**Field Data Sheet/Site Map**

### Site Information

- **Organization/Group Name:** 
- **Waterway:** 
- **Major Watershed:** 
- **Sub-Watershed:** 
- **Closest Town/City:** 
- **Site Code:** 
- **Site Name:** 

- **Investigators:** 
- **Total Time Spent Monitoring:** 
- **Number of Participants:** 
- **Latitude:** 
- **Longitude:** 

### Placement Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of Packs</th>
<th>Air Temp [° C]</th>
<th>Water Temp [° C]</th>
<th>Leaf pack contents/weight</th>
</tr>
</thead>
</table>

### Habitat type for placement:  
- [ ] Pool  
- [ ] Riffle  
- [ ] Run

### Retrieval Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of Packs</th>
<th>Air Temp [° C]</th>
<th>Water Temp [° C]</th>
</tr>
</thead>
</table>

### Storm & Non-storm Events

A. Did any storm events occur while your leaf packs were in the stream?  
- [ ] Unknown  
- [ ] Yes  
- [ ] No

If YES for A, list the following:

<table>
<thead>
<tr>
<th>Storm Date</th>
<th>Precipitation [cm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Did flooding occur?  
- [ ] Unknown  
- [ ] Yes  
- [ ] No

C. Was this site experiencing a drought during your monitoring?  
- [ ] Unknown  
- [ ] Yes  
- [ ] No

### Comments

__________________________________________________________________________

Submit data to the online portal at [MonitorMyWatershed.org](http://MonitorMyWatershed.org)
Site Map

Sketch the stream area. Show the position of each leaf pack in the stream and note any landmarks that may help in locating them when it is time to retrieve them.
**SITE INFORMATION**

- **Organization/Group Name:** white Clay Creek Club
- **Waterway:** White Clay Creek
- **Major Watershed:** Delaware
- **Sub-Watershed:** Brandywine-Christina
- **Closest Town/City:** Avondale
- **Site Code:** WCC-US1
- **Investigators:** Vince, Mandy, Steve, Tara
- **Total Time Spent Monitoring:** 03:15 HH/MM
- **Number of Participants:** 4
- **Latitude:** 39.85914
- **Longitude:** -75.78369
- **Site Name:** White Clay Creek above Spencer Rd

---

**PACK DATA**

**Placement Data**

<table>
<thead>
<tr>
<th>Date: 04/01/2019</th>
<th>Date: 04/22/2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Packs: 3</td>
<td>Number of Leaf Packs: 2</td>
</tr>
<tr>
<td>Air Temp (° C): 15.5</td>
<td>Air Temp (° C): 16.0</td>
</tr>
<tr>
<td>Water Temp (° C): 12.0</td>
<td>Water Temp (° C): 12.3</td>
</tr>
</tbody>
</table>

Leaf pack contents/weight: # Each leaf pack has 10 g beech + 10 g elm + 10 g Sycamore

Habitat type for placement: [ ] Pool  [ ] Riffl e  [ ] Run

---

**STORM & NON-STORM EVENTS**

A. Did any storm events occur while your leaf packs were in the stream?

[ ] Unknown  [ ] Yes  [ ] No

B. Did flooding occur?

[ ] Unknown  [ ] Yes  [ ] No

C. Was this site experiencing a drought during your monitoring?

[ ] Unknown  [ ] Yes  [ ] No

---

**COMMENTS**

We checked the leaf packs each week and they were there until week 2 when the storm hit! Our little stream went up a lot and looks like we didn’t anchor one of our leaf packs in good enough. Will do better next time!

Submit data to the online portal at MonitorMyWatershed.org
Site Map

Sketch the stream area. Show the position of each leaf pack in the stream and note any landmarks that may help in locating them when it is time to retrieve them.
Habitat Data Sheet

The Habitat Survey links the physical characters of the stream and the surrounding land use to the macroinvertebrate survey results. There are two major factors that influence macroinvertebrate presence and absence: the overall water quality and the amount of available suitable habitat. Therefore, poor availability and poor quality of habitat features could influence the biotic index score since habitat and macroinvertebrate diversity are closely linked. The presence of poor habitat is considered one of the major stressors on aquatic communities.

The habitat survey should be completed at the start of the monitoring period - near the time that the leaf packs are placed in the stream. If average stream width, average stream depth, stream velocity, and stream discharge are to be determined, complete sections 12-15 before the leaf packs are placed in the stream.

