

Zika Virus: A Guide for Environmentalists

Zika Virus

Zika virus was first discovered in a monkey in the Zika Forest of Uganda in 1947. Before 2015, Zika virus outbreaks occurred in areas of Africa, Southeast Asia, and the Pacific Islands. Currently, outbreaks are occurring in many countries and territories (<http://www.cdc.gov/zika>). In December 2015, the Commonwealth of Puerto Rico, A United States territory, reported its first confirmed locally transmitted Zika virus case. Local transmission means that mosquitoes in the area have been infected with Zika virus and can spread it to people. Cases of local transmission have recently been confirmed in two other US territories, the United States Virgin Islands, and American Samoa.

On January 22, 2016 the CDC activated its Emergency Operations Center to respond to outbreaks of Zika occurring in the Americas and increased reports of birth defects and Guillain-Barre syndrome in areas affected by Zika.

Zika virus is spread to people primarily through the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). When feeding, a mosquito will pierce the skin and inject saliva into the person's skin. This allows the virus to enter the site. Additionally, a mother can pass Zika virus to her fetus during pregnancy. Although mosquito bites are the main way that Zika virus is spread, a man can sexually transmit the virus to his partner(s). There is also a strong possibility that the virus can be spread through blood transfusions.

The most common symptoms of Zika virus disease are:

- Fever
- Rash
- Joint pain
- Conjunctivitis (red eyes)

Other symptoms include:

- Muscle pain
- Headache

Four out of 5 people infected with Zika virus will not have any symptoms. The sickness is usually mild with symptoms lasting for several days to a week. People usually do not get sick enough to go to the hospital, and they rarely die of Zika.

At this time, Zika has not been spread by mosquitoes in the continental United States; however, cases have been reported in travelers returning to the United States, as well as cases of sexual transmission. The CDC monitors and reports cases of Zika, which will help improve our understanding of how and where Zika is spreading.

For Zika to cause an outbreak in the continental United States, all of the following must occur:

- People infected with the virus enter the United States.
- An *Aedes* mosquito in the United States bites the infected person during the relatively short time that the virus can be found in the person's blood.
- The infected mosquito lives long enough for the virus to multiply and for the mosquito to bite another person.

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Aedes Mosquitoes

Mosquitoes have a complex life-cycle with dramatic changes in shape, function, and habitat. There are more than 3,500 known species of mosquitoes worldwide and there are about 60 different species in Alabama. Some mosquitoes are disease vectors, while others are just a nuisance.

The *Aedes aegypti* mosquito, commonly known as the yellow fever mosquito, used to be common in Alabama, but has mostly been displaced by the *Aedes albopictus*, commonly known as the Asian tiger mosquito. The *Ae. aegypti* is also the main carrier for the Zika virus, although *Ae. albopictus* can also be a carrier.



The *Ae. albopictus* is a small, dark mosquito with a white dorsal stripe and banded legs.

