MISSOURI STREAM TEAM

JUNIOR LEADERSHIP

HANDBOOK

2026 EDITION

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"This material is based upon work supported by AmeriCorps under Grant No. 19VSWMO006. Opinions or points of view expressed in this document are those of the authors and do not necessarily reflect the official position of, or a position that is endorsed by, AmeriCorps."

Optional Supplies for Hands-on Activities

- Large map of a watershed or topographic map that has the boundaries of a watershed outlined

- Aluminum pan, foil, and spray bottle with water to simulate precipitation and paths that water flows by gravity

- Yarn to simulate roots. One very long piece to simulate the roots of a native plant, and a short piece to a simulate non-native plant. Place both in your hands with a little bit showing, so that students can not see which is which. Ask students which root they believe will be longer, then have two volunteers come up to pull the yarn from your hand.

- Native plant or root poster

- Turbidity tube and cloudy water

- Blue Bug Cards (can be printed from “mostreamteam.org” → Events and Activities → Water Quality Monitoring → Training Materials and Resources → Macroinvertebrate Reference Guides → Blue Bug Card

- Kick net and meters to demonstrate sampling equipment

- River simulation to practice river safety ABCs (like gym tumbling mats)

WATERSHED

What is a Watershed?

A watershed is an area of land where all the water flows into the same place, like a pond, wetland, river, lake, or ocean. All land is part of a watershed. Watersheds of smaller rivers are a part of larger watersheds.

Example:

The Mississippi River Watershed includes land and water from several rivers, such as the Missouri, Mississippi, Ohio, Tennessee, Arkansas, White, and Red rivers. All of these rivers drain into the Mississippi River.

Mark your home's location on the map below.



(Source: Missouri Stream Team Water Quality Monitoring Level 1 Notebook)