Definitions:

**Survey Stream Reach:** the total length of stream that is included in the survey. The recommended length is approximately 15-meters upstream and 15-meters downstream from the leaf pack placement location, for a total of 30-meters.

**Right and Left Bank:** determined by looking downstream with the flow of the stream. The right bank is on the right and left bank on the left.

See the Glossary for unfamiliar terms.

**IN-STREAM CHARACTERISTICS**

This section is a survey of what attributes occur within the stream - not on the banks or in the riparian zone.

1A. **Stream Habitats Present**  Enter the relative percentages for each category to total 100%.

- _____ Pools
- _____ Riffles
- _____ Runs
- _____ Cascades
- _____ Log Steps
- _____ Boulder Steps

1B. **Submerged Stream Habitats Present**  Check all that apply

- [ ] Woody Debris
- [ ] Leaves
- [ ] Aquatic Plants
- [ ] Submerged Roots

2. **Stream Bottom Mineral Composition**  Check all that apply

- [ ] Cobbles (2.5 - 10” or 6.4-25.6 cm diameter)
- [ ] Boulders (>10” or 25.6 cm)
- [ ] Fine Sediment and Silt
- [ ] Gravel (0.08-2.5” or 0.02-6.4 cm diameter)
- [ ] Bedrock
- [ ] Other:  

3. **Water Appearance**  Check all that apply

- [ ] Clear
- [ ] Turbid
- [ ] Foamy
- [ ] Oily Sheen
- [ ] Algae
- [ ] Colored [describe]:  

Reproduce for use
4. Human and Hydrologic Modifications to Stream Channel  Check all that apply

☐  None  ☐  Cement  ☐  Rip Rap  ☐  Pipe or Ditch Entering Stream

Upstream or Downstream from the packs? (Circle One)

☐  Bridge  Upstream  Downstream  ☐  Dam  Upstream  Downstream  ☐  Beaver Dam  Upstream  Downstream

5. Presence of Litter in Stream or on Banks  Check all that apply

☐  None  ☐  Tires  ☐  Cans  ☐  Plastic/Glass Bottles  ☐  Other: ________________________________

STREAMBANK CHARACTERISTICS

The streambank is the area of land immediately adjacent to the bed of the stream. It is important to maintaining the health of the waterway.

6. Percent of Streambank Covered by Vegetation [grass, shrubs, trees, etc.]  Check the appropriate category for each bank.

Left Bank  ☐  0% (bare soil)  ☐  <20%  ☐  20-50%  ☐  >50%

Right Bank  ☐  0% (bare soil)  ☐  <20%  ☐  20-50%  ☐  >50%

7. Bank Slope [or Grade]  Check the appropriate category for each bank

Left Bank  ☐  <6%  ☐  >6%  Right Bank  ☐  <6%  ☐  >6%

To determine the slope or grade of a stream bank:

1. Have two people stand 100 feet apart and face one another; one uphill or further from the stream and one downhill, closer to the stream.

2. Have the person who is uphill hold a flat surface (e.g. notebook or clipboard) at horizontal sight level and look in the direction of the downhill person. If the uphill person can see any part of the downhill person’s body, the slope is rated at less than 6%. If no part of the downhill person’s body is visible, the rating is greater than 6%.
RIPARIAN ZONE
The riparian zone is the area of land immediately next to the stream and begins at the edge of the streambank. If vegetated, this zone is also called a streamside forest or buffer, and is a critical component to keeping a stream healthy. The trees, shrubs, and herbaceous plants stabilize the stream banks with their roots, provide shade to keep streams cool, and filter pollution within runoff.

8. Vegetation in the Riparian Zone  Explore 30 meters from the stream edge into riparian zone of the left bank and the right bank. Check all that apply.

