Trees Work for Clean Water

Objectives

- 1. Identify the role of trees and other plants in cleaning water as it enters creeks, streams and rivers.
- 2. Identify the three main principles of Stormwater Management: Slow, Spread and Soak.
- 3. Identify Best Management Practices (or BMPs) when working to control stormwater runoff in towns and cities.
- 4. Apply Stormwater Best Management Practices (BMPs) to a real town scenario.
- 5. Justify BMP and tree placement choices by explaining (and listening) to others.
- 6. Find examples of Best Management Practices (BMPs) in your area.

7. Gain a better understanding and appreciation for trees by observing and considering their role in helping with stormwater runoff.

Time Considerations

Activity 1: 40-50 minutes (allow more time if a forester can help by taking students outside to identify tree species in school yard and also show students how to measure DBH) Activity 2: 40-50 minutes Activity 3: On-going for many days OR may also be used in the classroom

Additional Resources

Website used for Activity 1: <u>https://planting.itreetools.org/app/location/</u>

PowerPoint/Google Slides for Activity 1 and 2 and all Handouts for Activity 2 and 3 found on website:

www.mocommunitytrees.com

References

The following two websites provide information for students about the Water Cycle:

https://www.usgs.gov/special-topic/water-scienceschool/science/water-cycle-schools-and-kids?qtscience center objects=0#qt-science center objects

https://climatekids.nasa.gov/water-cycle/

This resource can provide teachers with more information about Stormwater Management principles:

https://extension.psu.edu/stormwater-basics

This resource specifically focuses on using trees for Stormwater runoff Management:

https://www.epa.gov/soakuptherain/soak-rain-treeshelp-reduce-runoff

Missouri Learning Standards

Science

5.ESS2.A.1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact. (Ex. Influence of atmosphere on landforms and ecosystems through weather and climate). (Activity 1, with water cycle and link to trees as part of biosphere)

5.ESS3.C.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (Activities 1 and 2 together)

3-5.ETS1.B.1 Generate and compare multiple possible solutions to a problem, based on how well each is likely to meet the criteria and constraints of the problem. (Activity 2)

These activities also **lead** to the following Science Standards:

4.ESS2.B.1 Analyze and Interpret maps as an introduction only—this standard is really getting to the use of topographic maps to look at ocean floor features, fault lines, mountains to predict locations of volcanoes and earthquakes. (Activity 2)

3-5.ETS1.A.1 Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time or cost. (Activity 2)

Resources Needed

Activity 1: Access to the internet for whole class and possibly for groups or individuals, if desired: PowerPoint/Google Slides for Activity **#1**, Projector, Paper and pen or pencil, colored pencils (optional) for final activity.

Activity 2: Flat Creek Map (1 per group, on colored paper and laminated to use again, if possible), Student Activity page (1 per group on white paper—this one gets cut apart and is not re-usable), Scissors (2 or 3 pairs per group), Device or camera to take picture of completed map (optional), Power Point/Google Slides from Activity #1, as a review or to reinforce information.

Activity 3: Stormwater and Forestry Activity Grid (1 copy per student)

Special Note for Teachers

Although this series of activities has been set up generally in a 5E format, it could be more so, or more inquiry-based, if the teacher wants to try Activity 2 first, before the Forester visits the classroom for Activity 1. If opting to do the series this way, students do not have any background in stormwater management principles, so they would simply be doing the activity without that lens. It would be important to do it again, after Activity 1, this time identifying what they did the first time that would fit with stormwater best management practices (BMPs) and making improvements to their town. More time with discussion would be important for the second time, rather than spending much time on it for round one. Perhaps having students research some additional BMPs to implement would add an additional piece. The flooding questions from Activity 1 are the first "E "in 5E or the Engage piece. Teachers could also do this before the first round of the Activity 2 activity and then mention it to the Forester, who could quickly recap or remind students about their flooding discussion with their teacher. This makes the first round of the Flat Creek Planning Activity (Activity 2), the Explore piece, while the second time around, it becomes Elaborate, if going into more detail about additional BMPs. More BMP info can be found above in the Resource section. The Forester would provide the Explain part in Activity 1. Teachers would be responsible for the last "E", Evaluation, or use the last round of Activity 2 as Evaluation and ask each student to write up a short explanation paragraph, so all are held accountable for their own Evaluation.

