Rain Barrels and Mosquitoes

Fact Sheet FS1240

Cooperative Extension

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Storage of rainwater for later use, or "rainwater harvesting," is a sustainable or low impact development practice currently in use to conserve water resources and to treat stormwater runoff. Rainwater harvesting treats stormwater as a resource, rather than the more conventional approach of treating it as waste and removing stormwater from a site as quickly as possible. Rainwater can be harvested by simply capturing water during a rainfall event for reuse, such as watering the garden, the lawn, washing the dog, or other purposes. It is important to note harvested rainwater is not potable and should not be used for drinking or cooking.



Fig. 1. Five-thousand gallon cistern to collect rainwater and reuse for street sweeping and truck washing at Parsippany-Troy Hills. Department of Public Works facility. Photo credit: Pat Rector.

Rainwater harvesting can be a large-scale collection of thousands of gallons of water in a cistern (Fig. 1) or underground tanks. In New Jersey, however, it is most commonly associated with the small-scale use of rain barrels which come in all shapes and sizes. Although rain barrel design may vary in small ways, the primary concept is the same. The focus of this fact sheet is on the closed top lid or screw-on lid rain barrels described in the Rutgers Bulletin E329 Rain Barrels Part I: How to Build a Rain Barrel, or similar type rain barrels that are built or purchased. This information therefore will be applicable to many of the rain barrels generally in use in New Jersey. This design concept is simple, it includes drilling two holes in the barrel, one for a faucet and one to screw in an overflow hose adapter. Both are then secured by attaching an electrical conduit locknut to the hardware on the interior of the rain barrel (Fig. 2). When using the screw top lid type barrel a piece of fiberscreen is placed on the top of the barrel and then held on by screwing on the lid (Fig. 3). If using the closed top barrels it is suggested that the screen be placed over the top of the barrel, hanging over the sides and held in place with a bungee cord. The rain barrels discussed in the fact sheet are reconditioned 50–60 gallon food grade



Fig. 2. Parts of a rain barrel. Poster by Teresa Duckworth and Pat Rector.

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drums made of a high-density polyethylene (HDPE). The barrel is used to collect rainwater from a roof via the gutter's downspout (Fig. 4).



Fig. 3. Screens visible on rain barrels. Photo: Pat Rector.

Rain barrels are a relatively inexpensive and an easy-to-install tool to reduce residential stormwater runoff and promote water conservation efforts. During a 1.25 inch rain event, approximately 600 gallons of water will drain from an 800 square foot roof area (Bakacs and Haberland, 2010). Most rain events in New Jersey are less than 0.5 inches, yielding 240 gallons or less from an 800 square foot roof. To handle this volume of water, several rain barrels can be linked together with a garden hose attached to the overflow directing it to a pervious surface such as the garden or lawn, thereby allowing the excess water to infiltrate into the ground. Rainwater harvesting can reduce the amount of water impacting our streams significantly if installed at a community scale. Further, we can reuse that water,making our homes more sustainable. However, standing water in rain barrels may become a source for mosquitoes, therefore mosquito control agencies have raised concerns regarding the proliferation of rain barrels in urban and residential landscapes.



Fig. 4. Rain Barrel installed. Photo: Ron Czajkowski.

Mosquito Facts

There are over 3,500 mosquito species worldwide, 176 in the continental United States, and 63 in New Jersey. Only female mosquitoes bite and do so to acquire blood to obtain enough energy to produce eggs. For day-to-day nutrition both male and female mosquitoes feed on plant nectar, plant sap, or other sugary substances; blood is not food for adult mosquitoes and humans are not the primary source of blood for most mosquitoes. Instead, specific mosquito species specialize on birds, reptiles, amphibians, or various mammals. However, several mosquito species, including non-native species, thrive in human environments leading to increased likelihood of human feeding. While mosquitoes are a nuisance, they can also spread diseases such as West Nile virus (WNV), eastern equine encephalitis (EEE), dengue, chikungunya, and malaria. Mosquitoes can also transmit diseases to our pets and livestock such as dog heartworm, WNV and EEE.