Aedes albopictus



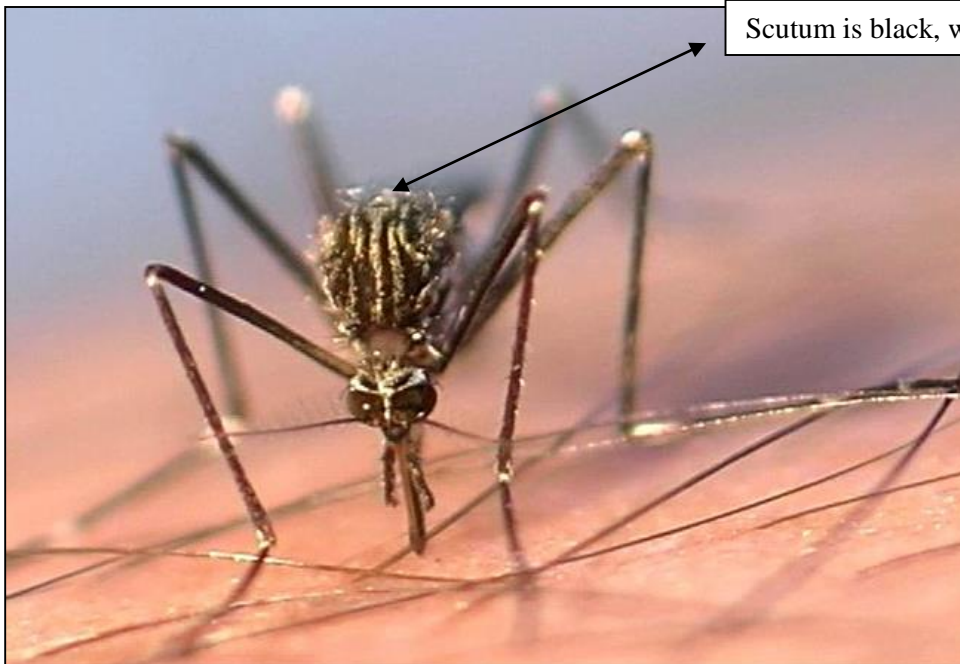
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Ae. aegypti is a small, dark mosquito with white lyre shaped markings and banded legs.

Aedes aegypti

Aedes japonicus is often mistaken for *Ae. aegypti* because the scutum looks similar; however, *Ae. japonicus* has golden markings whereas *Ae. aegypti* has white. This species transmits the virus that causes Japanese encephalitis in its native area; however, since it was introduced to the United States in 1998, it is not known to be a disease vector here.

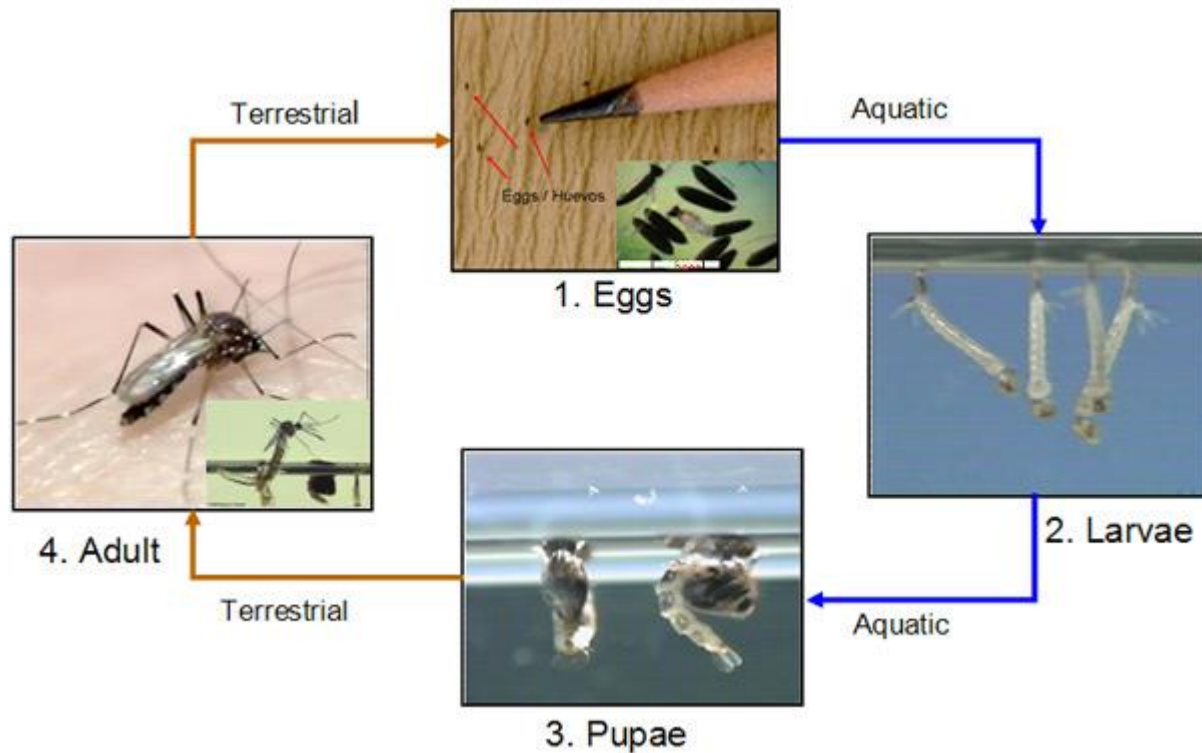


Scutum is black, with golden stripes.