Activity 1: Where Does Water Go When There is Too Much of It?

Objective

- 1. Identify the role of trees and other plants in cleaning water as it enters creeks, streams and rivers.
- 2. Identify the three main principles of Stormwater Management: Slow, Spread and Soak.

3. Identify Best Management Practices (or BMPs) when working to control stormwater runoff in towns and cities.

Background Information for Teacher and Preparing for the Activity

Trees play an important role in helping keep our water clean. Trees have the ability to take up enormous amounts of water through their roots that they then use for photosynthesis. But trees also help to clean water by filtering out potential pollutants through their roots. Any water not needed by the tree is then released through transpiration or evapotranspiration, which is part of the water cycle.

Precipitation, usually in the form of rain, can fall in any area and be just enough water for plants and animals or too much and flooding can occur. Humans notice flooding most and often work to prevent flooding in areas to preserve property and prevent property damage. Flooding is the starting point for this activity, since it may be most familiar to students. In rural areas, flooding is most often seen when creeks and rivers rise. Rivers rising can then lead to lake levels rising, as well. Low water river crossings may become covered and we sometimes hear stories about water rescues or people having to leave their flooded homes for a time. In towns or urban areas, rain water accumulates very quickly and flooding is made worse by the square footage of impervious surfaces (surfaces that don't allow water to flow through them) like concrete and asphalt found on sidewalks and streets. Any student who has been to a Walmart or grocery store parking lot during a thunderstorm has seen puddles of water accumulate in some parts of the parking lot.

The rain that falls in towns and cities is called stormwater (in the field of *Stormwater Management*, the word *stormwater* is just one word, rather than two words). Stormwater managers and builders have to think about where rain will go when it does rain, in an effort to control flooding and also to keep water clean as it returns to streams and rivers. Trees and other plants can play a big role in helping to control stormwater runoff by helping the rain water **slow**, **spread** and **soak** into the ground. This happens more naturally in rural areas, but must be thoughtfully planned in urban locations.

The three main principles of Stormwater Management are **Slow** down the water, **Spread** out the water to cover more area and **Soak**—allow the water to soak into the ground wherever possible. Slowing down water can be accomplished by creating gentle slopes that allow water to move more slowly and using plants to help catch the water droplets and slow them down. Water can be spread out by using some of these slopes to help water go in more directions. Finally, stormwater managers use plants and trees to help the rain water have some place to go, soak into the ground and be used by the plants and trees.

Stormwater Managers are also concerned with too much rain water in a flooding event, bringing trash, litter and potential pollutants washing off parking lots, back into nearby creeks and streams. Rain water or stormwater in nearly all towns and cities in Missouri, except the downtown part of St. Louis, goes into storm drains and then goes directly back to creeks, streams and rivers. Stormwater that falls during any rain event never gets treated, and takes all that it contains with it back to the stream. By helping stormwater **slow**, **spread** and **soak**, it allows plants and trees time to take in the extra water and filter it before it goes back to creeks, streams and rivers. A strip of grass near a parking lot can filter potential pollutants from the parking lot and help control flooding by slowing down the water.

In both rural areas and in towns that have a stream, a Riparian Zone (also called a Buffer Zone, Riparian Buffer, or Riparian Corridor) is a strip of any sort of vegetation—grass, plants, trees on either side of the stream that can act as a filter to keep water clean. One hundred feet of riparian area on either side of a stream is the goal of stormwater managers. Riparian zones are an important Best Management Practice (or BMP) used by Stormwater Managers. Other BMPs you may be familiar with include using pervious concrete or asphalt (has open spaces that allows water to pass through or soak into a parking lot); building water retention ponds or areas; and planting rain gardens (planting plants that are native to an area and use only the rain water that falls in an area).

Both Activities 1 and 2 are a good opportunity to help students see the connection between the Water Cycle (representing the hydrosphere) and trees and plants (representing the biosphere). This is one of the Missouri Learning Standards for 5th grade (5.ESS2.A.1). But teachers and educators will likely have to make this connection for students to help them see it. Typically, the Water Cycle is taught separately, but this is a good place to talk about how Transpiration occurs through leaves when a tree has too much water and runoff is a term used in the Water Cycle as well as in Stormwater Management.

