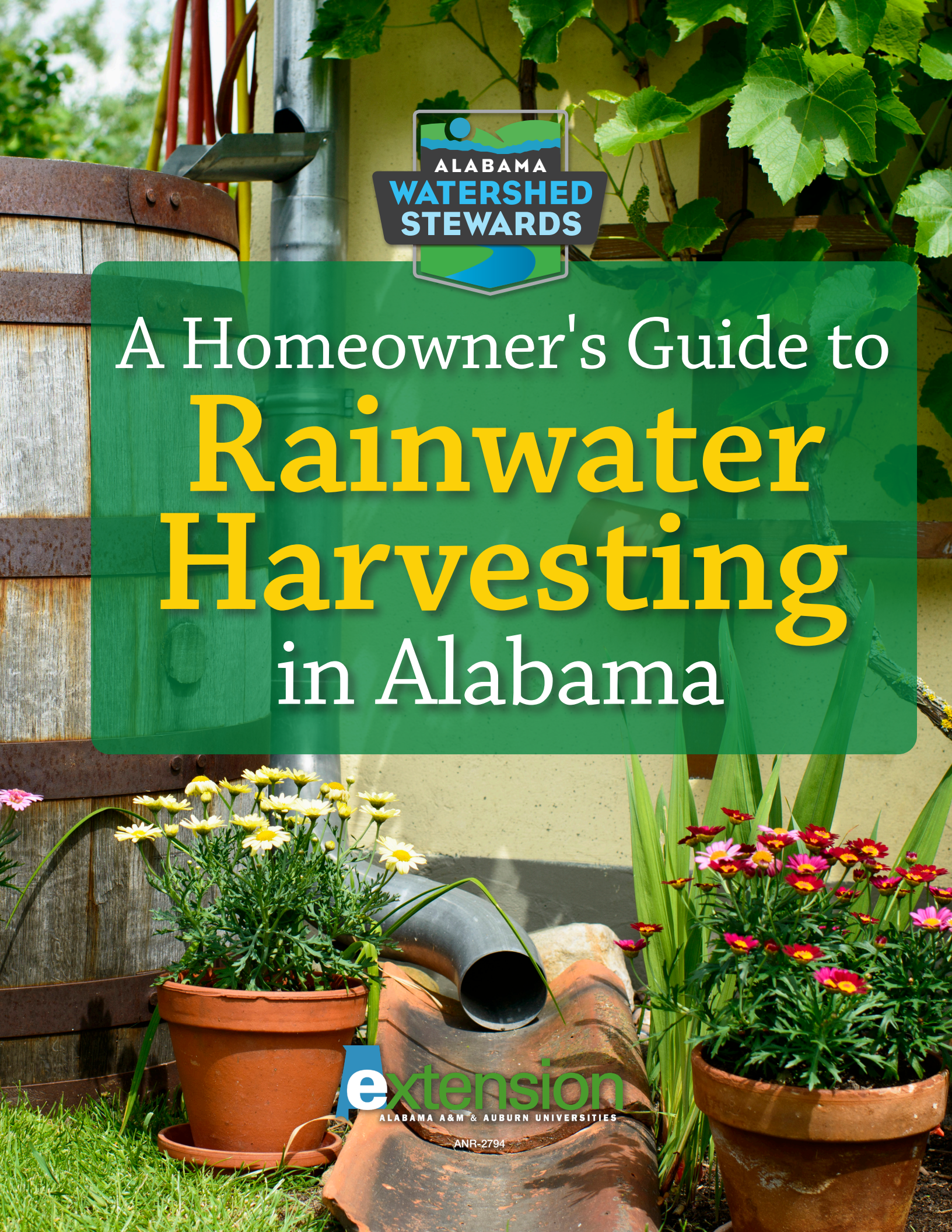

A Homeowner's Guide to Rainwater Harvesting in Alabama

extension
ALABAMA A&M & AUBURN UNIVERSITIES
ANR-2794

About this Guide

You will learn the basics of small-scale rainwater harvesting including how to design and build your own rain barrel in a watershed-friendly home landscape.

The information presented draws heavily from the Carolina Clear *Rainwater Harvesting for Homeowners* manual.[1] We are grateful to Clemson University Extension for permitting their resources for adaptation to Alabama.

Rainwater Harvesting in Alabama was created as part of the Alabama Watershed Stewards Program (AWS), an educational training developed by the Alabama Cooperative Extension System in cooperation with the Alabama Department of Environmental Management, US Environmental Protection Agency (EPA), Alabama Water Watch with the Auburn Water Resources Center, and other local and regional partners. The purpose of AWS is to promote healthy watersheds, increase understanding of potential causes of water pollution and resource degradation, and provide the knowledge and tools needed to prevent and resolve water-quality problems.

This project was funded by the Alabama Department of Environmental Management through a Clean Water Act Section 319(h) nonpoint source partnership grant provided by the US Environmental Protection Agency Region 4 (Southeast).

New August 2021, ANR-2794

www.aces.edu

A HOMEOWNER'S GUIDE

TO RAINWATER HARVESTING IN ALABAMA

AN ALABAMA WATERSHED STEWARDS PROGRAM PUBLICATION

LAURA BELL, Project Coordinator

EVE BRANTLEY, Extension Resources Specialist and Professor

NAOMI PITTS, Watershed Program Assistant

CAITLIN SWEENEY, Watershed Program Assistant

All with Alabama Extension Water Program, Auburn University

Special thanks to **RHONDA BRITTON,** Regional Extension Agent, for her contributions to this handbook.

Table of Contents

Chapter 1
Benefits of Rainwater Harvesting

Worldwide water consumption is rising at double the rate of the population; however, the amount of fresh water remains at only 2.5 percent of the world's water resources.[2] Thus, harvesting rainwater on-site has many benefits:

- Reduces stormwater runoff and associated negative impacts of flooding on downstream water quality in highly urbanized areas
- Helps with water conservation and reduces demand on public water supply
- Prepares for times of drought
- Assists with water management in flood- and erosion-prone areas in the home landscape
- Saves money on utility bills for irrigation
- Is better for plants that prefer rainwater, which does not contain chlorine by-products like treated public water does

REDUCING NEGATIVE IMPACTS OF STORMWATER RUNOFF

Impervious areas, such as roads, rooftops, and sidewalks, leave water with limited opportunity to soak into the ground. When rainwater is not captured for reuse or directed to a pervious area, it runs off and is channeled into nearby storm drains, ditches, and other conveyance devices.

As rainwater travels along impervious surfaces toward storm drains, it picks up pollutants that were left behind on the landscape. These pollutants include sediment, litter (like cigarette butts), fertilizers, pet waste, yard debris, oils, and many other contaminants. These pollutants then get washed away untreated into local streams and rivers at higher volumes, eroding stream banks and polluting the beaches and rivers where we swim, fish, and get our drinking water. This type of pollution is called "stormwater pollution," and it is the greatest threat to our nation's surface waters according to the US Environmental Protection Agency.[3]

Figure 2. Urban stream with eroded stream bank and little vegetation

Increased impervious areas can lead to localized flooding issues. Less water soaking into the groundwater table also prevents typical groundwater recharge.

