"A Day in the Life of the Buffalo River"
Teacher Information Packet

Adapted from "A Day in the Life of the Hudson River" and "A Day in the Life of the Carmans River"

Welcome to the "Day in the Life of the Buffalo River" program! This packet contains information about the event, activity lesson plans, an equipment list and resources.

To ensure the best possible experience for you and your students, please read this information carefully.

TABLE OF CONTENTS

Reinstein Woods Nature Preserve
93 Honorine Drive
Depew, NY 14043
716-683-5959
reinsteinwoods@yahoo.com
www.reinsteinwoods.org/dayinthelife

Event Information

"A Day in the Life of the Buffalo River" is a school field trip for which teachers partner with Reinstein Woods. Your school's individual field trip policies apply.

Before the event:

- A "Day in the Life Student Preparation" powerpoint is available online for training your students.
- Make copies of the Student Activity Packet.
- Arrange transportation to and from the site.
- Gather extra equipment (see "Suggested Equipment" on page 3).
- Inform Reinstein Woods of any student special needs or other concerns at least 2 weeks PRIOR to the event.
- Invite extra chaperones to the event, such as teacher aids or other teachers (strongly recommended).
- Optional: send home the Model Release to be signed by a parent/guardian. This allows us to take pictures of the students.
- Optional: fill out the "Predictions Worksheet" with your class (see page 9).

Day of the event:

- The Program will take place outside, so wear clothes and sturdy shoes that can get muddy. Water shoes/rubber boots and a change of clothes are good ideas.
- The Program should last between two and three hours.
- Your class will be accompanied by at least one trained staff person. You may have a Reinstein Woods employee, trained volunteer, or a partner organization. They will help run the event; however we look to you, the teacher, to take an **active role** in running the event.
- If there are any issues, please discuss them with your site leader.
- There are seven activities. The students are allotted 15 minutes per activity.
- Divide your class into groups of 3-6 students. Start each group with a different activity and have the groups rotate in order until everyone has completed all the activities. For example, Group 4 starts with Activity 4 and ends with Activity 3.
- You and your class may take a lunch break during the event.
- Help ensure that all equipment is collected and returned to the staff person at your site. Ensure the site and its facilities are left in good order.

Event Safety:

- Teachers are responsible for student safety and emergencies.
- Students should be supervised whenever they are near or directly in the water. Shallow wading is permissible, however, no swimming is allowed.
- Ticks are small arachnids which may attach to the skin and transmit diseases. Everyone should check for ticks after being outside.

After the event:

- Complete and submit the "Master Datasheets" packet to Reinstein Woods.
- Submit bus grant invoice to: Reinstein Woods Attn: Office Manager, 93 Honorine Drive, Depew, NY 14043. Invoice must be submitted by December 31 of your participating year.
- Look for you data to be up online in winter!
- Optional: Fill in the "Actual Results" column on the Predictions worksheet and make comparisons.

Links

Teacher Resources – download training powerpoints, student materials, teacher packet, data sheets, etc.
http://reinsteinwoods.org/dayinthelife/teachers

A Day in the Life of the Buffalo River – Data from previous years
http://communityservice.buffalostate.edu/BuffaloRiver/index.html

"A Day in the Life of the Buffalo River" Educator Contract
Note: this is a copy of the contract you signed for the Program.

During "Day in the Life," you will be collecting data to submit to event organizers and share with other groups that take part. This is critical: everyone shares and learns from the data, and all of it is important.

Reinstein Woods provides the equipment, bus grants, training and support, assesses and obtains permission to sample at river sites, recruits partner organizations and staff, and assists with running the event. We do all of this in the expectation that teachers will be prepared, participate, and send in their results before the deadline. When that doesn't happen, we must reconsider whether to provide support in the future. Chasing after data is time-consuming and severely delays the completion of the program.

You must sign and mail in this contract along with your $25.00 deposit in order to be accepted into the program.

