Courtemanche, and the assistant superintendent, Timothy Deschamps. *West Nile virus, eastern equine encephalitis, and heartworm in dogs*, I was told. Two months earlier the CDC had backed off on its advice to nuke a two-mile radius around every dead bird, and instead recommended no spraying unless "the presence of infected adult mosquitoes poses a risk to health." Superintendent Courtemanche hadn't heard about this. How bad was West Nile in Massachusetts? I asked. *Well, no one had gotten it yet*. And how bad was eastern equine encephalitis in their service area?

Well, *no one had gotten it yet*. I knew that central Massachusetts dogs get heartworm, but not if you give them preventive medication once a month. How do you know which wetlands to larvicide? *Field technicians perform dipping procedures and bring back samples to be identified by the staff entomologist*. So the entomologist decides? No, *the field technicians decide*. And what is their average education? High school. How do you decide when to spray for adults? *If someone complains about mosquitoes, and by "landing rates"--i.e., how many mosquitoes land on a technician in five minutes*. What if I don't want to be sprayed? *You need to make a formal request by registered letter to the town clerk, listing your property abutters, send a carbon copy to the project, and festoon your property with these attractive paper pie plates that say, "No Spray."* And what about drift? *We'll stop spraying 150 feet from your house*. But how can you know where my property line is when I don't, and wouldn't this unfairly deprive my neighbors on both sides of the benefits of spray? *We have portable foggers*. What's the flight range of a mosquito? *Depending on the species, up to 25 miles*. Which adulticide will be used in Grafton? *Resmethrin, a synthetic pyrethroid*. What are the effects on nontarget organisms, including people? *Caffeine is more toxic*.

Other sources were less sanguine. Professor David Ozonoff, the chair of Boston University's Department of Environmental Health and an adviser to the Massachusetts Department of Public Health on West Nile virus policy, told me this: "It's not just resmethrin; it's resmethrin with a synergist called piperonyl butoxide, which causes cancer in rats and mice [the same stuff New Yorkers were forced to assimilate last year]. I would never use these pesticides for nuisance control, because the risk equation doesn't work. You're not getting any real benefit for public health." Lab studies indicate that synthetic pyrethroids are endocrine disrupters and hormone replicators. For this reason, the EPA rates them as among the most dangerous to children of all pesticides in common use.

"Here's the analogy I use," says Krinsky. "If there

were a vaccine being considered for West Nile virus, we would require by law that it be safe and effective. I say we should ask for nothing less, maybe even more, for any spraying, because at least with a vaccine you can decide you don't want to take it. If someone can't demonstrate that a program will prevent West Nile virus, which is very low risk to begin with, why should we accept such an intervention?"

That question should have been asked by the Grafton Boards of Health and Selectmen. The business of the Grafton Conservation Commission, on the other hand, is to protect land, water, fish, and wildlife, and, to that end, enforce the commonwealth's Wetlands Protection Act. So the commission was distressed to learn that Massachusetts mosquito-control projects, which are exempt from wetlands regulations, routinely allow themselves to be used by development interests as a means of circumventing wetlands permitting processes. In 1974, when I worked for the Massachusetts Division of Fisheries and Wildlife, I was sent to Mansfield to investigate the destruction by mosquito controllers of Hodges Brook. I was appalled at what I found. The last real trout stream in town had been converted into a straight, sterile gutter--not to control mosquitoes but to dry out the floodplain for the convenience of developers, who were already building houses when I arrived. Our southeast district manager called it a "clever little conspiracy perpetrated by special interests." A quarter-century later nothing had changed. Writing on her own time and as a private citizen, Maryann DiPinto of the Massachusetts Department of Environmental Protection chronicled similar capers in the late 1990s. In Westborough she observed the Central Massachusetts Mosquito Control Project excavating and polluting a tributary of Jackstraw Brook (a trout stream) and piling the dredge spoils "without any erosion controls." The work, they informed her, had been undertaken simply because the town Department of Public Works had asked for it. In Milford, DiPinto reported that project personnel--again at the request of the town DPW--destroyed 1,000 feet of significant stream habitat, dumping the spoils, including "large boulders, some over six feet

in diameter, [on] the bordering vegetated wetland." In Blackstone, against the wishes of the property owner, the Central Massachusetts Mosquito Control Project ditched "800 linear feet of stream [and] spread the spoils, including large stones and boulders, over the adjacent wetland."

Mosquito controllers who depend on this type of "source reduction," as they call it, and on chemical pesticides can never succeed because, along with a few mosquitoes, they take out whole ecosystems, including such natural controls as frogs, toads, salamanders, fish, damselflies, dragonflies, and birds. If birds aren't killed directly, hatchlings may starve when insects are poisoned off, and exhausted migrants may not be able to fuel up for the next leg of their journey.

But sometimes birds are killed directly. The EPA permits Florida mosquito controllers to bomb the state with fenthion, an organophosphate so toxic to birds that it's actually registered as an avicide and sold worldwide; one formulation used to be called Rid-a-Bird. To deliver this and other poisons, Florida mosquito controllers deploy a fleet of aircraft larger than most Third World air forces. Lee County alone uses 10 helicopters and 6 DC-3s.