Conventional stormwater practices focus on the immediate removal of stormwater from communities into conveyance pipe networks, which typically take stormwater to nearby waterways. As urban areas in Alabama expand and redevelop, the increase in stormwater flows can place tremendous pressure on aging infrastructures. Harvesting rainwater helps by slowly releasing water back into the ground.

Figure 1. Point source pollution

REDUCING AMOUNT OF DRINKABLE WATER USED FOR OUTDOOR IRRIGATION

Did you know that the average American family uses 320 gallons of water per day, about 30 percent of which is devoted to outdoor uses? More than half of outdoor water use is for irrigation of lawns and gardens.[4] Additionally, a considerable amount of energy is required to deliver and treat the water. For example, letting a faucet run for 5 minutes uses about as much energy as keeping a 60-watt light bulb turned on for 14 hours.[5]

The average annual rainfall amount in Alabama is 56 inches.[6] This amount is not guaranteed, however, and long dry spells are common. The impact of climatic events can be reduced through planning, preparing, and helping to recreate the natural hydrology cycle that is disrupted by urbanization. Rainwater harvesting is just one of many ways citizens can help replenish groundwater and reduce nonpoint source pollution.

Figure 3. Stormwater can pick up oil from parking lots and enter a storm drain that flows to a local waterway.

Figure 4. Toxic chemicals (paint) are washed into a storm drain, ending up in local waterways.

Does Owning a Rain Barrel Pay Off?

Through a series of case studies it was estimated that if 25 percent of the population in a watershed adopted rainwater harvesting practices, a number of ecological and human health benefits, including reduced use of fresh surface and groundwater, could be gained. Potential maximum lifetime energy cost savings were estimated at $5 million from domestic rainwater harvesting in one watershed and $24 million from agricultural rainwater harvesting in another.[7]

The United Nations' World's Cities report notes, "By 2030, urban areas are projected to house 60 percent of people globally, and one in every three people will live in cities with at least half a million inhabitants." Now imagine how these large cities will change urban hydrology and impact stormwater pollution.[8] Fortunately, we can all take small steps to have a big impact.

Chapter 2
Basics of Rainwater Harvesting

WHAT IS IT?

Rainwater harvesting is the collection and storage of rainwater in a container or in the landscape through a designed practice. Rainwater is usually collected from rooftops, greenhouses, sheds, and other relatively clean surfaces. This stored water can be used for irrigation, washing cars, and flushing toilets.

Harvested rainwater should only be used for drinking water if system treatment components have been included. Water purification requirements vary with state and local ordinances, and systems must be inspected by local authorities.

All rainwater harvesting systems are comprised of the following:

- Catchment area (roof) where rainfall is collected
- Conveyance system (gutters, downspout, rain chain, or sheet flow), which helps to transport water
- Storage system (rain barrel or cistern), which holds the water for later use

Though rain barrels and cisterns differ in size and shape, both are rainwater harvesting systems, and the main components remain consistent. Rain barrels commonly are used to harvest rainwater since they typically are more readily available for purchase and relatively inexpensive. Barrels are used for small-scale rainwater harvesting and sized to hold less than 100 gallons. With the right tools, a rain barrel can be built for less than $20.

Figure 6. Rain barrels

Figure 5. Catchment roof with gutters leads water into a conveyance PVC pipe, transporting water into a cistern.

Figure 7. Rain barrel made out of recycled syrup barrel, placed upside down with a PVC connector

Figure 8. Smaller decorative ceramic rain barrel with filter

Rainwater can be harvested on a larger scale through the use of cisterns. A cistern is a storage tank with a storage capacity of more than 100 gallons. Cisterns come in all shapes and sizes, can be made of a diverse array of materials, and may be installed either above- or belowground. Cisterns tend to be more complex than rain barrels; they typically employ some type of filtration system to remove pollutants before they reach the tank, and they often require a pump system to convey the water across the landscape.

Because professional help is often needed to install large-scale cisterns, this guide focuses on do-it-yourself smaller rain barrels. For more information on cisterns, see *Rainwater Harvesting for Irrigation Water*.[9]

Figure 9. Cistern at Little River Canyon, Mentone, Alabama

Figure 10. A 1,000-gallon rain tank, Moulton, Alabama

Figure 11. A 3,000-gallon rain cistern, Moulton, Alabama

Figure 12. Cistern collecting rooftop rainwater through gutter system

Figure 13. Rainwater harvesting tank with downspouts and first flush diverter

Did You Know?

A 1-inch rainstorm falling on a 1,000-square-foot rooftop (almost half the size of a tennis court) will generate over 600 gallons of runoff. To visualize, imagine filling one and a half hot tubs with water after a 1-inch rain event!

RAINFALL IN ALABAMA

Most of Alabama experiences a humid subtropical climate, with very hot summers, mild winters, and precipitation throughout the year. Alabama is vulnerable to thunderstorms, tropical storms, floods, and droughts. Figures 15 and 16 demonstrate Alabama's rainfall amounts in a given year across the state.

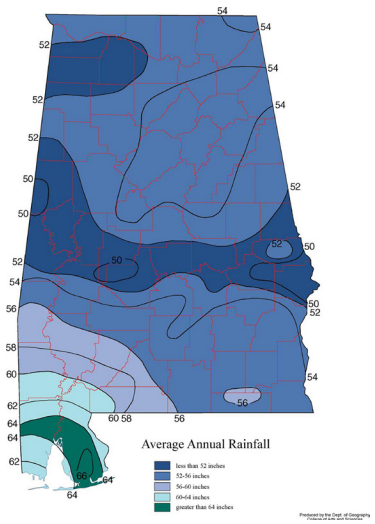

Figure 15. Average annual rainfall in Alabama. (Photo credit: ADECA-OWR)

As stated previously, the average yearly precipitation in Alabama is 56 inches. With frequent thunderstorms and tropical storms in the summer, the coast is wetter than the interior, receiving 60 inches (152.4 millimeters) of rainfall. August to October tend to be the hottest and driest periods in the northern and central portions of Alabama. During these months and in times of encouraged water restrictions, having a rainwater harvesting system has additional benefits.