1. I agree to attend the event on the agreed upon date and time. As there are several agencies involved with this event, this date and time cannot be changed. If I can no longer attend the event, I agree to inform Reinstein Woods PRIOR to the event date.
2. I agree to prepare for the event, either by attending a training workshop or viewing the online training.
3. I understand that I will have a trained staff member or volunteer from a partnering agency at my site with me; however, **I understand that I must take an active role in running the event.**
4. I agree to pay a deposit of $25.00 for the program. **Upon my completion of the terms laid out in this contract, I understand that I will receive this deposit back in full, plus a $25.00 stipend, for a total of $50.00. I understand that if I do not fulfill the terms of this contract, I forfeit my $25.00 deposit and $25.00 stipend.**
5. I understand that it is my responsibility to arrange for bussing for the event. I will send Friends of Reinstein Woods the invoice, and the Friends will apply the available bus grant money towards it. I understand that if the bus grant does not cover the full cost, my school district is responsible for paying the rest of the bill. **I understand that I must submit this invoice by December 31 of my participating year, or Reinstein Woods cannot guarantee that the grant money will still be available.**
6. At minimum, I agree to complete and send in the "Big Picture Data Summary" chart, the Teacher Evaluation, and the Student Attitudes Evaluation portions of the Master Datasheets **by November 30 of my participating year.**
7. I agree to return all equipment that is property of Reinstein Woods.
8. I understand that this program is considered a school field trip for which I am partnering with Reinstein Woods, and that my school's individual field trip policies apply. Friends of Reinstein Woods and its officers, agents, employees, volunteers, and its sponsoring agencies ("NYSDEC") claim no liability for me and my class's participation this program.

Equipment

Reinstein Woods provides all of the essential equipment for the event. However, with more than 200 event participants, we cannot provide personal equipment for every student (i.e. waders, nets). Teachers are strongly encouraged to bring their own supplies, particularly clipboards, pencils, waders/water shoes, calculators, and a first aid kit.

Provided Equipment:	Suggested Equipment (bring your own):
Clipboards (~5-7)	First Aid Kit
Trash bags	Pencils
Waders (1-3 pairs)	Change of clothes/shoes
Scooping nets (5)	Digital camera
Tape measure	Cell phone
Meter stick	Emergency contact sheet
Pond viewers	Additional field guides
Pond buckets & containers	Calculators
Colored pencils	Clipboards
Water thermometers	Water bottles & snacks
Air thermometers	Insect repellent
Water Chemistry test kit	Sunscreen
Hand sanitizer	Towels
Container for waste chemicals	Any additional equipment such as nets, chemistry kit, thermometers, etc.
Activity Instructions Sheets	
Maps of Buffalo River	Waders/water shoes
Macroinvertebrate ID sheets	Copies of Student Activity Packet
Compass	
Life jackets (1-2)	
Tarp	
Turbidity Tube	
Measuring cup	

A Brief Look at the Buffalo River

The Buffalo River has played a major role in the development of the city of Buffalo. It has been, and still is, used for industrial, recreational, commercial, and economical purposes. The freshwater river is 8.7 miles long and flows west, emptying into Lake Erie. It is fed by three tributaries: Cayuga Creek, Buffalo Creek, and Cazenovia Creek. All tributaries join together at various points to form the Buffalo River.

During the Industrial Revolution, wetlands around the Buffalo River were destroyed to build oil refineries, factories, grain elevators, and chemical industries. The river was used as a waste receptacle for heated water, toxic contaminants, and raw sewage. It became so polluted that the river actually caught on fire in 1968! In 1987, the Buffalo River was listed as an Area of Concern by the Environmental Protection Agency (EPA). An Area of Concern, or AOC, is a geographic location that has experienced environmental degradation.

To address these issues, the Department of Environmental Conservation, the U.S. Army Corps of Engineers, Buffalo Niagara Riverkeeper, Honeywell, and the EPA formed the Buffalo River Restoration Partnership. A $75 million cleanup and restoration effort is underway. Project goals include decreasing pollution, restoring and establishing new habitats, improving soil and water quality, and increasing public access to the river. Accomplishing these goals will in turn benefit wildlife, the environment, our economy, and human health. No longer is the Buffalo River “devoid of life.”

Note: The following pages are similar to the instruction sheets the students will see. More background information is provided here for teachers. For tables, charts and graphs, refer to the Student Activity Packet.

Activity 1: Turbidity

Objective: Students measure turbidity and discover how it relates to water quality.
Equipment: secchi disk, meter stick or measuring tape, twist ties or pieces of string, waders, life jacket

Vocabulary:
Secchi disk: a black and white disk that is lowered into water to the depth at which it vanishes from sight to measure turbidity.
turbidity: the cloudiness of water.