Left Side  □  No Vegetation  □  Grass  □  Herbaceous  □  Shrubs  □  Trees
Right Side □  No Vegetation  □  Grass  □  Herbaceous  □  Shrubs  □  Trees

9. Width of the Riparian Zone within the 30 Meter Stream Reach  Use a meter tape measure to determine the minimum and maximum width of the riparian zone within the 30-meter stream reach for both the left bank and the right bank.

| Left Side | No Forest | Forest (>5m tall; >40% interlocking canopy; >20% deep) | Forest is: (Mostly evergreen) | Forest is: Mostly deciduous |
| Right Side | No Forest | Forest (>5m tall; >40% interlocking canopy; >20% deep) | Forest is: (Mostly evergreen) | Forest is: Mostly deciduous |

<table>
<thead>
<tr>
<th>Minimum Width [m]</th>
<th>Maximum Width [m]</th>
</tr>
</thead>
</table>

LAND-USE CHARACTERISTICS
The types of land use in an area surrounding a stream contributes greatly to the health of a waterway. From agricultural uses to forests, commercial spaces to wetlands, it is important to know how the land is being used in the stream reach and in the greater watershed. The questions in this section only begin to scratch the surface of this understanding, but the process of identifying what might be playing a factor in your leaf pack monitoring result is a start.

Describe the main land use within the 30 meter reach area – 15 meters upstream and 15 meters downstream from the leaf pack location.

10. Current Land use Observed from the Leaf Pack Location  Check all that apply

□  Row Crop (in growing season)  □  Parks and Recreation  □  Mowed Lawn
□  Row Crop (non-growing season)  □  Sewage Treatment Plant  □  Active Construction
□  Pasture with animals  □  Forest  □  Residential/Commercial
□  Meadow  □  Resoration Area [tree planting]  □  Industrial
□  Hay Field  □  ATV Trails  □  Other
□  Golf Course  □  Trails
11. Percent of Impervious Surfaces Observed from the Leaf Pack Location  Check all that apply

- [ ] <20%
- [ ] 20-50%
- [ ] >50%

ADDITIONAL INFORMATION ABOUT YOUR STREAM

Simple measurements provide important supplemental information about the available habitat and size of the stream. Complete Activity 2 Determining Stream Discharge before placing any leaf packs in the stream to obtain the average stream width, stream depth, stream velocity and stream discharge.

12. Average Stream Width [m] ________________________________

13. Average Stream Depth [m] ________________________________

14. Stream Velocity [m/s] ________________________________

15. Stream Discharge [m³/s] ________________________________
# Biotic Index Data Sheet

**Date:** ___________________

**Investigator Names:** ___________________

**Time:** __________ AM/PM

**Leaf Pack Location:** ___________________

---

### Calculating the Biotic Index

**Sort the macroinvertebrates into taxa groups.**

1. **Count the number of individual macroinvertebrates for each taxa.** Record the quantity in the box to the left of the taxa name.

2. **Determine the Sum of All Individuals** by adding the numbers in the boxes next to all of the taxa names. Record the total in the **Sum of All Individuals** box on the far right.

3. **Count how many boxes in each sensitivity group column have a quantity entered.** 
   - [Group 1 and Group 2: maximum 8, Group 3: maximum 7]. Enter the **Number of TAXA** in the box at the bottom of each column.

4. **Multiply the Number of TAXA by the weighting factor [3, 2 or 1] at the bottom of the column to obtain the Index Value** for each Sensitivity Group.

5. **Add the Index Values** for the three groups to determine the **Pollution Tolerance Index (PTI) Score**. Enter the PTI Score in the box.

6. **Determine the Pollution Tolerance Index Rating** from the PTI Score.

### Polluted Tolerance Index Rating

<table>
<thead>
<tr>
<th>PTI Score</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 or more</td>
<td>Excellent</td>
</tr>
<tr>
<td>17-22</td>
<td>Good</td>
</tr>
<tr>
<td>11-16</td>
<td>Fair</td>
</tr>
<tr>
<td>10 or less</td>
<td>Poor</td>
</tr>
</tbody>
</table>

---

### Group 1: Sensitive

- Stoneflies
- Mayflies
- Other Caddisflies
- Dobsonflies, Fishflies, and Alderflies
- Riffle Beetle Larvae/Adults
- Water Pennies
- Right-Handed/ Gilled Snails
- Aquatic Snipe Flies

### Group 2: Somewhat Sensitive

- Damselflies
- Dragonflies
- Sowbugs
- Scuds
- Crane Flies
- Clams/Mussels
- Crayfish
- Net-Spinning Caddisflies

### Group 3: Tolerant

- Midge Flies
- Black Flies
- Planarians
- Leeches
- Left-Handed/ Lunged Snails
- Aquatic Worms
- Rat-Tailed Maggots

---

**Sum of All Individuals**

Add the values from all boxes next to the taxa names.
Calculating the Biotic Index

Sort the macroinvertebrates into taxa groups.