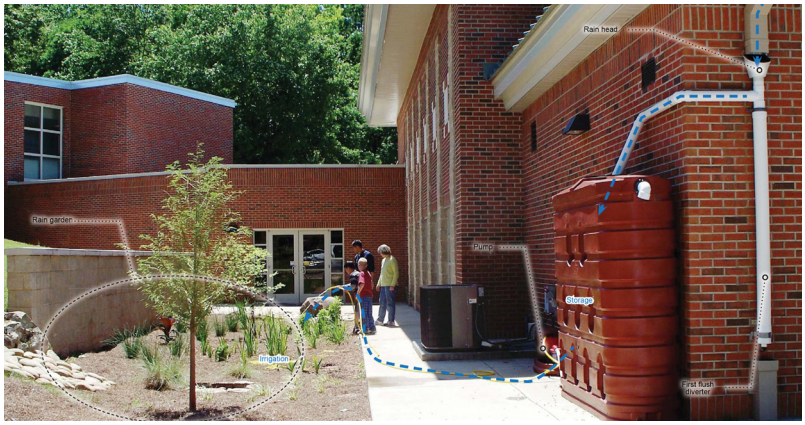

Figure 14. Cistern in use with a rain garden. Note the prefiltration devices on the right including the first flush diverter and rain head collecting water from the downspout.

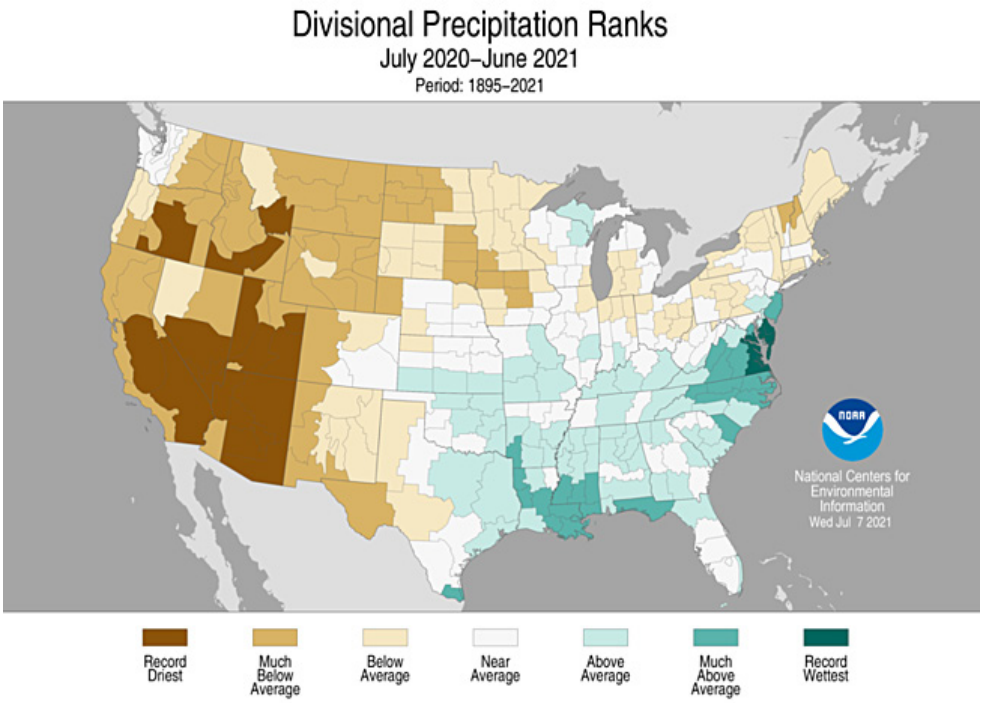

Figure 16. County precipitation ranks, February 2020. Credit: National Oceanic and Atmospheric Administration

To estimate how many gallons of water you can harvest from your rooftop over the course of a year, or during a single rain event, fill in the following equation:

___ catchment area (ft.^{2}) × ___ rainfall (inches) × 0.5* (gallons per foot) = ___ harvested water (gallons)

**Collection efficiency is affected by leaks, wind, rainfall rate, etc. During a slow, gentle rain, with no leaks in the system, collection efficiency is about 95 percent. During a very fast, heavy rain, the efficiency would be closer to 50 to 75 percent because gutters overflow and gutter covers are overrun with water.*

You can refer to Alabama Extension's *Rainwater Harvesting for Irrigation Water*[10] to estimate how much water you may need to harvest to irrigate a 2,000-square-foot vegetable garden.

Figure 17. Heavy rainfall. (Photo credit: Vidar Nordli Mathisen, Unsplash)

Chapter 3
Planning Ahead

MOVING WATER FROM ROOFTOP TO RAIN BARREL

Gutter or no gutter, you can still harvest rainwater from your rooftop. Gutters are an easy transport mechanism that can be modified to direct rainwater directly into your barrel (figure 18).

Rooftop runoff can be directed to either vegetated areas (like a rain garden) or to a rain barrel or cistern by redirecting gutter downspouts. A good plan is needed for your entire project prior to disconnecting and redirecting the downspout.

Without a gutter, you can collect rainwater in the corners of your eaves where rain concentrates or utilize a rain chain to direct water into your rain barrel. Observe the path that water travels on your rooftop during a rain event.

Rain chains can be both useful and artistic elements in the home landscape. Designs vary from simple to complex (figure 19). Manufactured rain chains are attractive ways to direct rainwater but can be expensive. Chains available at the local hardware store can be as effective and less costly, but they have a different aesthetic. We suggest finding alternatives to copper as a means to transport rainwater since some research suggests that trace copper in water can have a negative impact on fish.[11]

Figure 18. Gutter and downspout directing water to ground. This would be a potential area to intercept water from a downspout and transfer it to a rain barrel or cistern.

Figure 19. A rain chain is used to direct rain to a rain barrel. (Photo credit: Ken Mayer)

IDENTIFYING WHERE TO INSTALL

Once you have identified how water is collected from your roof, you can identify where your rain barrel will be placed and how you will use your captured rainwater.

1. Select downspouts or corners/eaves where water will be captured. Make sure you install an appropriately sized container and have space to direct overflow.

2. Determine a plan for water use based on landscape needs. Ideally a rainwater harvesting system does not sit full and is emptied in between rain events. A rain barrel should be located in close proximity to where the water will be used for irrigation. Water needs vary with weather, plant requirements, soil type, and sun or shade conditions. In drought conditions, categorize

your plants based on water requirements. Harvested rainwater may be used first on priority plants that define the landscape. These may include heirloom, fruit, and vegetable gardens.

3. Map it out. It may help to print out an aerial view of the building where rooftop square footage can be estimated, downspouts can be located, and the catchment area and surrounding landscape are easily viewed. Alternatively, you can walk the property to identify downspouts and estimate catchment areas with a tape measure.

Figure 20. Consider installing your rain barrel near plants where it can be used.

Figure 21. This yard with vegetation could benefit from a nearby rain barrel for watering plants.

4. Consider using first flush diverters. If installing a cistern or larger-scale rainwater harvesting system, a first flush diverter should be considered. Dust, bird droppings, and tree debris can accumulate on the roof and other catchment surfaces between rain events.