Turbidity is the cloudiness of water. Turbidity is caused by things suspended in the water, like small plants, animals, sand, mud, and pollutants. High turbidity levels can decrease how much oxygen fish can use from the water. Turbidity can also stop light from reaching plants beneath the surface. A **Secchi disk** is that black and white disk inside the **turbidity tube** that used to measure turbidity.

1. Put on waders, go into the river, and fill the measuring cup with water. Don't kick up too much mud, as this will throw off your results.
2. Fill the turbidity tube to the top with water. Get another cup full of river water if needed.
3. Place the turbidity tube near the edge of the water with the bottom valve facing the water (this way, when you spill the water out, it doesn't get the whole site wet). As one student looks through the top of the turbidity tube, another slowly lets water out of the tube through the valve at the bottom.
4. The student looking through the top says "Stop" as soon as they can see the black and white circle (Secchi disk). The other student closes the water valve as soon as they hear "Stop."
5. Record the height of the remaining water in the tube as "Reading 1."
6. Repeat steps 1-4 to obtain "Reading 2."
7. Take the average of your two readings to get your turbidity measurement.
8. Complete the "Field Observations" box on your data sheet.

Activity 2: Weather and Wind

Objective: Students measure air temperature, observe current weather conditions, and determine how recent weather conditions could affect their data.
Equipment: air thermometer, compass

Vocabulary:
dissolved oxygen (DO): the amount of oxygen gas in the water.
habitat: The area or natural environment in which an organism or population normally lives. A habitat is made up of factors such as soil, temperature, light, availability of food and the presence of predators.
runoff*:* the flow of water, from rain, snow melt, or other sources, over land.

Weather and wind tell us about the physical conditions around the river. Weather includes what the weather is today and what the weather was like during the past few days. Weather conditions can affect water quality. Heavy rains might flush pollution into the river. High winds can mix extra oxygen from the air into the water and increase dissolved oxygen levels (see Activity 7).

1. **Weather**
   1. Hold the air thermometer upright and out of direct sunlight. Allow several minutes for the thermometer to give an accurate reading.
   2. Record air temperature, cloud cover and precipitation.

2. **Wind**
    1. Use the compass to determine wind direction. Remember, winds are named for the direction the wind is coming *from*.
    2. Refer to the "The Beaufort Scale: Effects on Land" figure to estimate wind speed. Record the figure number and wind speed.
    3. Describe the wind's effect on the river surface.
    4. Complete the "Field Observations" box on your data sheet.

Activity 3: The Environment at the Sample Site

Objective: Students explore, observe, and describe the river and surrounding area.
Equipment: measuring tape, meter stick, waders, life jacket, field guides (optional)

Vocabulary:
biodiversity: the variety of species found in an area.
bulkhead: a barrier of wood timber, concrete or metal, holding the shore in place along the water's edge
ecosystem: a community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships
habitat: The area or natural environment in which an organism or population normally lives. A habitat is made up of factors such as soil, temperature, light, availability of food, and the presence of predators.
marsh: an area of shallow water with many plants growing through the water's surface.
riprap: large rocks that are piled up along a shoreline to protect it from strong waves and erosion.

Each sample site is unique, ranging from old industrial sites to rural nature preserves. Some sites may show heavy human involvement, such as industries or houses near the river. Other sites will have many **ecosystems**, such as forests and marshes. An area with more **habitats** usually has a greater variety of living things (**biodiversity**). Every environment has features that can potentially help or harm water quality.

1. Explore and observe the area around your sample site, using the numbered list as a guide. Record data.
2. Put on waders, choose a location, and use the meter stick to measure the water depth. Do not go in water deeper than your knees.
3. Complete the "Field Observations" boxes. Use field guides to identify plants (optional).

Activity 4: Sketch a Map of the Sample Site

Objective: Students explore and draw their sampling site, taking note of significant landmarks and specific sampling locations.
Equipment: colored pencils, camera (optional)
Note: There is no Datasheet or laminated Instructions sheet for this activity.

Procedure: Include a compass rose (N, S, E, W) and rough scale. Indicate specific locations where you sampled. Label landmarks, waterways and other notable features. If possible, take pictures of the site and activities.

Some students may want to be as accurate as possible and include scales, measurements, and labels. Others might be more creative and abstract (one group of students smeared mud and crushed plants on their map to draw different features!)