Aedes japonicus

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Mosquito Lifecycle



The lifecycle and biology is similar for both the *Ae. albopictus* and *Ae. aegypti*, but we will focus on *Ae. albopictus* since it is the common one of the two found in Alabama. In addition to Zika, this mosquito is also a vector for dengue, chikungunya, the dog heartworm parasite, and yellow fever in the tropics.

Life Stages of Aedes Mosquitoes

Eggs

- Adult, female mosquitoes lay their eggs on the inner, wet walls of containers with water, above the waterline.
- Mosquitoes generally lay 100 eggs at a time.
- Eggs are very hardy; they stick to the walls of a container like glue and can survive drying out for up to 8 months- even over the winter in the southern United States.
- It only takes a very small amount of water to attract a female mosquito (mosquitoes do not breed in flowing water).

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Aedes eggs. To the naked eye, the eggs look like little specs of dirt.

Larva

- Larvae (plural) emerge from mosquito eggs, but only after the water level rises to cover the eggs. Rainwater or people adding water to containers with eggs will trigger the larvae to emerge.
- Mosquito eggs hatch into larvae in as few as 2-3 days.
- Larvae feed on small aquatic organisms, algae and particles of plant and animal material in water-filled containers. After molting three times, the larva becomes a pupa.
- Commonly known as “wigglers” because they look like little wiggly worms in the water. Early stages of larvae can be difficult to see, but not impossible. The later stages are easy to spot.
- Depending on food sources and temperature, this stage can last from 4 days to 2 weeks.



Ae. albopictus larvae

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Pupa

- Pupae (plural) will develop until the body of the newly formed adult flying mosquito emerges from pupal skin and leaves the water. This stage typically lasts for about 2 days.



Ae. aegypti pupae

Adult

- After adult mosquitoes emerge: male and female mosquitoes feed on nectar from flowers, but the female mosquitoes need blood from humans or animals to produce eggs.
- After feeding, female mosquitoes will look for water sources to lay more eggs.
- Typically, the *Ae. albopictus* only flies a few blocks during its lifetime. They prefer to live near people and they can be found inside homes, buildings, and businesses where window and door screens are not used or doors are left open.
- They are strongly attracted to bite humans, but will feed on cats, dogs, squirrels, deer and other mammals, as well as birds.
- They are a very aggressive daytime biter and will bite in direct sunlight. Their peak feeding times are during early morning and late afternoon.
- This mosquito has a rapid bite that allows it to escape most attempts by people to swat it and they will bite any exposed skin surface.

The entire aquatic cycle (egg to adult) can occur in as little as 7-9 days. Extreme heat can speed up development. The life span for adult mosquitoes is around three weeks.

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Breeding Environments

One of the best ways to avoid mosquito bites around the home is to not raise them. One water-filled can or bottle can be the hatching site for several thousand mosquitoes. Many residents are not aware that mosquitoes can breed in a very small amount of water. They commonly believe their mosquitoes are coming from a nearby ditch or a neighbor's old swimming pool. However, oftentimes, it is an area of their yard that they do not realize can cause a problem. *Ae. albopictus* have a short flight range (less than 200 meters), so egg production sites are likely to be close to where the mosquito is found. *Ae. albopictus* can use natural locations or habitats (for example treeholes and plants) and artificial containers with water to lay eggs.

Basically, anything that can hold a small amount of standing water for as little as a week can be a problem. Below are some examples of what to look for.