A first flush diverter is a pipe that catches the first flush of water and has a plug or trickle drain on the bottom. Once this pipe fills up with the initial water, the remaining water bypasses the pipe and runs directly to the storage container. The plug at the end of the first flush diverter should be removed and the pipe drained after each rainfall event; if there is a trickle tube, the water will slowly clear from the tube.

Rain barrels typically do not require a first flush diverter since the inside of a rain barrel can be cleaned. If you are interested in these, however, you can find more information on how to size and install first flush diverters in *Rainwater Harvesting for Irrigation Water*.[12]

Figure 22. Olive barrel with overflow pipe to divert excess overflow away from foundation

PREPARING YOUR SITE

Once you have selected a location and identified a rainwater harvesting purpose, you will need to prepare your site.

Before disconnecting your downspout, you must estimate the height of your rain barrel. Clear the area of debris and create a stable surface. The ground should be level; if a platform is being built, that also should be a stable surface that can support a significant weight. A full 55-gallon rain barrel will weigh over 450 pounds! This is not something to be taken lightly. You want to ensure that the full rain barrel will not tip over and cause damage or injury.

Platform examples include stacked cinder blocks, stacked square paving stones, or a wooden platform. Here are some tips:

- A stable arrangement of cinder blocks makes a great platform for 60-gallon tanks but is not ideal for larger tanks as the blocks can easily shift.
- Pressure-treated 4 × 4–foot lumber laid out in alternating rows is a great option for a platform.
- Be sure that your platform is strong enough to withstand the weight of a full tank. Tanks are light when empty, but a full tank can weigh thousands of pounds. It is better to overbuild a strong platform than to underbuild a platform that will fail.

Raising your rain barrel will provide pressure coming out of the spigot. Just like water towers, rain barrels gain pressure by gaining height. A water level of 2.31 feet above its exit point will produce 1 psi (pounds per square inch). A rain barrel should be raised at least high enough to place a watering can or bucket under the spigot.

Figure 23. Hand-watering seedlings

Most likely you will use your rain barrel to water by hand with a watering can or garden hose. The pressure generated from a small rain barrel will not be adequate to operate an in-ground sprinkler system or low-volume device such as a mist sprayer.

A soaker hose or drip irrigation system is an option if the water is applied in close proximity to the rain barrel and the rain barrel is elevated. For the soaker hose, water will leach out very slowly unless you remove the pressure-reducing washer to allow more water to flow through (this is the round insert at the beginning of the hose). Drip irrigation systems should have adjustable nozzles to regulate the rate of flow.

Due to the low volume of water stored in a rain barrel, a pump is not typically used. If considering a pump for a cistern, review *Rainwater Harvesting for Irrigation Water*.[13]

Figure 24. Make sure your platform is level before installing the rain barrel. Pea gravel can be used to create a supportive and easily leveled platform.

Figure 25. Make sure your rain barrel base is both level and secure. Elevating your barrel will increase your water pressure.

Figure 26. Rain barrel examples

Chapter 4
DIY Rain Barrel Construction

Rain barrels are available for purchase at many stores and online as well as sold inexpensively through environmental conservation organizations. To save costs and travel, it is important to consider what barrels are available to you locally. If considering the build-your-own option, check with feed supply stores and food distributors; many will sell previously used food-grade barrels. Here you have an opportunity to collect rainwater and reuse something that otherwise would have ended up in a landfill.

In this chapter, instructions are provided for making your own rain barrel from two different and readily available barrel types:

Pickle or Olive Barrel (figure 27)

Advantages

- The screw-top lid makes the top screen more secure than other options and can make the barrel more accessible for maintenance (depending on design).
- Dark-colored barrels reduce algae growth and camouflage well.
- If you do not own a jigsaw, this barrel design saves money on tools as the top is already removable.

Disadvantages

- It may be less available than a sealed barrel.
- It may be more expensive than a sealed barrel.

Figure 27. A pickle or olive barrel has a screw top and is typically orange, black, gray, or tan.

Soda Barrel (figure 28)

Advantages

- It is typically less expensive and more readily available than the screw-top barrel.
- There is more flexibility in how you open the top of the barrel. Depending on your design and need, you can have the plastic surface mostly intact, which is stable and safe.

Disadvantages

- Depending on how you cut the top, maintenance could be difficult.
- If you choose to completely remove the top, the screen and bungee cord design (shown later) could be a hazard if wildlife, cats, or children have access to the top of the rain barrel.
- The blue color may be difficult to camouflage.
- White or light barrels need to be painted a darker color to reduce algae growth.

Figure 28. Repurposed soda/syrup barrel collecting roof water. These barrels are sealed at the top and are typically blue or white.

POINTS TO CONSIDER

Whether you are purchasing a manufactured rain barrel or building your own, addressing the following considerations will help ensure that your rain barrel functions as intended.

WATER QUALITY AND WATER USE

Water-quality tests on the runoff from both an asphalt-shingled roof and metal roof showed quality suitable for irrigating vegetables. If you are concerned about the quality coming out of the rain barrel, you can always use a first flush diverter and/or have this water tested. Remember, this water is not for drinking, cooking, or other potable use without further treatment.

MOSQUITOES

Some species of mosquitoes breed in water-filled containers and require approximately 7 days to go from harmless egg to major annoyance. To minimize mosquitoes, your rain barrels should be completely screened or sealed. You also can use mosquito dunks to prevent them from developing in your rain barrel.

OUTFLOW SIZE

It is important to provide a path for water to exit the rain barrel once it is full. In the designs you'll notice there are two sizes of hole-boring drill bits. The larger hole-boring bit is for rain barrel overflow. Be sure to direct overflow at least 10 feet away from your home and preferably into a pervious area such as a landscaped bed or rain garden. Water should never be directed toward a septic system adsorption field.

SCREENING OUT DEBRIS

Leaves, twigs, and other items can get into your rain barrel and clog the spigot. A secure screen prevents mosquito breeding and assures higher water quality with less maintenance. A rain barrel should never have an open entry point with no screening.

If you are on a heavily wooded lot and have debris frequently accumulating on the top of your rain barrel, consider other available screening options. These include leaf screens and leaf guards that affix to the gutter, funnel-type downspout filters that have built-in screens, and strainer baskets that fit over the exterior of the downspout.

SAFETY

Small pets or children could fall into a rain barrel if the opening is unsealed or open, so be sure that screening is secure to prevent accidental entry. If you are using a pickle barrel, you might leave the insert below the screw top in place and drill larger holes through the insert to allow water to filter in and provide a stronger surface. The screen would still be used between the insert and the screw top. For sealed barrel designs, you may opt to keep the top and instead insert and cement a grate or pool filter (or similar fixture) that can directly receive runoff from the downspout.

Do children have access to the top of the barrel? If so, additional considerations are needed. This is described further in the second sealed barrel design.