1. Count the number of individual macroinvertebrates for each taxa. Record the quantity in the box to the left of the taxa name.
2. Determine the Sum of All Individuals by adding the numbers in the boxes next to all of the taxa names. Record the total in the Sum of All Individuals box on the far right.
3. Count how many boxes in each sensitivity group column have a quantity entered. (Group 1 and Group 2: maximum 8, Group 3: maximum 7). Enter the Number of TAXA in the box at the bottom of each column.
4. Multiply the Number of TAXA by the weighting factor [3, 2 or 1] at the bottom of the column to obtain the Index Value for each Sensitivity Group.
5. Add the Index Values for the three groups to determine the Pollution Tolerance Index (PTI) Score. Enter the PTI Score in the box.
6. Determine the Pollution Tolerance Index Rating from the PTI Score.
## Experiment Summary Data Sheet

### MACROINVERTEBRATE TAXON

<table>
<thead>
<tr>
<th>GROUP 1: SENSITIVE</th>
<th>CONTROL # Leaf Packs:</th>
<th>EXPERIMENTAL # Leaf Packs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>STONEFLIES (Plecoptera)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAYFLIES (Ephemeroptera)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER CADDISFLIES (Trichoptera)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOBSONFLIES, FISHFLIES and ALDERFLIES (Megaloptera)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIFFLE BEETLES LARVAE/ADULTS (Elmidae)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER PENNIES (Psephenidae)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIGHT-HANDED/GILLED SNAILS (Gastropoda)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQUATIC SNIPE FLIES (Athericidae)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUP 2: SOMEWHAT SENSITIVE</th>
<th>CONTROL # Leaf Packs:</th>
<th>EXPERIMENTAL # Leaf Packs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAMSELFILIES (Odonata)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRAGONFLIES (Odonata)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQUATIC SOWBUGS (Isopoda)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCUDS (Amphipoda)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANE FLIES (Tipulidae)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLAMS/MUSSELS (Mollusca)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRAYFISH (Decapoda)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NET-SPINNING CADDISFLIES (Hydropsychidae)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUP 3: TOLERANT</th>
<th>CONTROL # Leaf Packs:</th>
<th>EXPERIMENTAL # Leaf Packs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIDGE FLIES (Chironomidae)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLACK FLIES (Simuliidae)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLANARIANS (Turbellaria)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEECHES (Hirudinea)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEFT-HANDED/LUNGED SNAILS (Gastropoda)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQUATIC WORMS (Oligochaeta)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAT-TAILED MAGGOTS (Syrphidae)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sum of All Individuals

<table>
<thead>
<tr>
<th>CONTROL # OF INDIVIDUALS</th>
<th>EXPERIMENTAL # OF INDIVIDUALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pollution Tolerance Index (PTI) Score

<table>
<thead>
<tr>
<th>CONTROL</th>
<th>EXPERIMENTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pollution Tolerance Index Rating

<table>
<thead>
<tr>
<th>CONTROL</th>
<th>EXPERIMENTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Experiment Summary Data Sheet

<table>
<thead>
<tr>
<th>MACROINVERTEBRATE TAXON</th>
<th>CONTROL # Leaf Packs: 4</th>
<th>EXPERIMENTAL # Leaf Packs: 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># OF INDIVIDUALS</td>
<td># OF INDIVIDUALS</td>
</tr>
<tr>
<td>STONEFLIES (Plecoptera)</td>
<td>55</td>
<td>0</td>
</tr>
<tr>
<td>MAYFLIES (Ephemeroptera)</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>OTHER CADDISFLIES (Trichoptera)</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>DOBSONFLIES, FISHFLIES and ALDERFLIES (Megaloptera)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RIFFLE BEETLES LARVAE/ADULTS (Elmidae)</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>WATER PENNIES (Psephenidae)</td>
<td>6</td>
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<tr>
<td>RIGHT-HANDED/GILLED SNAILS (Gastropoda)</td>
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<tr>
<td>AQUATIC SNIPE FLIES (Athericidae)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>DAMSELFILIES (Odonata)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>DRAGONFLIES (Odonata)</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>AQUATIC SOWBUGS (Isopoda)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>SCUDS (Amphipoda)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CRANE FLIES (Tipulidae)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CLAMS/MUSSELS (Mollusca)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>CRAYFISH (Decapoda)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NET-SPINNING CADDISFLIES (Hydropsychidae)</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>MIDGE FLIES (Chironomidae)</td>
<td>23</td>
<td>30</td>
</tr>
<tr>
<td>BLACK FLIES (Simuliidae)</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>PLANARIANS (Turbellaria)</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>LEECHES (Hirudinea)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>LEFT-HANDED/LUNGED SNAILS (Gastropoda)</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>AQUATIC WORMS (Oligochaeta)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>RAT-TAILED MAGGOTS (Syrphidae)</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