With flooding, too much rain falling in the winter is always more problematic because there are no leaves on the trees (for transpiration) and trees don't take up as much water since they don't need water for photosynthesis (deciduous trees only). No grass or other vegetation also can't help slow down and spread out or even soak up the rain water/stormwater, so flooding happens much more quickly in the winter than in the other months.

For Activity 1, students will use the iTree website to find out how much water a tree can take up when it rains. The teacher needs access to the iTree website for calculations <u>https://planting/itreetools.org/app/location/</u>, a projector to show the website calculator and to show some Power Point/Google Slides.

If a Forester can teach Activity 1 as a Guest Speaker, please allow time for the Forester to help students identify trees in their school yard to use with the iTree website and to also show students how to find the DBH or Diameter at Breast Height of each tree. Students could take notes to bring back into the classroom OR take a device or two outside for students to input the information there on the iTree website.

Teachers may want to add in more math to this activity by talking about how gallons of water might be determined or why the iTree website uses both metrics and English units.

Steps for Activity 1: Where does water go when there is too much of it?

1. Start with a question: **Who has seen an area flood from too much rain? Or a creek or lake overflowing its banks?** Explain what you observed and know about the situation. Allow two or three students to tell about flooding they know. You can include all by asking who has had a similar experience, after one student tells their story—the others can simply raise a hand. That way all are acknowledged, but without having to hear all stories.

2. Discuss the difference between flooding in town and out of town—refer to Background info and slides, but out of town, waters in creeks rise gradually or flooding typically happens after the rain has stopped. In town, all of the hard surfaces—asphalt, concrete, roads and parking lots, make flooding happen more quickly. Ask the following questions below in bold-face type:

Where does all of the water go? Answers: Out of town, it runs into creeks and rivers and as they get too full, it floods out over the banks and onto the land around it (called the riparian zone and then the flood plain).

Why does flooding happen so fast in town? Answer: All hard surfaces funnel water to creeks or low areas, taking all trash and anything on these surfaces right into the water. After flooding in town, there is usually more trash and pollutants in the water that has washed into the creeks.

3. Today we will investigate the role trees and other plants play in helping to control flooding and more importantly how trees and other plants help keep our water clean for animals and for us to drink and use.

4. Let's find out first, how much water a tree can take up or soak up through the tree roots and use each year by using the iTree website.

5. Click on the link to the iTree website: <u>https://planting.itreetools.org/app/location/</u>

6. To use the iTree website to calculate how much water a tree can take up through its roots, first fill in your exact location in terms of your state, county and town/city.

7. The next tab is called "Parameters" and could be left, as is, autofilled, unless you would like to change anything.

8. Next, enter information about a tree species found in the school yard area, or another tree all students are familiar with. Along with tree species, the DBH or Diameter at Breast Height (which is 4.5 ft from ground), must be entered. If at all possible, a trip outside with students to show them how to identify their school's tree species and how to figure DBH would be ideal.

9. The next group of information is all about the building near the trees or "Building Information". Here, information about the location of the tree to the building (North, South, East and West, plus variations of each) is entered; "Vintage" refers to the age of the building; and "Climate Controls" refers to whether or not the building has heat, air conditioning or both.

10. Finally, the section called "Tree Details" provides more specifics about the trees near the building students may rate the condition of the trees (another good opportunity for the forester to explain how that might be determined, generally); determine the exposure of the trees to sunlight and the number of trees, of the same species.

11. The next page to come up is the "Report" page and there includes several subgroups or tabs there too: across the top tabs, it reads as follows: Copy, Export (both for doing something with the report), CO_2 , Energy, Eco and Air Pollution. The tab that directly ties with Stormwater and the amount of water that trees can take up by their roots is under the "Eco" tab. There, "Rainfall Interception" tells how much water is taken up by the tree's roots and "Avoided Runoff", both in gallons, looks at this information in a different way by describing how much water then stays in the area.

12. Go ahead and try another tree species (example species to try might be White Oak, Sugar Maple, Sycamore, etc.) The key is to try 2 or 3 examples for comparison. Another possibility is to use the same DBH for each species and compare the water amounts that way.

13. Some Powerpoint/Google Slides are included from the National Tree Benefits Calculator for a White Oak tree. This tool will no longer be available after December 2020, but the information is provided in a slightly different way and would be a good opportunity for students to see a real use for a pie chart.