When the Collier Mosquito Control District, which has five helicopters, three turbo-prop Sky Vans, and a DC-3, was criticized for killing fiddler crabs, it began spraying fenthion in "ultra-low volume." But though the dose was reduced, it was delivered in finer drops that hung in the air far longer, drifting as far as five miles. Four years ago Ted Below, the biologist at Audubon's Rookery Bay Sanctuary, on Marco Island, began finding large numbers of dead birds on a sandbar off Tiger Tail Beach, designated critical habitat for shorebirds. Since then there have been at least 12 separate die-offs. Victims have included western sandpipers, least sandpipers, dunlins, sanderlings, short-billed dowitchers, willets, snowy plovers, snowy egrets, cattle egrets, little blue herons, black skimmers, sandwich terns, fish crows, ring-

billed gulls, laughing gulls, threatened least terns, and one endangered piping plover. About 500 carcasses have been recovered, but because Marco Island is surrounded on three sides by mangroves, this doubtless represents only a tiny fraction of the birds killed. After finding fenthion on and in the dead birds, the Fish and Wildlife Service launched a criminal investigation into apparent violations of the Endangered Species Act and the Migratory Bird Treaty Act.

Twenty or more piping plovers feed on the sandbar, about 10 of which wear bands that identify them as part of the Great Lakes population, now down to 30 pairs. "We've been in contact with Audubon people around the Great Lakes who are enraged by this, because they post guards on these birds' nests," says Linda Farley of the American Bird Conservancy. "The dead piping plover was from this population."

The mosquito-control district, says Below, "is always raising the specter of mosquito-borne disease. Now they're talking about West Nile virus." So is Louisiana, which plans to use fenthion as a defense. According to the pesticide's manufacturer (Bayer), Texas and California are also interested.

"The Keys have the worst mosquitoes in Florida, so how are they able to get along without fenthion?" Farley demands. It's a good question, one that Collier Mosquito Control district director Frank Van Essen, who vows to continue spraying fenthion, couldn't answer. Not that mosquito control in the Keys is any model of enlightenment. "I'd say they're the sickest ecosystem in the United States," remarks Jeffrey Glassberg, president of the North American Butterfly Association. "It's like walking into a wasteland. There you are, in what should be this tropical paradise, but it's eerily silent. You hear no crickets, no grasshoppers. You spend the whole day at a place that ought to be filled with butterflies, and maybe you see one cloudless sulfur. There's a whole host of butterflies--species, not just subspecies--that are on the verge of extinction largely because of spraying for mosquitoes. We've petitioned the Fish and Wildlife Service to list the Miami blue. It used to be common

throughout all of southern Florida in the 1950s. In the 1980s it was hard to find anywhere. Then, in the 1990s, nobody saw one. Finally, we discovered a colony on the Keys a year ago. *And mosquito control is spraying it.*"

By working with native ecosystems rather than attempting to kill off undesirable parts, a few mosquito controllers actually control mosquitoes. No state program is more effective than Connecticut's, which didn't buy into the regional hysteria or take up the CDC's battle cry of "Fire, ready, aim." Instead, it sprayed only where it found mosquitoes infected with West Nile virus. Because adulticiding for nuisance mosquitoes doesn't work, Connecticut doesn't do it. And because the greatest mosquito breeders are wetlands that have been trashed by humans, Connecticut restores them.

So enlightened has been the approach of the Essex County (Massachusetts) Mosquito Control District that its superintendent, Walter Montgomery, got the state legislature to change the district's name to the Northeast Massachusetts Mosquito Control and Wetlands Management District. Montgomery and his staff have been involved in virtually every salt-marsh restoration project from Boston to the New Hampshire border. Even the Fish and Wildlife Service hired them, to restore the Parker River National Wildlife Refuge. Before the district restored 1,500 acres of Rumney Marsh, just north of Boston, the neighbors would phone in about 40 mosquito complaints per summer day. When I toured the marsh with Montgomery in 1996, I saw new tide channels and ponds of the sort that used to be part of natural salt marshes before old-school mosquito controllers dewatered them with useless grid ditches. Shoals of mummichog minnows, a mosquito larva's worst nightmare, dimpled over new glasswort. Herons stalked the mummichogs. Waterfowl dabbled in new widgeon grass, and shorebirds scampered over reborn mudflats. Now there are hardly any mosquito complaints, and instead of a festering phragmites monoculture, the neighbors get a healthy, diverse

marsh teeming with fish, birds, and mammals. (See "What Good Is a Wetland?" *Audubon*, November-December 1996.)

This doesn't mean that the neighbors aren't bitten by mosquitoes. After all the wetlands have been restored, all the bottles, cans, and tires picked up, all the rain gutters cleaned, all the garden ponds stocked with goldfish, and all the birdbaths changed, even after you've marinated yourself in repellent, mosquitoes will still feast on your blood. Grin and bear it. The more you get bitten, the less you will itch. If your children complain about mosquitoes, tell them they are part of wild, wet places where frogs, turtles, and trout abide, part of staying up late, part of summer.

In the AMCA's March-April 2001 newsletter there's a photo of a kid named Bobby Wilson, age 10, I would guess, who lists mosquitoes first among "summertime nuisance[s]." I submit that when American boys are more offended by mosquitoes than, say, summer reading, Mark Twain is blanching and Teddy Roosevelt isn't saying "Bully" for them or us. And I submit that the future for wasteful, destructive, ineffective mosquito control is even brighter than when West Nile virus hit New York City.

Ted Williams *does field research on mosquitoes near his home in Massachusetts.*

<http://www.audubonmagazine.org/incite/incite0109.html>