| Sum of All Individuals | 184 | 83 |
| Pollution Tolerance Index (PTI) Score | 35 | 7 |
| Pollution Tolerance Index Rating | Excellent | Poor |

**Name(s):**

Vince, Mandy
Steve, Tara

**Date:**
04/22/2019

After completing a Biotic Index Data Sheet for each control Leaf Pack and Experimental Leaf Pack, enter the averages for the Control Leaf Packs and the Experimental Leaf Packs on the chart.
**GLOSSARY**

- **artificial leaf pack**
  A mesh bag containing leaves or grass that is placed in a stream to simulate natural leaf packs. Used in the study of aquatic macroinvertebrates.

- **bank**
  Where a stream or river meets the land.

- **biodiversity**
  The variety of living organisms present.

- **bioindicator organisms**
  Groups of plants or animals that tolerate specific levels of pollution that are used to indicate water quality.

- **biotic**
  Living things.

- **biotic index**
  A method of estimating organic pollution by comparing the abundance of organisms and their tolerance to environmental stress.

- **collectors**
  Macroinvertebrates that collect small/fine food particles by gathering or filtering them from the water.

- **complete metamorphosis**
  The process of completing a four-stage life cycle consisting of egg, larva, pupa, and adult stages. Examples of insects that undergo complete metamorphosis are true flies, beetles, caddisflies, and dobsonflies.

- **control leaf pack**
  Leaf packs that do not contain the experimental variable that are used to evaluate the influence of the experimental variable that is present in other leaf packs.

- **decomposer**
  Bacteria and fungi that break down [decay] organic substances, such as dead plants [leaves] and animals.

- **detritus**
  Dead plant or animal matter.

- **experimental leaf pack**
  A leaf pack that includes an experimental variable.

- **experimental variable**
  The one tested difference or change between experimental conditions. The purpose of the variable is to test a specific influence that will affect the colonization of the leaf pack.
- **functional feeding groups**  Method of classifying macroinvertebrates based on feeding adaptations and/or preferences.

- **grazers/scrapers**  Aquatic macroinvertebrates which feed on the algal coating of rocks and rubble. Often the bodies of these animals are flat, enhancing their ability to hold on in fast-flowing water. They include some caddisflies, water pennies, and certain midges and mayflies.

- **habitat**  The environment in which a plant or animal lives.

- **incomplete metamorphosis**  The process of completing a three-stage life cycle consisting of egg, nymph, and adult stages. Examples of insects that undergo incomplete metamorphosis are mayflies, dragonflies, damselflies, stoneflies, and true bugs.

- **larval stage**  Immature stage of an insect which undergoes complete metamorphosis.

- **leaf pack**  A naturally forming accumulation of leaves within a stream which provide habitat and food for aquatic organisms. The formation of leaf packs within a stream is directly related to the surrounding riparian vegetation and the forest canopy. See Artificial Leaf Pack.

- **macroinvertebrate**  Animal without a backbone and large enough to be seen with the unaided eye.

- **nymphal stage**  Immature stage of an insect which undergoes incomplete metamorphosis.

- **percent EPT**  The total number of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) divided by the total number of all macroinvertebrates, divided by 100.

- **pollution tolerance index rating**  A component of the biotic index, which gives a range of poor, fair, good, and excellent for grading the health of a stream or river.

- **pollution tolerance index score**  A component of the biotic index, which gives a range of 0 – 23+ grading the health of a stream or river.

- **pool**  Deep section of a stream in which the flow or current is slow.