ROOF PRODUCTS

If you use a moss-control product on your roof, be sure that it is garden safe before harvesting this runoff. Removing debris as it accumulates on the roof surface will reduce the amount of material that can be washed into the gutters and rain barrel.

FOOD SAFETY

You can definitely use your rain barrel for irrigation on edibles, but using a drip irrigation is a safer way to avoid any contaminated water from getting onto your established vegetables. There are important maintenance and conveyance considerations to keep in mind (see tables 1 and 2).

For consumption by pets, wildlife, and humans, safety depends on what the rainwater contacts before it is consumed. Raindrops are pure, acquiring slight acidity as they fall through the air. Once in contact with your roof and container, however, rainwater is changed by dust, dirt, plant material, fecal matter from birds and rodents, pollen, and so on. Collected rainwater is *not* suitable for consumption or direct human contact without further treatment.

RETROFITTING A RAIN BARREL

Suppose you have a commercial rain barrel but the overflow is small (¾ inch). Based on rainfall amounts in Alabama, we advise that the rain barrel be retrofitted (according to the steps identified in each design) to accommodate a larger overflow of at least 1¼ inch.

Table 1. Design and Maintenance of Rainwater Harvesting Systems to Irrigate Edibles

Cistern or Rain Barrel	Management Strategy	Recommended Practices: Design and Maintenance
Rain Barrel	Prevent exposure to potentially harmful chemicals.	When building your own rain barrel, be sure that the barrel is food grade and never transported chemicals.
Rain Barrel	Disinfect using chlorine application recommendations if concerned about the quality of water in a rain barrel. Note: chlorine will kill beneficial microbes in the soil and should be used sparingly and only when necessary.	Before irrigating a vegetable garden, add unscented bleach with a 5% to 6% chlorine solution at a rate of ⅛ teaspoon per gallon to the harvested water. After treatment, let water stand for 24 hours before applying to vegetables.
Both	Prevent accidental ingestion of untreated water.	Label spigot with "Do Not Drink" or other nonpotable-water message. Use hangtag or sticker. Make sure language is culturally appropriate.
Both	Prevent insects and small animals from entering the tank.	Make sure that screening, point of entry, and top are secured.
Both	Remove leaves, twigs, sediment, and other forms of debris that may contaminate water.	Clear debris from gutters and downspouts at least twice a year.
Rain Barrel	Remove leaves, twigs, sediment, and other forms of debris that may contaminate water.	Clear debris from screened inlet at least four times a year.
Cistern	Remove leaves, twigs, sediment, and other forms of debris that may contaminate water.	Clear debris from downspout filter, basket filter, vortex filter, and/or first flush diverter at least four times a year.
Both	Maintain healthy soils, which have greater ability to offset risk.	Add compost and other amendments rich in organic content.
Both	Use harvested rainwater regularly to prevent stagnation and associated water-quality degradation.	Use the water!

Table 2. Application of Harvested Rainwater on Edibles

Management Strategy	Recommended Practice
Allow time for solar treatment.	Apply water in the morning. Do not apply water the day of harvest.
Decrease direct contact of potential pollutants in harvested rainwater with plants and fruit.	Do not apply water directly to plant (foliar application); apply instead to soil around the plant base. Apply with drip irrigation or other method that applies water to soil (ex. watering can).
Prevent ingestion of harmful materials such as bacteria.	After harvest, wash fruits, vegetables, and herbs thoroughly with cool, potable/treated water. Store at proper temperature. After hands or other body parts have had direct contact with harvested rainwater, wash thoroughly with soap and potable/treated water.

GETTING STARTED

CHOOSE YOUR BARREL

When selecting a barrel, only use one that has contained food-grade materials (nonmeat preferred). Other types of barrels are sometimes used for chemicals such as commercial soaps, which may not be safe for your plants or the environment.

You can often find food-grade barrels for reuse and retrofitting through feed supply stores, soda companies, Craigslist, Facebook Marketplace, and farmers who have them for sale. The two design options featured here use (1) a pickle or olive barrel and (2) a screened-top soda barrel.

CLEAN YOUR RECYCLED BARREL

Before you begin, you need to rinse out the barrel with a hose. If there are lingering odors, add 2 teaspoons of castile soap and 2 teaspoons of lemon juice or vinegar for every gallon of water used to clean your barrel. Using commercial cleaning products or bleach is less preferred due to potential impacts to soil and plants that will come in contact with the water stored in the rain barrel.

Castile soap can be found at many grocery stores. It is a multipurpose soap made of fats from vegetable origins versus animal origins; it will easily rinse out and not harm the environment like other cleaners could.

CHOOSE YOUR DESIGN

How you construct your rain barrel can be very specific to your needs and interests. The designs featured here are found to be useful and effective for residential and small-scale rainwater harvesting and reuse. There are many ways to harvest rainwater, however, so do not feel restricted to these designs. No matter how you choose to construct your barrel, there are four components that should always be present:

1. The food-grade barrel you will use to collect the rainwater

2. An inlet that is designed to allow rainwater into the barrel but keep out twigs, leaves, mosquitoes, and potentially other creatures

3. An outlet you can turn on and off to drain your water

4. An emergency overflow that directs water away from your home and to an infiltration area when the barrel is at capacity

GATHER YOUR TOOLS

For the most part, the standard tools you'll need are the same for all the featured barrels. Exceptions will be noted with each design.

- Two hole-boring drill bits: 1½ inch and 1 inch. You can use a paddle drill bit, but for those new to power tools we find the boring drill bit much easier to work with.
- Adjustable channel lock pliers
- Shoe rasp (a tool that can smooth edges of wood, metal, and plastic)
- Box cutter
- Scissors
- Flathead screwdriver
- Caulking gun and silicone
- Teflon tape
- Safety glasses
- Gloves, if desired

Note: This list does not include materials that may be needed to raise your rain barrel (concrete blocks for example), nor does it include downspout diverters, PVC elbows, first flush diverters, pumps, or other PVC piping that may be desired for larger irrigation systems.

If disconnecting a downspout, be sure to measure the inside diameter of the standpipe (the pipe connected to the gutter that leads underground to a sewer or other drainage system) so that the correct size rubber cap and hose clamp are purchased. If the downspout is only attached to the standpipe and a gutter, a strap or bracket should be used to attach the downspout firmly to the building once it is disconnected. Use durable materials for the elbows and extensions; avoid using corrugated plastic, PVC, dryer hose, or other materials that will degrade quickly.[14]

Figure 29. Elevated olive barrel collecting rooftop rainwater with overflow valve directed to downspout; hose connected for watering nearby plants

Figure 30. Recycled olive barrel soon to become rain barrel

DESIGN 1: PICKLE OR OLIVE BARREL

For the components of this rain barrel design, you need the following:

- Food-grade, screw-top barrel (figure 30)
- Fiberglass screen, enough to secure around the top of your barrel (2 × 2 feet), plus some extra. Do not use a metal screen as it will have sharp edges (figure 31).
- ¾-inch hose bib quarter-turn brass spigot (figure 32)
- 1-inch flat washer
- 1½-inch threaded hose adapter for 1¼-inch hose. You can find this as a set called a "universal drain kit" that has the hose clamp included as well.
- 2 × 1–inch PVC sch40 bushing
- 1½-inch hose clamp

Figure 31. Fiberglass window screen for reused olive barrel

COMPLETING YOUR RAIN BARREL

1. Using a drill and ¾-inch drill bit, make hole for spigot on flat area of barrel at minimum 1 inch below last indentation at bottom of barrel (figure 33). Remember height consideration.