Activity 5: Water Temperature

Objective: Students measure the water temperature and identify sources of thermal pollution.
Equipment: water thermometer, meter stick, waders, life jacket

Vocabulary:
dissolved oxygen (DO): the amount of oxygen gas in the water.
saturation: the point at which a solution of a substance can dissolve no more of that substance.
thermal pollution: discharge of heated water into a water source that can cause a dangerous rise in temperature.

Water temperature can determine which animals survive in the river. It affects their feeding habits and other bodily functions. Water temperature also determines how much oxygen the water has in it. Oxygen that is mixed into water is called "dissolved oxygen." Warm water holds less oxygen than cold water, which means there's less oxygen for fish and other animals to breathe.

One factor that can change water temperature in a river is **thermal pollution**. Thermal pollution occurs when heated water flows into a waterway. Industries and power plants may draw in cold river water to cool machines, and then return warmer water to the river. Buildings and sidewalks can trap heat and warm up rainwater, which then runs off into the river.

1. Put on waders. Do not go in water deeper than your knees.
2. Choose a location and measure the water depth with the meter stick. Record water depth.
3. Submerge the water thermometer for 2 to 4 minutes at your chosen location. Record the water temperature as "Reading 1."
4. Repeat steps 2-3 to obtain "Reading 2."
5. Average the two readings.
6. Complete the Field Observations box.

Activity 6: Bioassessment

Objective: Students collect, identify, and record the aquatic creatures, and then use their results to determine water quality.
Equipment: waders, life jackets, scoop nets, viewers, Cool Whip containers, shallow tubs, macroinvertebrate ID sheets, field guides (optional), seine net (optional)

Vocabulary:
adaptation: a feature that allows an organism to adjust to differing environmental conditions.
aquatic: living in fresh water, as opposed to marine (salt water).
bioassessment: a survey of living systems that measures presence, condition and number of organisms to evaluate the overall health of aquatic ecosystems.
biodiversity: the variety of species found in an area.
ecosystem: a community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships.
invertebrate: an animal without a backbone.
macroinvertebrate: an animal without a backbone that is visible without a microscope.
metamorphosis: A change in the form of a living thing as it matures.
vertebrate: an animal with a backbone. Includes fish, reptiles, amphibians, birds, and mammals.

Macroinvertebrates ("macro" = big, "invertebrates" = animals without backbones) are animals visible to the naked eye, such as insects, worms, and spiders. Some macroinvertebrates spend their entire life in the water. Others, such as dragonflies and damselflies, begin life in the water and take to the air as adults. Just like frogs, macroinvertebrates go through **metamorphosis**, where their bodies change from egg, to juvenile, to adult. They also have special **adaptations** that help them survive in the water, such as oar-shaped legs, snorkel-like breathing tubes, and hairs that trap air like a scuba tank.

A **bioassessment** ("bio" = life, "assessment" = study) looks at the health of an **ecosystem**, like a river. It uses living things in the ecosystem, like macroinvertebrates, as clues to its health. Species that can live in polluted waters are "tolerant." Species that can't handle pollution are "intolerant." If you find pollution-intolerant animals, it means you have good water quality!

1. Put on the waders. Grab a small net and Cool Whip container. Scoop for macroinvertebrates along the river's edge, under rocks, along the river bottom, or on aquatic plants.
2. Use the bigger nets to scoop in deeper water. Do not go in water deeper than your knees.
   To use the seine net: stretch the net between two people. Make sure the sinkers are on the bottom and the foam rollers are on top. Walk upstream (against the current) and see if anything swims into the net.
3. Place macroinvertebrates in the pond viewers and shallow tubs. Identify and record each species.
4. Complete the Pollution Tolerance Index and the Field Observations boxes.
5. You may keep macroinvertebrates in the tubs for other students to see. Release all animals back to the river at the end of the event.

Activity 7: Chemical Analysis

Objective: Students measure Dissolved Oxygen and pH levels to determine water quality and livability.
Time Limit: 15 minutes
Equipment: water chemistry kit, waders, water thermometer, container for waste chemicals, ruler (optional)

Vocabulary:
acid rain: precipitation that is unusually acidic due to atmospheric pollution and harmful to the environment.
concentration: the amount of an ingredient in a given volume of liquid or other substance.
decomposition: the process of breaking down organic material, such as dead plant or animal tissue, into smaller molecules that are available for use by organisms.
dissolved oxygen (DO): the amount of oxygen gas in water.
pH: a number used to express acidity or alkalinity on a scale with values from 0 (acidic) to 14 (alkaline).
photosynthesis: the process by which plants that contain chlorophyll make carbohydrates from water and from carbon dioxide in the air in the presence of light.
saturation: the point at which a solution of a substance can dissolve no more of that substance.