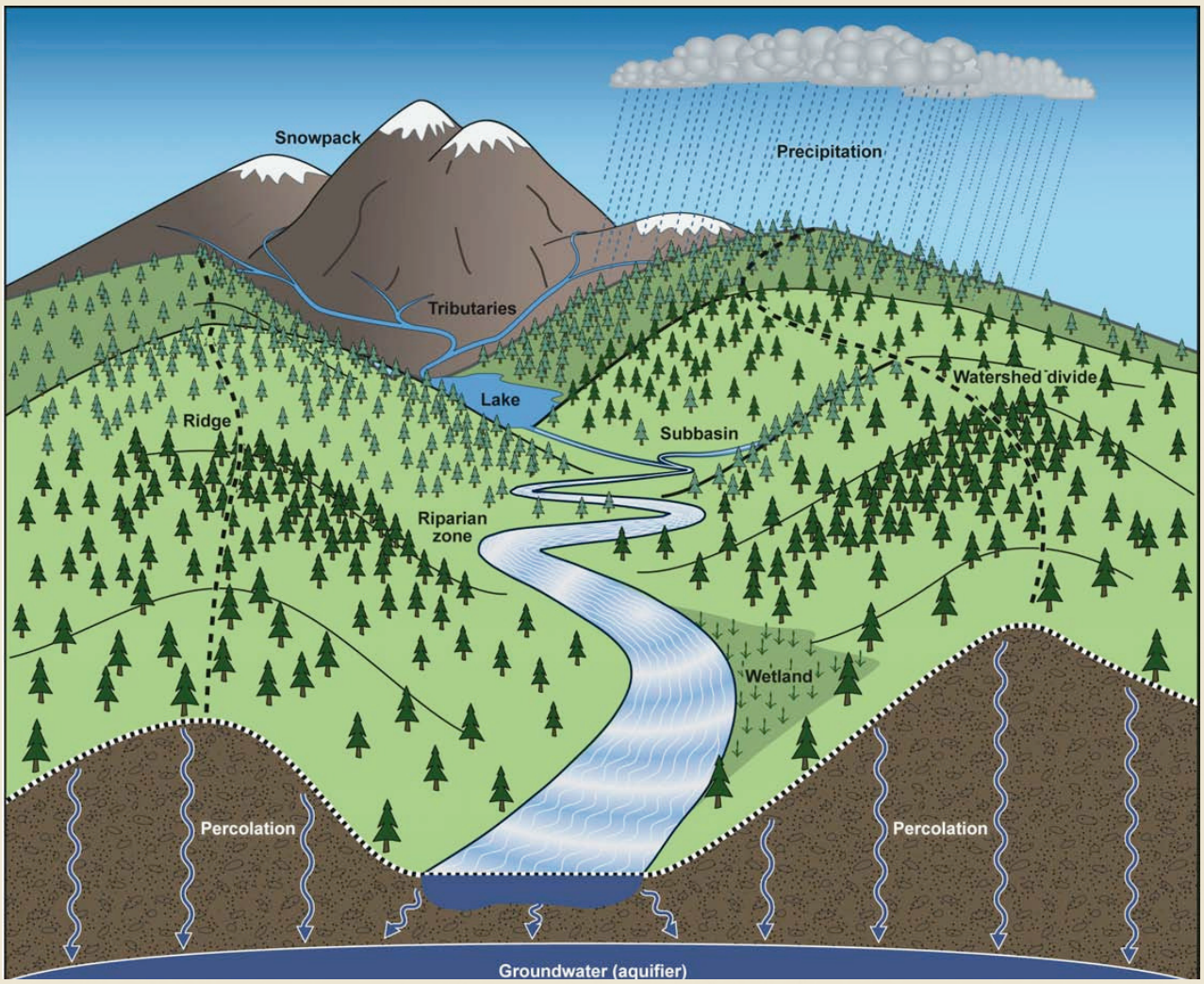
WATERSHED

How Watersheds Affect Water Quality

The health of a stream or river depends on the land around it, called its watershed. Because people live, work, and play in watersheds, our actions can change the water quality in both good and bad ways.

As water moves across the land, it can pick up pollutants like soil, chemicals, and even extra heat. This can affect the health of the water.

In the example below, you can see that the precipitation falling within the dotted lines would eventually flow into the tributaries, lake, and river. The land inside the dotted lines that drains water to the river in this picture is the watershed of the river and lake. Watersheds can also be called drainage basins or catchments.

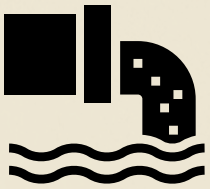


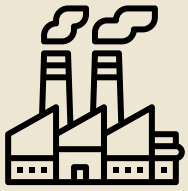
(U.S. Government Accountability Office. (2012). Nonpoint source water pollution: Greater oversight and additional data needed for key EPA water program (GAO-12-335). https://www.gao.gov/assets/gao-12-335.pdf)

WATERSHED

Key Terms You Need to Know

Watershed:
An area of land that drains water to a specific water body, like a creek, river, wetland, pond, or lake.



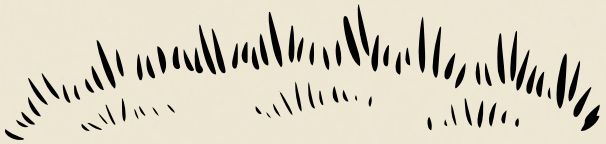


Point Source Pollution:
Pollution that comes from a single, specific source, like a pipe from a wastewater treamtment plant or factory, and is regulated by laws.

Non-Point Source Pollution:
Pollution that comes from across the landscape like trash or chemicals from streets, lawns, and farms.







Activity: Identify Your Watershed

Every place has a watershed. First, let's figure out what stream is nearest to where we are now!

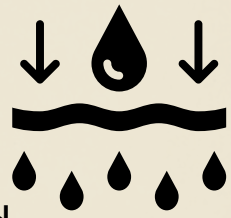
What creek or stream is closest to our current location?
Write the name of the creek or stream here:

What larger watershed does this creek belong to?
Does it flow into the Missouri River?
Note: all Missouri streams, including the Missouri River, eventually drain to the Mississippi River.