2. Switch drill bits and drill larger outflow with 1½-inch bit in direction you want overflow to be directed. This style rain barrel can overflow out of the top as well.

3. Use rasp if needed to enlarge lower hole to fit spigot in tightly.

4. When hole is ready, place washer on spigot and add silicone to side of washer that is against side of barrel (if you want to use silicone). Line threads of spigot with Teflon tape if you want an extra secure fit. Apply tape in clockwise fashion, holding spigot towards you, then push in spigot.

5. On inside of barrel, secure spigot with 2 × ¾–inch female threaded plastic bushing. Tighten with channel lock pliers. It may take one person to hold spigot on outside of barrel while the other works from inside.

6. Similarly, use rasp for overflow, ensuring a tight fit.

7. When hole is ready, use silicone against flat edge of bushing to secure back of hose adaptor. Tighten with channel lock pliers.

8. For overflow, cut a small square of screen to put over hose adapter if you want; then add hose with hose clamp already on it. The screen is an extra step in preventing mosquitoes.

9. For top of barrel, cut screen size to fit under screw-top lid, which will screw over screen and be fairly secure.

10. If you used silicone, give some time (24 hours or so) for silicone to dry completely. You are now ready to install your new rain barrel!

Figure 32. Rain barrel spigot

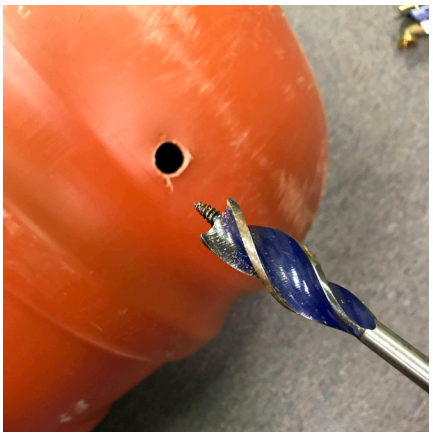

Figure 33. Use a ¾-inch drill bit to drill the hole in the rain barrel.

Figure 34. Finished rain barrel, slightly elevated, under gutter downspout

DESIGN 2: SCREENED-TOP SODA BARREL

Additions to Standard Tools and Components

- Reciprocating saw (or jigsaw)
- Sanding paper

Materials

- Food-grade, sealed plastic barrel
- Fiberglass screen, enough to secure around top of barrel, plus some (about 4 × 4 feet)
- ¾-inch hose bib quarter-turn brass spigot
- 1½-inch 45-degree PVC street elbow
- 1½ × 1¼–inch PVC male adapter and nut
- Metal snap-down barrel rim fastener. This is recommended, but, if unavailable, a 4-foot bungee cord can be used.

COMPLETING YOUR RAIN BARREL

1. Drill hole in top of barrel to accommodate reciprocating/jigsaw.

2. Use reciprocating saw to cut top off barrel (from top and not from side, about 1 to 2 inches in from rim). Trim away excess plastic shards using box cutter, and sand cut surfaces.

3. Drill a ¾-inch hole in side of barrel about 2 inches above bottom (figure 35). This will be for the spigot. Use a ½-inch brass spigot to cut threads for spigot. Another option is to use a ¾-inch tap to cut threads for spigot. You may need to install Teflon tape or silicon around spigot if it leaks.

Figure 35. Drilling spigot hole in rain barrel

4. When hole is ready, place washer on spigot and add silicone to side of washer that will be against side of barrel. Line threads of spigot with Teflon tape. Apply tape in clockwise fashion, holding spigot towards you, then push in spigot.

5. Apply silicone to flat side of 2 × ¾–inch bushing, which will secure back end of spigot. On inside of barrel, secure spigot with 2 × ¾–inch female threaded plastic bushing and tighten with channel lock pliers. It will take one person to hold spigot on outside of barrel while another works from inside.

6. Drill 1½-inch hole in side of barrel, 2½ inches below top and at 90 degrees from bottom hole. This hole will be too small for the 1½ × 1¼–inch PVC male adapter. Use a shoe rasp to enlarge hole (no more than 1/16 inch). Frequently try to screw in adapter. Leaking here will be less of a problem than with the lower assembly, but have adapter fit as tightly as possible.

7. Screw 1½ × 1¼–inch PVC male adapter into upper hole of barrel to create overflow.

8. Apply generous amount of silicone to threading of 1½ × 1¼–inch male adapter on inside of barrel.

9. Screw nut onto male adapter and hand tighten.

10. Measure and cut screening to allow 3 to 4 inches of overhang all the way around top of barrel. Do not skimp on the overhang!

11. Lay cut screen over barrel and look for any extra room on any corners.

12. Cut a circle from the extra room big enough to cover opening of the 45-degree PVC street elbow, with a bit of overhang (about 2 inches in diameter).

13. Insert screen circle into PVC male adapter overflow from the outside.

14. Insert 45-degree PVC street elbow into outer side of overflow to hold screen circle in place.

15. Lay screen on top of barrel.

16. Put rim fastener over top of screen and onto rim of barrel, loosely attaching nut and bolt.

17. Position rim fastener so that it will easily tighten without having to readjust its position.

18. Tighten screen under rim fastener by pulling screen all around the barrel.

19. Tighten rim fastener loosely and retighten screen.

20. Tighten rim fastener the rest of the way, leaving plenty of screen overhang for easier attachment after removal.

21. Give some time (24 hours or so) for silicone to dry completely. You are now ready to deploy your new rain barrel!

Chapter 5
Maintenance

Regardless of barrel type, all rain barrels require maintenance. Simple maintenance can prevent problems in the future. Following are steps to keep your rain barrel in good working order:

- Avoid letting water sit in the barrel for more than a week. The goal should be to empty the barrel in between rain events.
- Clean gutters at least twice a year, more often if you have trees.
- Completely empty and rinse your barrel at least once a year; after pollen season is a good time.
- Check for leaks at all fixtures.
- Check and clear downspout elbows.
- Caulk any gutter or downspout fixtures that may be leaking.
- If your rain barrel is a light color, consider painting it a darker color to help reduce algae growth.
- If your rain barrel is in the sun, consider relocating it to a shadier spot to help reduce algae growth and/or plant around it to yield shade.
- Check all screens regularly to be sure that mosquitoes cannot gain access.
- Clear debris on screens after heavy storms.
- Monitor where overflow is going. Is it causing erosion? If so, use plants or stone to prevent further erosion. Continue to direct overflow to permeable surfaces where the water will slowly infiltrate rather than run off.
- In the winter, if there is no demand for water, empty your rain barrel when it fills up. Be sure to empty it into a permeable section of your yard a good distance away from your home. Alternatively, store your barrel and route the rainfall to that location.