- **predators**  Animals that feed on other animals.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>pupal stage</td>
<td>The transitional stage between the larva and the adult in an insect that undergoes complete metamorphosis.</td>
</tr>
<tr>
<td>replicate</td>
<td>A duplicate (e.g., a duplicate leaf pack) of the same experimental condition.</td>
</tr>
<tr>
<td>riffle/riffle area</td>
<td>The shallow area of a stream through which water moves swiftly and there are many rocks.</td>
</tr>
<tr>
<td>riparian</td>
<td>Pertaining to the streamside; the area adjacent to a stream (e.g., riparian vegetation is the vegetation found growing alongside a stream).</td>
</tr>
<tr>
<td>shredders</td>
<td>Aquatic macroinvertebrates that feed on leaf matter, breaking it down into finer matter, making it available for the collectors (see Collectors) to consume. Shredders include the craneflies, some caddisflies or stoneflies, sowbugs, and scuds.</td>
</tr>
<tr>
<td>taxa [taxon]</td>
<td>Taxonomic (see Taxonomy) group, whatever its ranking (e.g., class, order, family).</td>
</tr>
<tr>
<td>taxonomy</td>
<td>The science of classifying organisms according to their shared characteristics and evolutionary relationships.</td>
</tr>
<tr>
<td>water quality</td>
<td>The overall health of a body of water, including the measured chemical, physical, and biological characteristics.</td>
</tr>
<tr>
<td>watershed</td>
<td>A land area bounded by a divide and draining to a particular body of water or watercourse.</td>
</tr>
</tbody>
</table>
RESOURCES

A Guide to Common Freshwater Invertebrates of North America
J. Reese Voshell
McDonald & Woodward Publishing Co.
431 E College St
Granville, OH 43023

Aquatic Entomology
W. Patrick McCafferty
Jones and Bartlett Learning
5 Wall Street
Burlington, MA 01803

Beautiful Images of Macroinvertebrates
http://lifeinfreshwater.net/

Bugs of the Underworld Videos:
Ralph and Lisa Cutter

*CThe full DVD can be purchase on LaMotte’s website

Creek Critters App
https://anshome.org/creek-critters/

Dichotomous Identification Key to Freshwater Macroinvertebrates:
https://stroudcenter.org/macros/key/

Field Manual for Water Quality Monitoring, 11th Edition
Mark Mitchell and William Stapp Kendall/Hunt Publishing Company
4050 Westmark Drive
P.O. Box 1840
Dubuque, IA 52004-1840

Gallery of 3D Macroinvertebrate Images and Learning Library
Macroinvertebrates.org

Importance of Streamside Forests
https://stroudcenter.org/restoration/streamside-forests/

https://stroudcenter.org/research/landmarks/streamside-reforestation/

Leaf Pack Network*
https://leafpacknetwork.org/

Share data with other groups using the Leaf Pack Stream Ecology Kit.
Stroud Water Research Center
970 Spencer Road
Avondale, PA 19311

Linking Trees to Streams
https://leafpacknetwork.org/learn/linking-trees-streams/

Macroinvertebrate Links
Macroinvertebrates.org

Mayfly Hatching Video:
https://www.youtube.com/watch?v=gtXX9J7iZQA

Monitor’s Guide to Aquatic Invertebrates
www.iwla.org

The Monitor’s Handbook

LaMotte Company
P.O. Box 329
Chestertown, MD 21620

Pond and Brook: A Guide to Nature Study in Freshwater Environments
Michael J. Caduto
Prentice-Hall Inc.
Upper Saddle River, NJ 07458

River Continuum Theory
https://stroudcenter.org/continuum/

Super coolio website, navigating through a watershed, learning about river continuum:

https://stroudcenter.org/education/curriculum/navigate-a-watershed/

Save Our Streams Program
Izaak Walton League of America
707 Conservation Lane
Gaithersburg, MD 20878-2983
301-548-0151

Water Quality App:
For Apple devices:
https://apple.co/2KqRJoA

For Android devices:

Watershed Tea
https://stroudcenter.org/research/landmarks/watershed-tea/

WikiWatershed Toolkit
Web toolkit designed to help citizens, conservation practitioners, municipal decision-makers, researchers, educators, and students advance knowledge and stewardship of fresh water. This includes Model My Watershed, Monitor My Watershed, Runoff Simulation, EnviroDIY, Leaf Pack Network, and Water Quality Mobile App

WikiWatershed.org

Wow! The Wonders of Wetlands: An Educator’s Guide
Environmental Concerns Inc.
Education Department
P.O. Box P
St. Michaels, MD 21663
REFERENCES