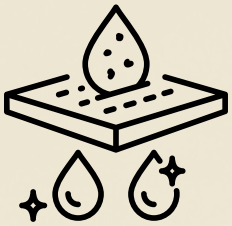
How Vegetation Helps Water Quality

Vegetation, like native plants, trees, and grass, can help improve water quality in many ways.

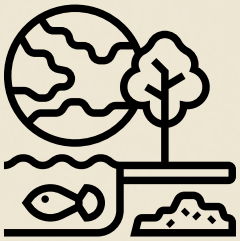
Absorb Floodwater: Native plants have deep roots that soak up water, which helps prevent flooding.



Filter Pollution: Plants help filter out chemicals and pollutants before they reach the water.

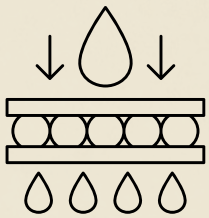


Provide Habitat: Native plants give animals, like birds and insects, a place to live.



Pervious vs. Non-Pervious Surfaces

Pervious Surfaces: These are surfaces that allow water to soak into the ground, like grass, soil, or gravel.



Impervious Surfaces: These are surfaces that don't allow water to soak in, like concrete or asphalt.



WATER QUALITY

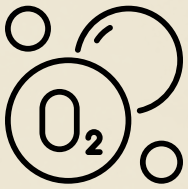
Understanding the Basics

Water quality is measured by different factors that help us determine the health of a stream, river, or lake. Here are just a few parameters that determine water quality:

Temperature: How hot or cold the water is, measured in degrees Celsius or Fahrenheit.



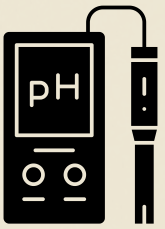
Dissolved Oxygen: The amount of oxygen in the water that fish and other animals need to breathe.



Conductivity: How much electricity the water can carry, which shows the amount of salt and other dissolved substances in the water.



pH: How acidic or basic the water is. pH ranges from 0 to 14, with lower values being acidic and higher values being basic.



Turbidity: How clear the water is. If it's cloudy, it has high turbidity. If it is clear, it has low turbidity.



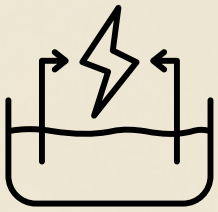
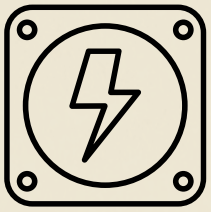
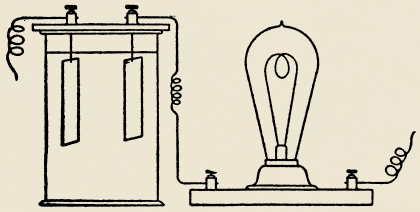
Nutrients (N and P): These are chemicals like nitrogen (N) and phosphorus (P) that help plants grow. Too much can cause problems in waterways such as algae blooms.



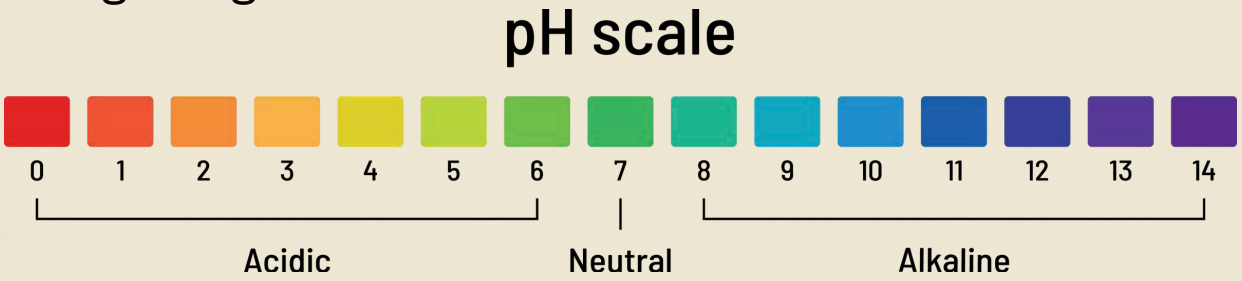
WATER QUALITY

How Do These Affect Aquatic Life?