Flower pot dishes should either not be used during mosquito season or emptied and scrubbed out to remove eggs at least weekly. Also, it is very important that flower pots have drain holes to avoid over saturation of the soil. Overly saturated soil can breed mosquitoes. Additionally, small wading pools are commonly used as water bowls for pets. This can be a problem because they are typically too heavy to dump out the water. Residents just keep adding water as needed. This makes them an optimal breeding area because the eggs are never removed.



Tires are an ideal breeding environment for *Ae. albopictus*. They should be permanently removed or stored in a shed or garage so that they cannot collect water. It is nearly impossible to dump water out of a tire. Check with your local schools and see if they use tires for sports practice, such as football. Recommend that they drill holes in the tires so they cannot hold water or to store them in an area where they will not collect water when not in use. Check your tire dealers: if they do not remove tires frequently

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from the site or store them so that they cannot collect water, you can have a major breeding area with just one dealer. Tires may also be treated with a larvicide to prevent mosquito breeding.



Rain barrels or buckets used for collecting water to reuse should be kept covered or have screening with holes too small for an adult mosquito to enter. If using screening, a larvicide should also be used in the water because *Aedes* eggs are extremely small and can fall through the holes.



Children's toys are common mosquito breeders. Recycling bins can also breed mosquitoes if the drain holes are clogged with fallen leaves. Residents also use garbage cans to collect yard debris for curbside pickup. These cans should have holes drilled in the bottom to prevent collecting water.



Wheelbarrows should be stored inverted when not in use.

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Swimming Pools



Swimming pools are potential mosquito breeders. They should be repaired or have a tight-fitting cover to prevent the entry of mosquitoes. Oftentimes, the pool will turn into a “pond” environment and will not cause a mosquito problem due to natural predators on the larvae, such as frogs and dragonflies, etc. However, the skimmer is typically found to be a breeding area because it has holes that allow the adult mosquito to enter, but is covered, providing the shade typically preferred by the mosquito.



A bacterial larvicide, such as the one pictured, is an excellent recommendation for treating swimming pools or other containers where the water cannot easily be dumped (such as bird baths or inoperable fountains and fish ponds, etc.). One “doughnut” will treat 100 square feet of water for 30 days. They can be crumbled up for smaller areas such as bird baths and flower pot dishes. They are safe around animals and humans. They can be purchased online or at local retailers that carry pesticides.

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Other Potential Breeding Sites



Fish ponds that are no longer circulating the water are ideal breeding areas.



Tarps will breed numerous mosquitoes. If used, there should be no recessed areas that can hold water.

Treeholes should be filled with sand or mortar to prevent the accumulation of rainwater.



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Bird baths can breed numerous mosquitoes over the season, particularly if they are located in the shade. The water should be dumped out and the basin scrubbed to remove eggs at least weekly. During extreme heat, this should be done twice a week. Alternatively, a bacterial larvicide may be added to prevent the emergence of the adult mosquitoes. Carefully read label instructions, but most bacterial larvicides should not be harmful to wildlife, pets, or humans. They are typically not recommended for potable water intended for human consumption.



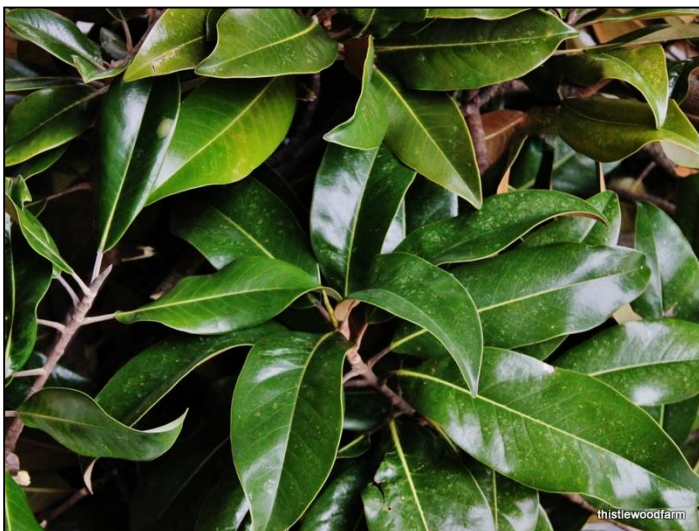
Clogged gutters are excellent breeders because they provide a moist environment for the mosquito to develop and a food source for the larvae. Gutters should be cleaned regularly or screening placed over the gutters to prevent the accumulation of leaves and other debris.