14. Make sure and do 2-3 examples total, with different tree species. You can do them all together with students or allow students to choose one species on their own, find out the number of gallons of rainfall intercepted, as well as the number of gallons of "avoided runoff" and then share this with a partner or the class. This might also be a good time to talk about how some tree species like a lot of water and want to be near water (sycamore) and some do not like wet areas and need a drier place (pines). In other words, trees prefer certain habitats, just like animals do. The amount of water they can take up and filter, though, may not seem to fit with this info—some trees just have the ability to take up more water than others and is also due to their location as a bottomland tree (near water and down towards the bottom of a slope) or an upland tree, found in a drier area and higher in location.

15. It's time now to focus on the basic Stormwater principles, as well as putting it all together with the idea of riparian zone we talked about earlier. Refer to slides to share with class. The idea of **Slow**, **Spread** and **Soak** are basic Storm Water principles—the goal is to slow the water down, spread out the water and allow it to soak into the ground, rather than running off the surface back to a creek (and potentially taking pollutants with it). **Impervious** surfaces are hard surfaces that don't allow rain to pass through them, like a sidewalk (concrete). A good **Riparian Zone** has lots of trees and plants that can help, slow the water down, spread it out over the riparian zone area and allow the rain water to soak into the ground. This all helps prevent flooding AND helps to clean and filter the water before it goes back into the creek or river.

16. The next slide, taken from the National Tree Benefits Calculator, explains how trees reduce Runoff in an area. The information in parentheses and in all capitals is for you to link the 3 main Stormwater Principles with the information here—the highlighted information includes the important parts for focus:

Trees act as mini-reservoirs, controlling runoff at the source. Trees reduce runoff by:

- Intercepting and holding rain on leaves, branches and bark (THIS IS THE SAME AS SOAK)
- Increasing infiltration and storage of rainwater through the tree's root system (THIS IS THE SAME AS SOAK)
- Reducing soil erosion by slowing rainfall before it strikes the soil (THIS IS THE SAME AS SLOW AND SPREAD)

17. As trees take up water or extra runoff, they use their roots to filter out potential pollutants, and any extra water they don't need escapes through the leaves as part of Transpiration or Evapotranspiration from the Water Cycle. (This idea directly ties to one of the science standards for Grade 5 Science—linking the water cycle or hydrosphere to trees and plants or the biosphere, but it would have to be pointed out to students. In addition, the diagram included on the National Tree Benefit Calculator under the Storm Water link, shows this too and uses water cycle vocabulary. Please point this out to students and see if they can tell you what Transpiration is, for example. So many times students see the water cycle as completely separate from anything else, so to link it to a tree is important too.)

18. As a wrap up to this activity, and to make sure and fully address the Missouri Learning Standard for Science (**5.ESS2.A.1**), students need their own piece of paper or half sheet of paper and a pen or pencil. You may also allow more time and use colored pencils for the drawings, but students must create a diagram or drawing to represent how the water cycle and trees work together to clean water. What is their current understanding of this relationship?

19. Another alternative to the above wrap-up is for students to draw or create a diagram of their understanding of the words **Slow**, **Spread** and **Soak**. Please note this option only addresses Stormwater, but not the above science standard.

Activity 2: A Plan for Flat Creek

Objective

- 1. Apply Stormwater Best Management Practices (BMPs) to a real town scenario.
- 2. Justify BMP and tree placement choices by explaining (and listening) to others.

Background Information for Teacher and Preparing for the Activity

City managers, stormwater managers, engineers and developers need to consider where water goes when it rains in towns and cities. Once a Missouri town reaches a population of 10,000 people, stormwater Best Management Practices (BMPs) must be followed in an effort to control stormwater runoff (rain water that falls in towns/cities). Stormwater must be controlled during the building of any new buildings or parking lots; education about stormwater provided for the community; and implementation of some BMPs must be in place as part of the city's MS4 permit (Multiple Separate Storm Sewer System or MS4) process. Even though these mandates exist, as well as zoning laws that might prohibit the building of certain buildings or lots near other business or natural structures like a stream or river, some areas of Missouri do not have such procedures in place. Feel free to refer to the additional resources in the "References" section above for more stormwater BMPs and connections to trees.