- **High Conductivity:** If the conductivity is high, it means there are a lot of chemicals in the water, which can be harmful to plants and animals.

- **Low pH:** Too high or too low pH can harm fish and other living things in the water.

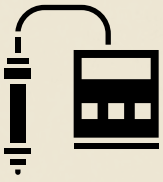


- **Low Dissolved Oxygen:** If there's not enough oxygen in the water, organisms that live in the water might not be able to breathe and could die.



- **High Nutrients:** Too many nutrients can cause algae blooms, which consume oxygen when the algae dies, and can harm aquatic life.

- **High Turbidity:** If the water is cloudy (high turbidity), it makes it hard for animals like fish to see food, and it can also block sunlight from reaching plants.



WATER QUALITY

1.) High **conductivity** in water indicates the presence of a high amount of dissolved substances.

(True / False)

2.) A low **pH** in water suggests that the water is acidic.

(True / False)

3.) Low **dissolved oxygen** in water can harm fish and other aquatic life.

(True / False)

4.) Too much **nutrients** in the water can lead to harmful algae blooms and affect water quality.

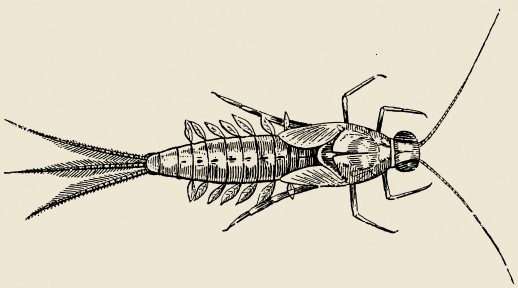
(True / False)

5.) High **turbidity** in a stream can negatively impact aquatic organisms ability to see and decreases light availability.

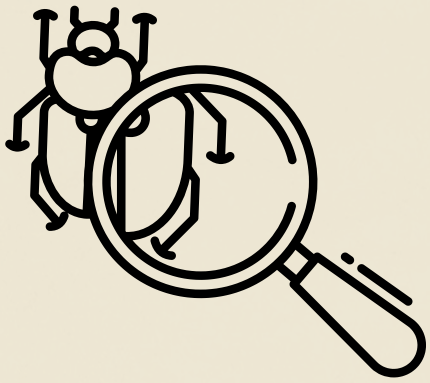
(True / False)

What are Macroinvertebrates

Aquatic macroinvertebrates are animals that live in water, can be seen without a microscope, and don't have a backbone. They are important because they help us understand the health of our streams.



Take a look at the "blue bug" card, if available.



Why Are They Important?

Answer these questions:

1. What are aquatic macroinvertebrates?

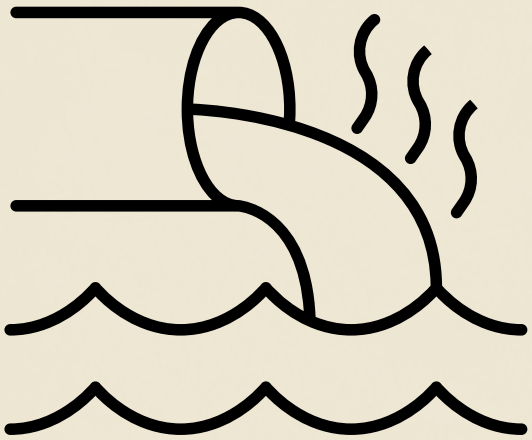
- They are animals that live in water, can be seen without a microscope, and do not have a backbone.