Chapter 6 Moving and Storing Water

PUMPS

There are many ways to get creative with your rain barrel and water use. A submersible pump can be handy if the area you wish to water is level to or higher than the barrel or at a great distance from it.

Submersible pumps, such as the 1/10 HP pump and 1/3 HP sump pump, have been used to push water up about 8 feet in elevation and across up to 120 feet. The 1/10 HP pump produces a very small trickle of water. The 1/3 HP pump produces a strong enough stream of water by hose (with a nozzle on it) for about a 12-foot distance.

Pumps will increase the cost of your rain barrel. Recent prices are $50 to $68 for the 1/10 HP pump and $97 to $105 for the 1/3 HP sump pump.

A sump pump will turn itself off when the water gets to a certain level in the barrel. A submersible pump, which is not a sump pump, can run dry and potentially burn itself out; therefore it must be monitored. If you purchase one, be sure that it has any attachments necessary to attach a garden hose.

Note: The electrical cord and hose will come out of the top of the barrel, so consider this when selecting a barrel top.

MULTIPLE BARRELS

Once you know how to build one barrel, you may find that you want more. If you want to capture more water, you can "daisy chain" barrels together so that when one fills up, the second one takes the excess volume. Daisy-chained rain barrels can sit alongside each other and are commonly connected with Y-connectors and pieces of flexible hose (female connector at both ends) or with PVC, but there are several alternatives.

Water seeks its own level, so as the first barrel fills, the other barrels will fill too, although more slowly. Barrels can be connected at the top overflow (figure 36) or at the bottom. If the connections are made at the top of the barrel, you will need to have an outlet on each barrel because there will be no other way to rid the water in the barrel once the water level drops. If the connections are made at the bottom, then an outlet is only necessary at the last barrel.

Figure 36. Rain barrels collecting water with gutter diverter, with linked connected overflow eventually directing excess into downspout

Chapter 7 Using Your Rainwater Harvest

Following are ten uses for harvested rainwater:

1. Watering ornamental or vegetable gardens

2. Watering perennial beds

3. Watering rain garden during dry periods

4. Washing dogs

5. Washing cars

6. Filling a bird bath

7. Irrigating young trees

8. Keeping compost from drying out

9. Hydrating mushroom logs

10. Flushing toilets. (Be sure to check with local plumbing codes and ordinances if you are interested in using rainwater inside your home.)

IRRIGATING EDIBLES

If rainwater is used for a vegetable garden, there are some precautions recommended, depending on what you are growing and your irrigation methods.[15] See tables 1 and 2 for suggested management strategies.

Chapter 8 Rain Barrel Aesthetics

PAINTING YOUR RAIN BARREL

Many options exist to get creative with your rain barrel. You may decide to paint your barrel, grow plants around the barrel, or even use a trellis to conceal it.

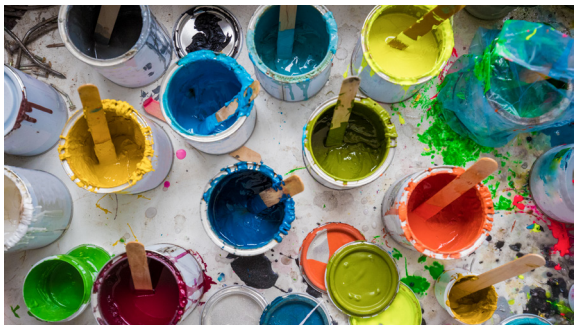

Figure 37. Paint cans open and ready to use

Cleaning and priming: We recommend cleaning and priming your barrel before painting. You also can sand the entire barrel with a 220 grit or finer sandpaper before cleaning. Be sure to use sandpaper that does not leave scratches. This extra step is well worth your time.

Clean the exterior surface with a 1:1 mixture of vinegar and water. Next, cover the barrel with any kind of color primer and paint, as long as the base coat is a paint that sticks to plastic. Check the label for appropriate use on plastic.

Coverage: One can of spray paint typically covers up to 25 feet. You can cover a rain barrel with one can, but two cans are recommended to create a more finished look. Darker colors require more paint. It's also good to have leftover paint to touch up your barrel if it gets scraped later.

How to paint:

1. Paint in a well-ventilated area, ideally 50 to 85 degrees F in low humidity.

2. Cover spigot and overflow valve with masking tape. Keep in mind that overflow may impact your painting design over time.

3. Shake can vigorously for 2 minutes; hold 8 to 10 inches from surface.

4. Spray in a sweeping motion, keeping an even distance from the barrel surface. To avoid messy edges, sweep the spray starting away from the surface of the barrel (into the air), moving to the barrel surface, and finishing into the air away from the barrel.

5. Apply a thin coat and wait 30 seconds.

6. Apply multiple thin coats to avoid runs and drips.

Color considerations: Consider painting your rain barrel the same color as your house to camouflage it; this may be helpful in areas with HOA restrictions. Remember, darker barrels are better for preventing algae growth.

Dry time: 15 minutes or less; handle after 1 hour

Recoat: Before 24 hours or after 7 days

Preservation recommendation: Use a car plastic preservative on your rain barrel a couple times a year to brighten, condition, and protect it for a long life.

Figure 38. Painted rain barrel. (Photo credit: Kimberly Counts Morganello, Clemson)

A MORE NATURAL WAY TO MAKE YOUR RAIN BARREL ATTRACTIVE

Another option for beautifying your rain barrel is to conceal it with plants. Secure a trellis, plastic mesh, or wiring adjacent to the barrel and plant a hardy vine at the base. Allow the vine to climb up the mesh, but be careful not to let it block access to the rain barrel. Anytime a vine is planted, it is important to maintain vine growth by regular hedging to ensure that the vine does not cover more space than intended.

Native plants provide habitat for local wildlife and food for beneficial groups such as songbirds and pollinators. Non-native species usually do not provide this benefit, and they can spread rapidly while competing with native species. Gardening with native plants is an effective way to support your local ecosystem. Here are some plants to consider:

Bignonia capreolata (crossvine) is a vigorous clinging vine that climbs using tendrils. It has semi-evergreen leaves and orange-red blooms that attract hummingbirds (figure 39).

Gelsemium rankinii (swamp jessamine) is very similar to Carolina jessamine but tolerates wet conditions better (figure 40).