This activity allows students to think about what might be best for a town when considering where to build, next to Flat Creek, which runs through the town. To have a water source in town, whether it be a stream, river or spring, is typical because in early times when towns in Missouri were founded, the settlers would have looked for a place with water to drink and use. **Note:** Today's towns rely primarily on well water for the town's drinking water (one exception in Missouri is Springfield, which relies mostly on local surface water lakes as well as some well water), rather than the local stream, BUT the wastewater treatment process in towns typically DO discharge treated sewage water back into the local streams and rivers. Please recall from the Background Information in Activity #1 that stormwater is NOT treated by the wastewater treatment plants, but goes directly back to streams and rivers. The exception mentioned in the Background of Activity 1, downtown St. Louis near Busch Stadium and the Arch, is the only place in our state in which stormwater IS treated by a wastewater treatment plant.

Students will work in small groups to decide where would be the best place for a town's houses and businesses within the vicinity of Flat Creek. The original Flat Creek area also has a park and wetland area adjoining it, which is another Best Management Practice (BMP) in controlling stormwater to prevent both flooding and more importantly to keep Flat Creek clean. You may share that at the end of the activity, but let students work around it first. You might want to remind students or have them tell you the three main principles of stormwater management: **Slow, Spread** and **Soak**. So, all of their ideas on placement should be keeping the three principles in mind. Students also need to be prepared to explain their ideas on placement, along with answering questions about their work. You also may want to wait to discuss MS4 or zoning at this time—allow students to think about this activity through a stormwater lens first.

Finally, please emphasize, once again, the importance of trees in taking up water from flooding, but also in cleaning the water as it filters through the roots and up the stem (trunk) of the tree. Other plants and grasses can play a large role in holding the stream bank in place and especially in filtering the water and trash/litter from the town before it gets to Flat Creek.

Activity idea adapted from the activity "*Dragonfly Pond*" from the *Aquatic WILD K-12 Curriculum and Activity Guide*, Association of Fish & Wildlife Agencies, 2017.

Steps for Activity 2: A Plan for Flat Creek

1. Put students into groups of 3 or 4 and provide the following materials to each group: One Flat Creek Map, one page of the Student Activity Page and pairs of scissors per group to cut out the activity pieces. Refer to the PowerPoint slides from Activity 1, slides 17-19, for slides of the activity scenario and review.

2. **Here is the task:** The town of Oakville has a creek running through the middle of town called Flat Creek. This creek provided water for the original settlers of Oakville and was a good location for the town, but it does occasionally flood the area near the creek. Flat Creek also has a park area that stays wet some of the time, next to it, and is drawn on the map. Oakville is expanding and some think building homes and businesses near the creek is a good idea. Keeping in mind the Stormwater Principles we learned in Activity 1 and the importance of trees to use and take up extra water through their roots, please place your items on the Flat Creek Map in the place that is best for the town. Be prepared to explain your choices in location for businesses, houses, trees, etc. Your group will have 8-10 minutes to cut out your pieces and place them on the map. You must use all of the pieces and some part of each piece must be on the map. You may also write a specific tree species on your tree cards, if you know good choices to plant in each spot.

Review the Stormwater Principles – **Slow**, **Spread** and **Soak**, along with the idea of riparian zones, if needed. Ask students to provide the information for the review.

3. Allow each group time to make its decisions and discuss the pros and cons of their choices (in addition, students could write down their pros and cons). As the teacher for this activity, it is good to pay attention to the discussions and note how some groups made their choices when you all come back together. Were there similarities or differences in the discussions? Did some groups approach this task differently than others? Be ready to point this out to the group when they return together to discuss.

4. Once groups are finished, have the groups decide who will speak for their group to explain their Flat Creek Map choices. You may then have the other groups come over to their work space so they may see how the pieces were laid out on their map. This does take a bit of time, but is important for each group to have a say (and be held accountable) for their work. Another option, using more technology, has students take a picture of their group's work and send to the teacher, who then pulls up each photo of their map to project (or simply use a document camera for their maps) for the group to explain to the class. Once again, though, it is important for each group to be accountable for explaining their ideas and plans by showing their work.

Questions to ask while groups are showing their work:

- How did your group decide to put your trees in this particular place? Do you know what kind of tree would be good for this spot?
- How does your arrangement keep the water clean in Flat Creek? Why is it important to keep the water clean in Flat Creek?
- How does your design slow down water coming off the convenience store parking lot (or the gas station parking lot) into Flat Creek?