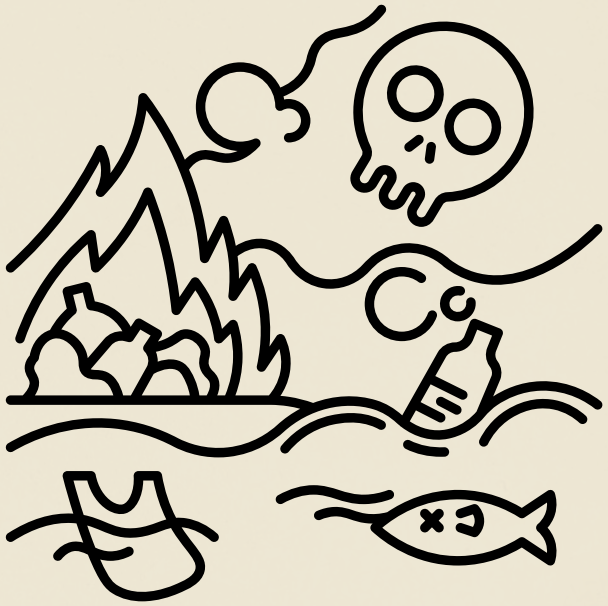
2. Why are aquatic macroinvertebrates good at telling us about water quality?

- They live in streams at least part of their lives and different species are more or less tolerant to pollution. This makes them good indicators of pollution.

Pollution in Streams

Pollution in streams can happen in sudden bursts called "pulses." These pulses of pollution can be caused by things like heavy rain or when harmful chemicals are added to the water.





Answer these questions:

1. What is a "pulse" of pollution?

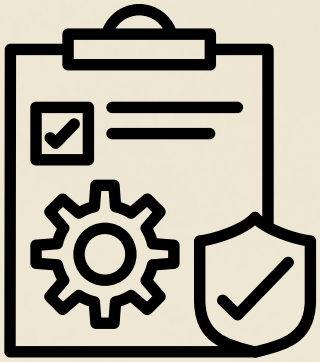
A pulse is a sudden burst of pollution in the water.

2. What can cause a pulse of pollution in a stream?

Rainfall, pollutants being released, and other factors.

How Do Macroinvertebrates Show Water Quality?

The types of macroinvertebrates in a stream can tell us a lot about the water quality in a stream. Some are very sensitive to pollution, while others can live in polluted water.





Answer these questions:

1. How do aquatic macroinvertebrates help us understand water quality?

They show us if the water is healthy or polluted over time.

2. What is the difference between "sensitive" and "tolerant" macroinvertebrates?

Sensitive macroinvertebrates can't live in polluted water, while tolerant ones can handle pollution.

Pollution Sensitivity of Macroinvertebrates

There are three types of macroinvertebrates based on how much pollution they can tolerate:

- "**Pollution-Sensitive":** These organisms are very sensitive to pollutants and will only be present in streams that have excellent water quality.

- "**Somewhat Pollution-Tolerant":** These invertebrates can survive in streams with moderate impairment.

- "**Pollution-Tolerant":** Organisms in this category are very tolerant of pollution and are the only organisms you will find in streams with severe impairment. Pollution tolerant organisms can be present in all streams, including those with excellent water quality.

(Source: Missouri Stream Team Program Water Quality Monitoring Level 1 Notebook)

Healthy vs. Polluted Streams

Healthy streams have a variety of macroinvertebrates, while **polluted** streams usually have only those that can handle a lot of pollution.

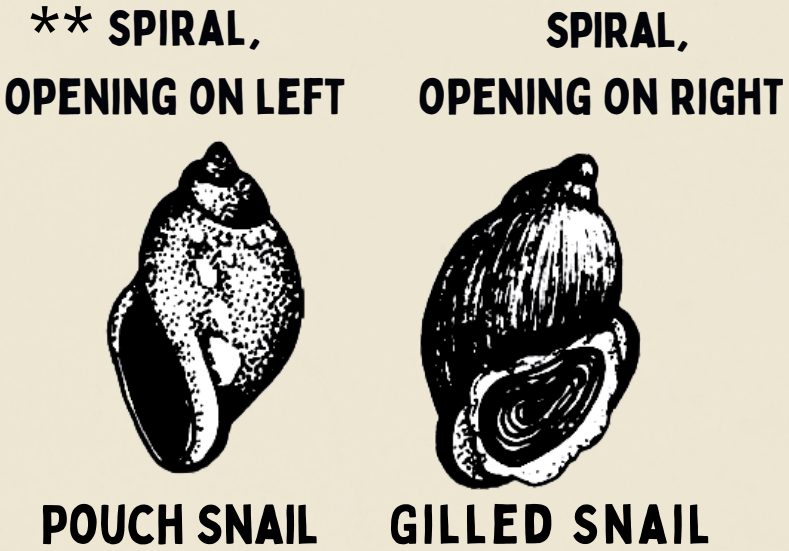
Answer these questions:

1. What kind of macroinvertebrates do healthy streams have?

Healthy streams have a mix of species, including sensitive, somewhat tolerant, and tolerant animals.

2. What kind of macroinvertebrates do polluted streams have?

Polluted streams have mostly pollution-tolerant species.



(** Life in River Key Reference Card , https://mostreamteam.org/assets/lifeinriverkey.pdf))

Mock Macroinvertebrate Sampling Sheet Activity Instructions

On the next page, you will see an example of an official Missouri Stream Teams Macroinvertebrate Sampling Sheet. For this activity, break up into groups of 2-3. You will need to fill in each section that is highlighted green:

- Your County
- The Name of your stream (Name a real stream, or make up your own!)
- Circle one of the site descriptions listed: Forest, Prairie, or Urban. (This is just for fun and does not affect the outcome.)
- Everyone in your team is the “Data Submitter”, so write everyone's name.
- Pick any number you want for your Stream Team!
- Sampling date is today's date.
- The current time in military time is what you will log. Ask your teacher if you aren’t sure!
- The number of Participants is the number of students in your breakout group.
- Your teacher will look up the amount of rainfall in inches that your area has received in the last week.
- List the number of people in your breakout group (this will be the same in all three spots)
- Multiply the number of people in your group by 5 (the amount of time you can pretend you spent picking macroinvertebrates from your kick net!)
- Look over the sampling sheet; if any row contains a number and not dashes, circle the number in the final column on the right in that same row (this is the score for having that organism present).
- Once you’ve circled the numbers on the right, add them together and determine the water quality rating of your stream!

MACROINVERTEBRATE DATA SHEET

Complete this data sheet and keep for your records. (*) fields are required. Submit data online at mostreamteam.org

*Site #: 1	*State: MO	*County:	Trib of ☐ *Stream Name:
*Site Description: Forest Prairie Urban			
*Data Submitter:		*Stream Team:	
*Sampling Date:		*Time (Military Time):	
Number of Participants:	Rainfall (inches in the last 7 days):		Water Temp in shade (°C): 14

	*Net Set #1	*Net Set #2	*Net Set #3	Score for Types Present
*Habitat Type	Riffle	Riffle	Riffle	Circle the number below if the organism was found in any of the three net sets. Next, add the circled scores together to get the Water Quality Rating.
*Net Type	☑ Kick Net ☐ D-Net	☑ Kick Net ☐ D-Net	☑ Kick Net ☐ D-Net	
*Time Spent Picking	Minutes Picking: 5	Minutes Picking: 5	Minutes Picking: 5	
	Number of People: ____	Number of People: ____	Number of People: ____	
	Total: ____	Total: ____	Total: ____	
Sensitive Organisms	**Number of Organisms**	**Number of Organisms**	**Number of Organisms**	
Caddisfly Larvae	2	1	---	3
Dobsonfly Larvae	1	---	---	3
Mayfly Nymphs	4	7	2	3
Gilled Snails (right)	7	3	1	3
Riffle Beetles	---	---	---	3
Stonefly Nymphs	8	5	3	3
Water Penny Larvae	4	1	---	3
Somewhat Tolerant				
Other Beetle Larvae	---	---	---	2
Clams/Mussels	---	---	---	2
Crane Fly Larvae	2	1	---	2
Crayfish	5	2	3	2
Dragonfly Nymphs	---	---	---	2
Damselfly Nymphs	10	7	9	2
Scuds	3	6	5	2
Sowbugs	1	---	---	2
Fishfly Larvae	---	---	---	2
Alderfly Larvae	---	---	---	2
Watersnipe Fly Larvae	---	---	---	2
Tolerant				
Aquatic Worms	17	9	13	1
Black Fly Larvae	---	2	3	1
Leeches	2	1	4	1
Midge Larvae	1	2	1	1
Pouch Snails (left)	11	15	12	1
Other Snails (flat)	---	---	---	1
Less Than 12 = Poor	12-17 = Fair	18-23 = Good	Greater Than 23 = Excellent	Water Quality Rating:

Comments:

Fish present during sampling event? ☑ Yes ☐ No



River Safety and Missouri Stream Team Cleanups
ABCs of River Safety

It's important to be safe when you are near or on a river. Here are the ABCs of river safety:

- **Always wear your life jacket.** Personal flotation devices save lives. Be smart and wear a life jacket.

- **Bottom down, feet up.** If you are flowing down a stream, float like this to help avoid injury.

- **Climb that rootwad!** Don't get sucked under, climb a rootwad if you can.



RIVER SAFETY

What Should You Wear When Near a River for Litter Pickups?

Always make sure to wear the right protective gear:

Gloves:

- Wear gloves that resist punctures to protect your hands from sharp objects.

Foot Protection:

- Wear sturdy, closed-toe shoes or boots to protect your feet from sharp objects or hazardous materials.

Eye Protection:

- Wear goggles or safety glasses to keep your eyes safe.

Smell Test:

- **Never** smell liquids you find. They could be dangerous.

Touch Test:

- If you don't know what something is, **DO NOT TOUCH IT!**

RIVER SAFETY

What to Do if You Find Dangerous Items

Sometimes, you may find things like weapons, needles, or chemical waste in or near a river. Here's what to do:

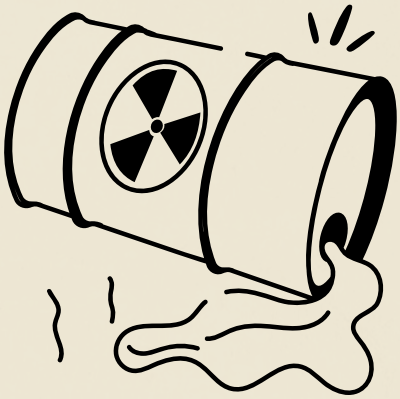
Do Not Touch It!

If you find dangerous waste or unknown chemicals, never touch it.



Report It

Tell an adult or call the proper authorities. They will know what to do to keep everyone safe.



24-hour DNR environmental emergency hotline

573-634-CHEM (2436)

Review and Reflection:

1.) It is important to always wear a life jacket when near water to ensure safety in case of an emergency.

(True / False)

2.) If you find something dangerous in or near a river, you should contact the appropriate authority and should not smell or touch the object.

(True / False)

3.) Missouri Stream Teams play a crucial role in protecting rivers and streams through conservation efforts.

(True / False)

CERTIFICATION

MISSOURI STREAM TEAM

What is the Missouri Stream Team Program?

The Missouri Stream Team Program is a group of people who care about protecting Missouri's streams. The program lets anyone get involved in helping to take care of rivers.
It was created in 1989 with three main goals:

1. **Education:** Learn about Missouri's 110,000 miles of rivers and streams. Stream Team offers training to understand how streams work and the problems they face.

2. **Stewardship**: Get involved in hands-on projects like cleaning up litter, planting trees along streams, and checking water quality. Missouri Stream Team helps you plan or join projects.

3. **Advocacy:** Speak up for streams when people or businesses harm them. Those who know the problems best can write letters, attend meetings, or talk to lawmakers to protect streams.

It's easy to join the Missouri Stream Team!
You can sign up with your teacher, a parent, or adult leader.
Visit the website to learn more.
https://mostreamteam.org/
Look for the "Start a Team" icon



CERTIFICATION

Stream Team Activity:

Create Your Own Stream Team Name!
Work with your class to come up with a fun and creative name for your very own Stream Team.

Become a Stream Team Member:
If you are not already a member, you can sign up to become part of the Missouri Stream Team. Your teacher will help you with the process!