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Corrugated pipes will breed mosquitoes in the ridges. They are commonly used on downspouts to drain water away from the home. Holes should be drilled into the pipe to prevent the collection of water or they should be graded to properly drain.

Watering cans left outdoors will collect rainwater and breed mosquitoes.



Some plants can breed mosquitoes if they are capable of collecting water.

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Construction sites can breed mosquitoes. Ruts caused by construction equipment commonly breed mosquitoes. You can ask the construction company/owner to regrade the property to remove the breeding ruts. Additionally, open dumpsters used at construction sites may quickly fill with items that can hold water and breed mosquitoes if they are not emptied frequently.



If your city or county government picks up leaves for composting, check the area where the leaves are stored. These areas typically have ruts and other depressions that can breed an extensive amount of mosquitoes due to the high organic matter content of the leaves. Ask those responsible for the site to regrade the area to remove any breeding depressions.

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Salvage yards and used appliance businesses can breed numerous mosquitoes in the abundant areas that can hold small amounts of water, which allows the mosquito to complete the aquatic phase of their lifecycle. Check with salvage yards and used appliance businesses in your area to see if they check for mosquito breeding and if they have a treatment plan.



Cemetery flower vases that do not have drain holes or are clogged can breed mosquitoes. Check with cemeteries in your area and see if they have a problem with mosquito breeding.

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Septic Tanks



Septic tanks that are open or unsealed, broken with cracks or spaces between the blocks, or lacking a vent pipe screen can produce hundreds to thousands of mosquitoes each day.

How to inspect a septic tank to avoid producing mosquitoes:

- Verify that vent pipes are covered with screen mesh
- Make sure the pipe that goes into the tank is not broken and connections are sealed
- Verify that there are no cracks in the exterior walls of the septic tank and if cracks are found, repair with cement
- If septic tank is not in use, fill it completely with soil.

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Underground storm shelters should have tight-fitting doors to prevent the entry of water and adult mosquitoes.

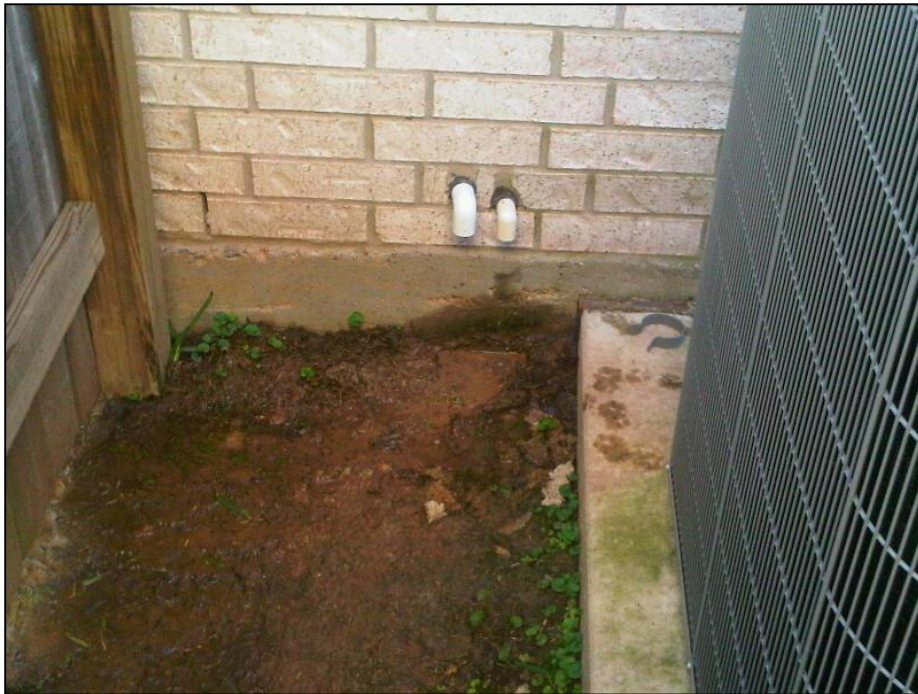


Bamboo internodes with water will breed mosquitoes. Additionally, adult mosquitoes will rest in bamboo during the day because it is cool and shaded.