1. **DISSOLVED OXYGEN**: Oxygen that is mixed into water is called "dissolved oxygen" (DO). It is a measure of how much oxygen is in the water for fish and other organisms to use. It is measured in parts per million (ppm). One ppm is like one cent in $10,000.

   DO increases when wind mixes up the water or when river plants make oxygen during **photosynthesis**. DO decreases when it is used by river animals to breathe, when photosynthesis stops during the night, or when the water is polluted. **A healthy stream DO range is 5 – 11 ppm.**

   1. Fill the small glass vial to overflowing with river water.
   2. Add **two** Dissolved Oxygen TesTabs to the vial.
   3. Cap the vial. Mix until the tablets have dissolved (about 4 minutes).

4. Wait 5 minutes. **You may complete the pH test while you wait.**
5. Hold the vial against the white area of the Dissolved Oxygen Color Chart.
6. Compare the color of the sample to the DO color chart. Record the result in the table.
7. Complete the Field Observations box and the Extra Activity (optional).

EXTRA ACTIVITY - Determining percent saturation: Percent saturation is a measure of how much dissolved oxygen is in the water and available for aquatic life to use. Waterways with a saturation value of **90% or greater** are considered healthy.

1. Measure the water temperature with the water thermometer. Record in the table.
2. On the graph in your packet, pair up your DO (ppm) result with the water temperature (^{o} C) with a ruler. Draw a straight line between the two values. The percent saturation is the value where your drawn line intercepts the angled saturation scale.

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2. **pH**: The pH scale measures how acidic or basic (alkaline) a solution is on a scale of 0 to 14. It is a measure of hydrogen ion **concentration**. A pH of 7.0 is neutral. A pH less than 7.0 is acidic, and a pH greater than 7.0 is basic. Most organisms are very sensitive to pH changes, and may die if the pH falls outside of the healthy range. A healthy stream pH range is 6.5 – 8.2.

Normal precipitation is slightly acidic, with a pH range of 5.0-6.3. **Acid rain** has a pH below 5.0, and is caused by car and industrial emissions. Acid rain can lower the pH of lakes and rivers and kill off resident plants and animals.

*****Actual instructions may vary; consult your specific chemical testing kit. *****

General Instructions for tablets	**General Instructions for test strips**
1. Fill a test tube with river water to the 10 mL line. 2. Add one pH Wide Range TesTab. 3. Cap the tube and mix until the tablet has dissolved. 4. Hold the tube against the white area of the pH Color Chart (#59-18CC). 5. Match the color of the sample to the pH color chart. Record the result in the table. 6. Dispose of sample water in the waste container. 7. Complete the Field Observations box.	1. Fill a test tube with river water to the 10 mL line. 2. Dip one pH strip in the sample water for 10 seconds. Hold the strip as still as possible. 3. Remove strip. 4. Immediately match the strip to the corresponding pH color chart. Record the result in the table. 5. Dispose of sample water and test strip in the waste container. 6. Complete the Field Observations box.

Predictions Worksheet (Optional)

Use the chart below and have your class predict the results of this year's event. To help you make these predictions, use the link below to look at data from past Day in the Life events.

http://communityservice.buffalostate.edu/BuffaloRiver/index.html
www.reinsteinwoods.org/dayinthelife/data

Parameter	Predicted Result	Actual Result
Turbidity (inches)		
Air Temperature (°F)		
Water Temperature (°F)		
Water Quality (poor/fair/good/excellent)		
Dissolved Oxygen (low/medium/high)		
pH		

Did your predictions match your actual data? Why or why not?

Example

Parameter	Predicted Result	Actual Result
Turbidity (inches)	12 inches	18 inches
Air Temperature (°F)	68°F	65°F
Water Temperature (°F)	55°F	62°F
Water Quality (poor/fair/good/excellent)	Good	Good
Dissolved Oxygen (low/medium/high)	High (8 ppm)	Low (2 ppm)
pH	7.5	7.5