CERTIFICATION

What is the Junior Stream Team Leadership Certificate?

After completing the lessons on river safety, water quality, and Missouri Stream Team cleanups, you have a chance to become a Junior Stream Team Leader! If you pass a test about the lessons, you will receive a Junior Stream Team Leadership Certificate with your name on it. You'll also get some cool Stream Team goodies!



CERTIFICATION

How to Earn Your Certificate

To earn your certificate, you need to:

1. **Study Lessons 1-4**
    - Make sure you understand the topics about water quality, river safety, and the Missouri Stream Team Program.

2. **Take a Multiple Choice Test**
    - The test will cover everything you learned in Lessons 1-4.

3. **Pass the Test**
    - If you pass the test, you will receive your Junior Stream Team Leadership Certificate!

“This material is based upon work supported by AmeriCorps under Grant No. 19VSWMO006. Opinions or points of view expressed in this document are those of the authors and do not necessarily reflect the official position of, or a position that is endorsed by, AmeriCorps".

Name: Date:

Junior Stream Team Leadership Certification Test

1. What is a watershed?
   A. A shed that houses water in your backyard.
   B. An area of land where all water flows into the same place, like a river, lake, or ocean.
   C. An area of water, like a river, a lake, or an ocean, that collects precipitation.

2. Which is an example of point source pollution?
   A. A wastewater treatment plant's discharge pipe.
   B. A water bottle on the side of the road.
   C. A puddle of oil in an empty parking spot.

3. Which is NOT a reason nutrients in a river might be high
   A. A nearby field has recently been over-fertilized.
   B. Large numbers of people or animals have been using the river as a bathroom.
   C. There are too many rocks at the bottom of the river.

4. How would the water of a stream look if the turbidity is high?
   A. Purple.
   B. Crystal clear.
   C. Cloudy, muddy, and hard to see through.

.

5. What is a macroinvertebrate?
   A. A fish that can be seen without a microscope.
   B. Bugs that live in water, can be seen without a microscope, and do not have a backbone.
   C. A small mammal that drinks the water only when it's clean

6. How do macroinvertebrates help us determine water quality?
   A. Some are sensitive to pollution, some are somewhat sensitive, and others are not sensitive. Helping us to determine how polluted the water is.
   B. No macroinvertebrates can handle pollution, so there will be no macroinvertebrates in the water if there is any pollution at all.
   C. An area of water, like a river, a lake, or an ocean, that collects precipitation.

7. What are the ABCs of river safety?
   A. Always bring a snack, Back away from danger, Carry a trash bag.
   B. Ask for help, Bring your best friend, Clean up after others.
   C. Always wear your life jacket, Bottom down feet up, Climb that rootwad.

8. If you find something dangerous while cleaning up a stream, what should you do?
   A. Clean it up immediately.
   B. Leave it and don't tell anyone.
   C. Don't touch it and report it to an adult

The Missouri Stream Team Junior Leadership Handbook is the perfect resource for educators and community leaders guiding the next generation of environmental stewards. Whether you're leading a classroom of students or organizing a local stream cleanup, this handbook will provide you with the tools, lessons, and strategies to engage and empower young people in stream conservation efforts.
Inside, you'll find lessons designed to introduce students to the fundamental concepts of stream ecology and water quality. From understanding the importance of watersheds and the impact of pollution to exploring the fascinating world of streams, this guide helps bring the wonders of Missouri's freshwater ecosystems to life.

Key lessons include:

- What is a Watershed? Understanding local and regional watersheds, the role of vegetation, and the importance of native plants in improving water quality.
- Water Quality Basics: Exploring the key parameters that affect stream health, such as temperature, pH, dissolved oxygen, and more.
- What lives in a Stream? Introducing students to the incredible diversity of Missouri's freshwater species, including unique aquatic macroinvertebrates.
- River Safety and Stream Team Cleanups: Essential safety tips for working on the water and instructions for how to get involved with Missouri Stream Team cleanups.

stream teams united

MISSOURI STREAM TEAM