Haliburton-Muskoka-Kawartha

children's water festival

Water Themed Lessons & Activities

Created for students from grades 4-6.

www.hmwaterfestival.ca

Haliburton-Muskoka-Kawartha children's water festival

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Protective Plants: WATER SCIENCE

AREA BEST LINKED TO

City of Kawartha Lakes, Haliburton County Municipality of Muskoka, Trent Severn Waterway.

OBJECTIVES

- for the students to gain a hands on understanding of the role of plants in absorbing moisture and nutrients from run off
- increase the student awareness of the pollution hazards of poor storm water management

MATERIALS

- topsoil and mulch
- native seeds/plants
- trees: willows (weeping willow), ash trees, white oak, red maple, etc.
- shrubs: dogwood, redbud, spice bush, arrowwood viburnum, highbush blueberry, american cranberry bush, inkberry and winterberry, etc.
- perennials: lily of the valley, wild geranium, spotted joe pye weed, cardinal flower, bluebells, wild columbine, many varieties of iris and mints, etc.
- tools: shovels, trowels
- small stones

CURRICULUM LINKS

Grade Four: Science and Technology, Understanding Life System, Habitats and Communities.

- Analyse the effects of human activities on habitats and communities.
- Investigate the interdependence of plants and animals within specific habitats and communities.
- Demonstrate an understanding of habitats and communities and the relationships among the plants and animals that live in them.

Grade Five: Science and Technology, Understanding Life Systems, Human Organ Systems

- Analyse the impact of human activities and technological innovations on human health.

Grade Six: Science and Technology, Understand Life Systems: Biodiversity.

- Assess human impacts on biodiversity, and identify ways of preserving biodiversity.
- Demonstrate an understanding of biodiversity, its contributions to the stability of natural
- systems and its benefits to humans

BACKGROUND INFORMATION

A rain garden is a small garden which is designed to absorb moisture and nutrients, particularly nitrogen and phosphorous that are found in run off. They are located close to run off sources to decrease soil erosion and to slow down run off as it travels. The idea is that storm water will be soaked up in the garden to infiltrate and not to allow run off to gain momentum. The garden will mimic the hydrologic cycle of a forest as it will improve stormwater quality, reduce run off volumes and facilitate infiltration of water. To achieve this, plants chosen for the garden must have fibrous roots that intake the stormwater. These plants should be able to withstand extreme flooding should be located in the middle of the garden as well as drought which should be on the upper edges of the garden. Soil used should be porous to slow down the flow of water and hold moisture longer. Plants with deep fibrous roots tend to have a competitive advantage in a rain garden and provide the most cleaning and filtration benefits to the environment. Most rain gardens include herbaceous perennials, woody shrubs and trees which allow for low maintenance.

TIMELINE AND WORK PLAN

Explain what run off is. (5 minutes)

Stormwater runoff is unfiltered water that reaches streams, lakes, sounds, and oceans by means of flowing across impervious surfaces. It is usually from precipitation. These surfaces include roads, parking lots, driveways, and roofs. When rain or snow falls onto the earth, it moves with the landscape. A portion of the precipitation seeps into the ground to replenish groundwater. Most of it flows downhill as runoff.

Explain the positive and negative impacts of run off. (5 minutes)

Positive: keeps rivers and lakes full of water

Negative: changes the landscape by the action of erosion, pollutants from run off into water bodies

Ask students how plants can alter this process. (5 minutes)

Vegetation can slow the movement of runoff, allowing time for it to seep into the ground especially in urban areas with surfaces that can not absorb water such as pavement and speed up run off. Plants can filtrate water by a process called phytoremediation. Phytoremediation is a general term for several ways in which plants are used to remediate sites by removing pollutants from soil and water. Plants can degrade organic pollutants or contain and stabilize metal contaminants by acting as filters or traps.

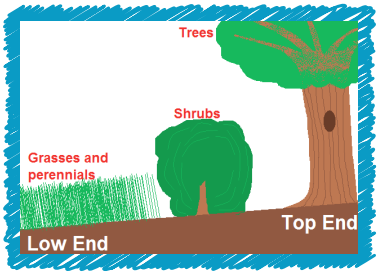
This includes the plant taking in contaminants, metals, and any pollutants in the run off to eliminate or reduce the amount of impact on the watershed.

Explain the idea of a rain garden. (10 minutes)

A rain garden is a natural system that mimics nature's manner of handling stormwater. Wetlands are nature's water filters and seasonal wetlands function as large scale rain garden systems. (see background information)

DESIGNING YOUR RAIN GARDEN

Location of the rain garden should be a run off problem area. For example: at the bottom of a slope or hill since water runs off quickly in these areas and does not have time to infiltrate, near a watershed or down slope from any gutters. It will probably be a location that remains wet after precipitation. A location in the school yard or a nearby park or watershed is recommended. The size of the garden can depend on funding and resources available. Parent volunteers or older students might be helpful for the planting process. The depression of the garden should be at least 8 inches below lawn surface being deepest in the middle. Sandy, fast-draining soil is ideal for rain gardens but you can amend other soil types to work well and absorb water. The goal is to collect the rain water from a storm in the depression of the rain garden, then let it slowly drain into the soil typically within 24-48 hours. Add organic compost and mulch material to the centre of the depression and plant the floor of the rain garden with native wildflowers, grasses, plants and shrubs based (see recommended species in materials). Other species will work as well these are only recommendations, consult your local nursery for advice. Arrange the plants and flowers by height. Trees would be at the top end of the garden, then shrubs then wildflowers and grasses (see diagram below). Stones or grass can be placed on the outside of the garden to direct storm water to garden centre.