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Many residents will place large rocks or other heavy objects on the base of the portable basketball goal to stabilize it. It is common for the weight of these heavy items to cause depressions in the base which can hold water and breed mosquitoes.



All leaking pipes should be repaired and air conditioner drainage should not be allowed to pond. The area should be graded to drain.

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More Breeding Environments



Drainage Problems



Drainage problems in yards should be addressed to avoid potential breeding sites.



If a drainage problem in a yard cannot easily be corrected, a rain garden may assist with mosquito breeding problems. A rain garden is a shallow, landscaped depression that facilitates the infiltration of stormwater runoff from impervious surfaces, confining it while it allows for slow percolation into the ground over 24-48 hours. The percolation time will depend heavily on soil type. It is very important that the garden drains within 72 hours. Not all sites are appropriate for rain gardens. More information on rain gardens may be found online or by contacting your county cooperative extension office.

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Standing Water on Agricultural Land

If inquiries are received regarding how to address standing water on agricultural land, direct residents to their local USDA Service Center. They have programs that may assist with biological control of mosquitoes. The service center locations can be found at: <http://offices.sc.egov.usda.gov>.



Stagnant Water in Ditches

Check with local government. The ditch may drain better if cleaned out or may need to be regraded.



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Yard Maintenance



Adult mosquitoes like to rest in shady vegetation on hot summer days. Weeds, vines, hedges and grass should be kept trimmed.

Grass clippings and other debris should not be thrown over fences, into ditches, or stored in large quantities because they provide habitat and food for mosquitoes.



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Other Preventative Measures



Window screens should be kept in good repair to prevent the entry of adult mosquitoes. Additionally, garage doors and others doors should not be left open while mosquitoes are active.

Mosquitoes tend to be weak flyers. You could recommend the use of an oscillating fan in outdoor areas and these may help prevent mosquito bites.



Community Organizations

Local community groups may be willing to organize cleanup events for areas that have debris that can breed mosquitoes, such as tires, cans, bottles, etc. Some groups may be willing to distribute information to residents of your community.

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Drain, Dress, and Defend

For mosquito prevention and protection, it is important for residents to practice the three D's: Drain, Dress, and Defend.

- Drain- remove breeding environments by draining water from property.
- Dress- if residents must be outdoors when mosquitoes are active, light-colored, loose-fitting and tightly-woven, long-sleeved shirt and long pants, socks, and shoes should be worn. Light-colored clothing is less attractive to mosquitoes and wearing tightly-woven clothing will make it more difficult for the mosquito to bite.
- Defend- Use an Environmental Protection Agency (EPA)- registered insect repellent with one of the following active ingredients:
 - DEET
 - Picaridin, also known as KBR 3023, Bayrepel, and icaridin
 - IR3535
 - Oil of lemon eucalyptus or para-menthen-diol
- All EPA-registered insect repellents are evaluated to make sure they are safe and effective. It is important to always follow the product label instructions.
- Treat clothing and gear (such as boots, pants, and socks) with permethrin or purchase permethrin-treated clothing and gear.
- Do not use permethrin products, intended to treat clothing, directly on skin.

If a resident is still experiencing a mosquito problem on their property after breeding environments have been addressed, they may want to consider treating their yard with products available at retail stores that carry pesticides. Products can be applied to vegetation to address adult mosquitoes that may rest there. Additionally, in more severe circumstances, a resident may want to purchase their own hand fogger to address mosquitoes in flight.

For more information on Zika and other mosquito-borne diseases in Alabama, visit:
www.adph.org/mosquito.

If you have any questions, please contact:

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