- How does your design spread out water coming back into Flat Creek when it rains?
- What helps soak up extra rain water before it goes back into Flat Creek?
- Why did you plan for a Riparian Zone (or not plan) on your map?
- Where will the water go, if Flat Creek ever floods? Will any businesses or homes be in danger if it floods?

5. As a wrap-up to this activity, review the good planning tools and BMPs you saw, as well as reviewing the importance of **slow**, **spread** and **soak** for stormwater management. Riparian zones are also important and trees play such an important role in taking in extra water, but also cleaning it by filtering it through the roots. Other plants help filter out trash before it gets into Flat Creek and hold the stream bank in place (prevent erosion). One last thing—the wetland is another way to keep water clean. **Wetlands** are special habitats that hold water for some time and have their own plants and animals who inhabit them. They aren't good for building, so many towns cover them up, BUT they also help filter large amounts of potential pollutants before they can go back into the creek. Wetlands are worth holding on to!

Can students help with the review by summarizing what they saw and learned? That is the best kind of wrap up activity—just be sure to include the above information and mention it, if students don't bring it up first.

Activity 3: Stormwater and Forestry Activity Grid

Objective

1. Find examples of Best Management Practices (BMPs) in your area.

2. Gain a better understanding and appreciation for trees by observing and considering their role in helping with stormwater runoff.

Background Information for Teacher and Preparing for the Activity

After doing both Activities 1 and 2, students should now be familiar with a few Stormwater BMPs that help keep our water clean, as well as the importance of trees in helping to keep water clean. Refer to the Background Information for both Activities 1 and 2 for more information, as well as the References Section for more stormwater BMPs.

This activity provides students more opportunities to look for and consider both of these ideas stormwater runoff BMPs and the importance of trees, by giving them choices of additional activities they might do to think about both. This can be done in Tic-Tac-Toe fashion, in which students get to decide the 3 items they will choose—either up and down, across, or diagonally. After a certain length of time, students will be prepared to share what they found with others, either at home with family or back at school with the class. Students will only need the Stormwater and Forestry Activity Grid to get started, although on the back of the sheet are some resources to help them plant a tree or the Adopt A Tree activity, if they choose to do those squares.

This activity may also be done within the classroom on an on-going basis when extra time allows or as a reward.

Steps for Activity 3: Stormwater and Forestry Activity Grid

1. Students will need a copy of the Stormwater and Forestry Activity Grid and time to do at least part of these items (as possible).

2. Ask students to try to get three in a row (like Tic Tac Toe) either up and down, across or diagonal. Or, for a bigger challenge, aim to do all 9! Although this activity could be done at home, it may also be a good on-going classroom reward or a rainy-day activity to bring out when needed.

3. For the Plant a Tree square, refer to the additional resources below (and on page 2 or the back of the Stormwater and Forestry Activity Grid copies)

4. Adopt a Tree simply means to find a tree that is handy to watch and then make drawings, take measurements, make notes about what the tree looks like for each month or season of the year.

5. Share your pictures, drawings and notes, charts and any other work you've done with the Activity Grid with fellow students or with your family or to display as part of a Science Night at school or Parent-Teacher Conferences.

Resources for Tree Selection:

Planting the right tree in the right place free download from MU Extension: "Right Species, Right Place: Considerations Before You Order Tree Seedlings in Missouri"

https://extension2.missouri.edu/g5006

"Right Tree in the Right Place" article from MDC website

https://mdc.mo.gov/sites/default/files/downloads/right-tree-right-place.pdf

Resources for Obtaining Trees to Plant:

Forest ReLeaf of Missouri has free trees for schools.

http://moreleaf.org

Source for native trees to Missouri from the Missouri Department of Conservation's (MDC) website. Contact your local MDC forester for more info and website for pricing/availability.

https://mdc.mo.gov/trees-plants/tree-seedlings/about-missouris-state-forest-nursery

Resources for Planting a Tree:

MDC publication for planting a tree-free download

https://mdc.mo.gov/sites/default/files/downloads/How-Plant-Tree.pdf

MU Extension flier for planting a tree-free download

https://extension2.missouri.edu/g6850