Gelsemium sempervirens (Carolina jessamine) is a twining vine. It grows upwards from the shoots in a helix rather than clinging form and needs a support to grow on.

Lonicera sempervirens (coral honeysuckle) is a semi-evergreen that attracts hummingbirds. It is a twining vine and needs a structure to grow on (figure 41).

Figure 39. Crossvine, 'Tangerine Beauty'

Figure 40. Swamp jessamine

Figure 41. Coral honeysuckle

For more native plant suggestions, visit the Lady Bird Johnson Wildflower Center's Native Plant Database at www.wildflower.org/plants. Under Combination Search, select the following: State (Alabama), Habit (vine), Duration (perennial), Leaf Retention (evergreen), Light Requirement (sun and part shade), Soil Moisture (moist). You can narrow this search further by also indicating blooming time and bloom color.

USING YOUR LANDSCAPE TO COLLECT RAINWATER

To further benefit the environment, consider using your active rainwater harvesting in tandem with passive rainwater harvesting landscape features. Overflow from your rain barrel can be directed to a rain garden or landscaped bed. Passive rainwater harvesting can

include contouring your landscape to help capture, hold, and infiltrate water to harvest more rainwater on your landscape. Be sure that water infiltrates soil before reshaping the contour to avoid creating issues associated with standing water.

Rain gardens are vegetated depressions that intercept runoff from impervious surfaces and allow that runoff to infiltrate into the soil. In a rain garden, physical, chemical, and biological actions take place to remove pollutants from that runoff. For instance, sediment settles out, plants uptake nutrients, and microbes remove bacteria and metals. For information on building a rain garden, read "How to Install Your Own Rain Garden" in the *Alabama Low Impact Development Handbook*.[16]

OTHER WAYS TO CONSERVE WATER

- Drip irrigation allows water to disperse directly to the plant and minimizes water evaporation (water loss).
- Getting your soil tested will help you learn which plants are suitable for a certain area of your yard. Agents at your county Extension office can offer advice (www.aces.edu/counties).
- Remember, plants require specific habitats and soil types. Using native plants can reduce the need for excess water use while providing valuable habitat. Putting the right plant in the right place helps to prevent overwatering.
- Utilize the tallest recommended mowing height to reduce irrigation needs; this also will lead to strong, deep root systems. In general, remove no more than one-third of the height of your grass blade.
- Water lawns only when they show signs of stress, like when you walk across your grass and your footprint stays. Most lawns and plants need no more than 1 to 1¼ inch of rain per week.
- Install a rain gauge to determine when and how much to irrigate.
- Group together plants of similar water needs.
- Use soil amendments such as compost to allow the soil to hold more moisture and extend the time between watering. Similarly, mulch landscaped beds to lessen soil evaporation and extend time between watering.

RESOURCES, LINKS, AND INFORMATION

- For environmentally friendly practices for your yard and how to become certified as an Alabama Watershed Steward, see the Alabama Watershed Stewards site at www.aces.edu/aws.
- For do's and don'ts around the home to help protect your local environment, see the *Alabama Smart Yards* handbook at https://store.aces.edu/ItemDetail.aspx?ProductID=13591.
- For insights on how your actions influence stormwater pollution, see www.epa.gov/owow_keep/nps/dosdont.html.
- For information about your watershed and water-quality concerns in your backyard, see "Surf Your Watershed" at cfpub.epa.gov/surf/locate/index.cfm.

OTHER GUIDES ON RAINWATER HARVESTING

- *Virginia Rainwater Harvesting Manual*: www.harvesth2o.com/adobe_files/Virginia%20Rainwater%20Harvesting%20Manual.pdf.
- *Rainwater Harvesting for Homeowners* by Clemson Cooperative Extension Carolina Clear program: www.clemson.edu/extension/carolinaclear/files/RWHmanual.pdf.
- *Rainwater Harvesting Guide* by GrowNYC: www.grownyc.org/files/osg/RainwaterManual_2018_FINAL_HighRes.pdf.
- *The Texas Manual on Rainwater Harvesting*: www.twdb.texas.gov/publications/brochures/conservation/doc/RainwaterHarvestingManual_3rdedition.pdf.

REFERENCES

[1] Giacalone et al. 2011. *Rainwater Harvesting for Homeowners*. Clemson Public Service, Carolina Clear. www.clemson.edu/extension/carolinaclear/files/RWHmanual.pdf.

[2] "Where Is Earth's Water?" United States Geological Survey. www.usgs.gov/special-topic/water-science-school/science/where-earths-water.

[3] "Soak Up the Rain: What's the Problem?" 2020. Environmental Protection Agency. www.epa.gov/soakuptherain/soak-rain-whats-problem.

[4] "Outdoor Water Use in the United States." 2017. Water Sense, Environmental Protection Agency. https://19january2017snapshot.epa.gov/www3/watersense/pubs/outdoor.html.

[5] "Why Water Efficiency?" 2017. Water Sense, Environmental Protection Agency. https://19january2017snapshot.epa.gov/www3/watersense/our_water/why_water_efficiency.html.

[6] Gomillion et al. "Alabama." Encyclopedia Britannica. www.britannica.com/place/Alabama-state.

[7] Ghimire, S. R., and J. M. Johnston. 2017. "Holistic Impact Assessment and Cost Savings of Rainwater Harvesting at the Watershed Scale." *Elementa*. https://doi.org/10.1525/elementa.135.

[8] *The World's Cities in 2018: Data Booklet*. United Nations. www.un.org/en/events/citiesday/assets/pdf/the_worlds_cities_in_2018_data_booklet.pdf.

[9] Sabota, C. 2009. *Rainwater Harvesting for Irrigation Water*. Alabama Cooperative Extension System. www.aces.edu/wp-content/uploads/2019/01/UNP-0026.pdf.

[10] See note 9 above.

[11] Padrilah et al. 2018. "Toxicity Effects of Fish Histopathology on Copper Accumulation." *Pertanika Journal of Tropical Agricultural Science*, 41, 519–540. Retrieved from: www.researchgate.net/publication/327232571_Toxicity_effects_of_fish_histopathology_on_copper_accumulation.

[12] See note 9 above.

[13] See note 9 above.

[14] Dylewski, K., J. T. R. Brown, C. M. LeBleu, E. F. Brantley. 2014. *Low Impact Development Handbook for the State of Alabama*. Alabama Department of Environmental Management, Alabama Cooperative Extension System, Auburn University. www.adem.state.al.us/programs/water/waterforms/LIDHandbook.pdf.

[15] Morganello, K. 2015. *Best Practices for Application of Harvested Rainwater on Edibles*. Clemson Cooperative Extension Service, Carolina Clear, publication 1728. www.clemson.edu/extension/hgic.

[16] See note 14 above.

extension
ALABAMA A&M & AUBURN UNIVERSITIES

WWW.ACES.EDU