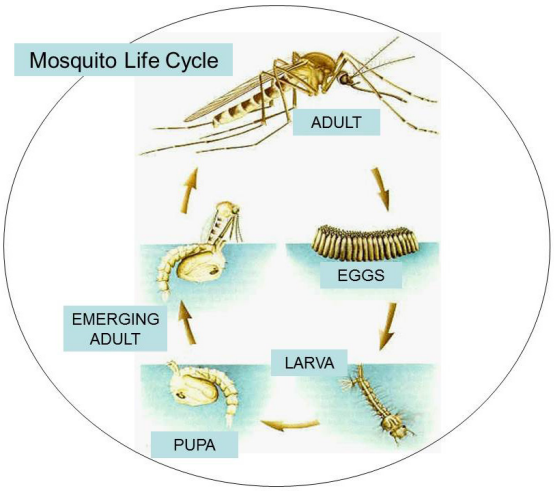


Fig. 5. Mosquito Life Cycle.

While each mosquito species has its unique characteristics, life-cycle (see Mosquito Life Cycle section below), and behavior, one common trait shared by most is that their immature stages (larvae and pupae) live in water. Mosquitoes use a variety of habitats in which to lay their eggs. Some natural mosquito habitats are wetlands, water-filled tree holes, and ponds. However, as mentioned, a few species now exploit human-created water environments such as ornamental ponds, catch basins, stormwater facilities, gutters, buckets, discarded trash and tires – literally any container that can catch and hold water for a week or so. Mosquito larvae are not found in moving water or in the open areas of ponds and lakes. Fish are excellent predators of mosquitoes and the two rarely co-exist.

Mosquito control in New Jersey is based on the concept of Integrated Pest Management and is conducted at the county level with support from the Office of Mosquito Control Coordination, the State Mosquito Control Commission, and Cooperative Extension programs at Rutgers University. Mosquito control programs utilize education, water management, biological control and regulated pesticides. Mosquito pesticides can be divided into two classes, those that kill larvae (larvicides) and those that kill adults (adulticides). All individuals applying pesticides for professional mosquito control agencies in New Jersey are trained and licensed to perform these activities.

Mosquito Life Cycle

Mosquitoes, are a type of fly, belonging to the insect order Diptera, and undergo complete metamorphosis (refer to Fig. 5 for the complete life-cycle). The females in some mosquito species deposit groups of eggs known as rafts, while others deposit eggs individually. Some must deposit their eggs directly on the water's surface while others deposit them in moist areas where they may be inundated with water at a later time. Some eggs hatch in 48–72 hours but others can sit dormant for months or years before hatching. Once the eggs hatch, larvae go through four stages or 'instars,' molting between each stage and are often referred to as "wrigglers". Most mosquito larvae feed on bacteria or other microorganisms in suspension in the water or on surfaces, but a few are actually predators and will eat other organisms in their environment. Larval mosquito growth is dependent on food availability and temperature. Generally the warmer the water the faster the mosquito proceeds through its growth cycle. The fourth larval stage molts into the pupa and is equivalent to the chrysalis stage of a butterfly. Unlike the chrysalis, mosquito pupae are very active and can move (tumbling) up and down in the water column. When the adult is formed in the pupa, the pupal skin splits at the water's surface and the adult slowly forces itself out, resting temporarily on the surface before taking flight. In the warmest weather some species of mosquito can proceed from egg to adult in 5–7 days.

Locating Larvae in Rain Barrels

If water remains after 72 hours, the rain barrel should be checked for mosquito larvae. However, in the early stages of development mosquito larvae are small and difficult to see. As the larvae grow larger it is usually possible to spot them with the naked eye. The small vertical larvae will come to the surface of the water to breathe. The larvae can also be seen "wriggling" in the water while the 'C' shaped pupae is usually found "tumbling" just beneath the surface of the water (Fig 6.). To check for larvae or pupae use a white cup or container to scoop some of the water out of the rain barrel to provide a clear background while checking the water for mosquitoes. Do not wait until you start seeing pupae before acting because the presence of pupae heralds adults, which are much harder to control. During hot New Jersey summers some mosquito species that thrive in containers in backyards, such as the Asian tiger mosquito, can develop from egg to adult in one week.



Fig. 6. Mosquito larvae and pupae. Immature mosquitoes (larvae and pupae) are visible against white background. Photo: William Karlak.

Keeping Your Rain Barrel Mosquito Free

The best way to keep a rain barrel mosquito-free is to accept the potential for it becoming a mosquito habitat and build and maintain the rain barrel accordingly. Rain barrels should be designed and constructed to prevent mosquitoes from entering to lay their eggs. Rain barrel owners should be vigilant about draining their barrels frequently; this will help to prevent mosquitoes or algae and provide room to capture the next rain event. They should also occasionally be disinfected with a mild solution of bleach to reduce the microbial community, which can lead to bad smells and attract mosquitoes.

These guidelines are recommended by Rutgers Cooperative Extension for the building and maintenance of rain barrels:

- The top of the barrel should be covered with window screening material that tightly fits to prevent access to the harvested rainwater. Such screening can be purchased at hardware stores.
- A garden hose that is at least 8–10 foot long should always be attached to the overflow adaptor. This length will discourage mosquitoes from traveling up the hose in search of water. To further prevent mosquitoes from entering through this opening,

attach a small piece of screen on the inside of the hose adapter with a ¾ inch electrical conduit locknut (Fig. 7).

- As mentioned above, mosquito larvae require access to air. You can suffocate them by adding several tablespoons of cooking oil that will float on the surface of the water and prevent their access to air. A 1/8 inch layer will be enough. An alternative and effective way to control mosquitoes inside rain barrels is to add Bacillus thuringiensis israelensis (Bti) often sold as a Mosquito Dunk. Bti is a naturally occurring soil bacteria that is used in mosquito control. It is ingested by the feeding larvae. Mosquito Dunks are labeled for use in animal watering troughs, bird baths, rain barrels, and roof gutters.
- Using the water for the garden or other intended uses shortly after a rain event assures there is space to capture rain water from the next rain event, while also depriving mosquitoes of habitat. Clean the barrel with a dilute bleach solution occasionally and rinse, this will remove available food for the mosquito larvae and make the barrel less attractive to the females looking for places to lay eggs. Standing water is always a lure for mosquitoes. Follow the above recommendations and check frequently for mosquito larvae in the rain barrel to help prevent adult mosquitoes from developing.
- Rain barrels should be removed in the winter and placed in a storage shed or turned upside down and secured (see FS1118).

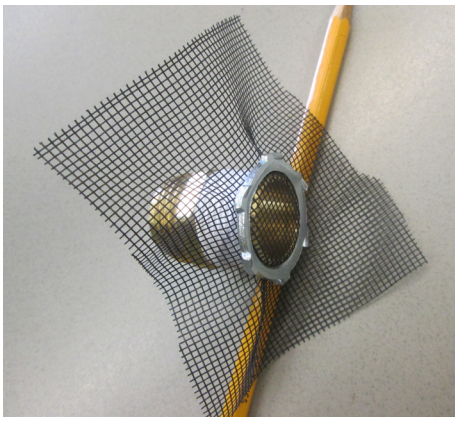


Fig. 7. Screen attached to overflow adapter. Photo: Sara Mellor.

Contacting Your Local Mosquito Control Agency

For further information or to report a mosquito control issue contact your local mosquito control agency. The NJDEP Office of Mosquito Control Coordination has set up a hot line for the public to reach their local mosquito agency. Dial 1-888-666-5968 or 1-888-NO-NJ-WNV. In addition, complete NJ state information on mosquitoes, including a list of county mosquito control agencies throughout NJ, is available online at nj.gov/dep/mosquito/index.html.

Resources

Bakacs, M., A. Boyajian, and M. Haberland. 2010. Rutgers NJAES Bulletin E329 Rain Barrels Part I: How to Build a Rain Barrel. Rutgers Cooperative Extension. New Brunswick, NJ 5 pp. njaes.rutgers.edu/pubs/publication.asp?pid=E329.

Bakacs, M. and M. Haberland. 2010. Rutgers NJAES Fact Sheet FS1118 Rain Barrels Part II: Installation and Use. Rutgers Cooperative Extension. New Brunswick, NJ. 3pp. njaes.rutgers.edu/pubs/publication.asp?pid=FS1118.

Frequently Asked Questions About Mosquitoes. Wayne J. Crans. Rutgers Cooperative Extension. New Jersey Agricultural Experiment Station. NJAES Publication No. H-40400-01-98.

Controlling Mosquitoes Around the Home. Wayne J. Crans and Farida Mahmood. Rutgers Cooperative Research and Extension. NJ Agricultural Experiment Station. Published October 1994. NJAES Publication No. H-40101-01-94.

Mosquito Dunk information is available at summitchemical.com/wp-content/themes/SUMCHM/images/Dunks_Front_NEW_out-12-7-08.pdf.

New Jersey Mosquito Control Association website. njmca.org.

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