Explain to students why the rain garden will help run off.
(see background information)

Introduce them to the type of plants that will be put into the garden with the reasons why.
(10 minutes)

Trees:
Tree cover can catch as much as half of the rain falling on their leaves. Their extensive root systems can absorb water from the soil and release it into the atmosphere through the process of evapotranspiration. Willows, ash trees, red maples and white oak grow successfully in wet soils.

Shrubs:
Shrubs interrupt rainfall before it hits the ground and absorb moisture from the soil through well-developed root systems. Native shrubs for wet areas include redosier dogwood, redbud, dogwood, spice bush, arrowwood viburnum, highbush blueberry, American cranberry bush, inkberry and winterberry thrive in wet soils.

Perennials:
An abundance of flowering perennials thrive in wet soils, absorbing the moisture and run off. Lily of the valley, wild geranium, spotted joe pye weed, cardinal flower, bluebells, wild columbine, many varieties of Iris and mints are productive in wet areas.

Get students involved in the planting once the location and depression are situated. Split up students into teams depending on type of plant they will be attributing to the garden. For example, a group of students planting trees will be directed to the top of the garden. A volunteer for each group should explain the specific way to plant the seed. The depth and distance apart should be made clear to students. It might be a good idea to have a sign on a stake indicating the purpose of the rain garden and that it is associated with the Haliburton-Muskoka-Kawartha Children's Water Festival.

Follow up:
Visit garden after rain fall. Maintain the garden by weeding although the garden should be low maintenance due to the choice of plants. Get community members involved in any summer maintenance needed. Garden can be used for other subjects as well, for example plant science.

RESOURCES/REFERENCES

- Conservation Ontario: Protect Water
  http://www.conservation-ontario.ca/source_protection/index.html
- United States Environmental Protection Agency: Phytoremediation Resource Guide
  http://www.epa.gov/tio/download/remed/phytoresgude.pdf
- Ministry of the Environment: Stormwater Management
  http://www.ene.gov.on.ca/environment/en/subject/stormwater_management/index.htm
- Rain Garden Design Template
  http://www.lowimpactdevelopment.org/raingarden_design/whatisaraingarden.htm
- The Groundwater Foundation: Rain Gardens 101
  http://www.groundwater.org/ta/raingardens.html

FEEDBACK

We appreciate your feedback! Please let us know…

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Haliburton-Muskoka-Kawartha children's water festival

Keep Lakes Clean, Prevent the Green: WATER SCIENCE

AREA BEST LINKED TO

Eutrophication and algae were recurring themes in the local watersheds of the districts. This issue is relevant to the District Municipality of Muskoka, region of Trent Severn Waterway, County of Haliburton and City of Kawartha Lakes. Potential causes identified included agricultural run off, waterfront development, lawn fertilizers and aging infrastructure, especially septic systems. Specific lakes identified were Three Mile Lake in the Muskoka District, Lake Simcoe in the Trent Severn Waterway region, Sturgeon Lake in City of Kawartha Lakes and Elephant Lake and Head Lake in Haliburton County. This is an important issue as the entire community can attribute to effects on the watershed and are impacted by the watershed.

OBJECTIVES

- Students learn to assess human impacts on biodiversity, and identify ways of preserving biodiversity.
- Students demonstrate an understanding of biodiversity, its contributions to the stability of natural systems, and its benefits to humans.
- For students to understand the process of eutrophication and what causes it and how it influences lake and river habitats.

CURRICULUM LINKS

Grade Four: The grade four Science and Technology curriculum includes Understanding Life Systems: Habitats and Communities. This theme includes analysing the effects of human activities on habitats and communities, analysing the positive and negative impacts of human interactions with natural habitats and communities and evaluating ways of minimizing the negative impacts, identifying reasons for the depletion or extinction of a plant or animal species (depletion of fish population in a eutrophic environment), evaluating the impacts on the rest of the natural community, and proposing possible actions for preventing such depletion or extinction from happening, demonstrating an understanding of habitats and communities and the relationships among the plants and animals that live in them and describing ways in which humans are dependent on natural habitats and communities.

Grade Five: The grade five Science and Technology curriculum includes Understanding Life Systems: Human Organ Systems which includes analysing the impact of human activities and technological innovations on human health, assess the effects of social and environmental factors on human health, and proposing ways in which individuals can reduce the harmful effects of these factors and take advantage of those that are beneficial. This relates as eutrophication effects the quality of drinking water.

Grade Six: The grade six Science and Technology curriculum includes Understanding Life Systems: Biodiversity. This theme includes assessing human impacts on biodiversity, and identifying ways of preserving biodiversity. This relates to the effects of eutrophication on aquatic biodiversity such as a decrease in fish populations.

MATERIALS

- Boxes (approximately 16 inches by 16 inches or 40 cm by 40 cm; slightly smaller or larger will work as well): one for every three or four students (keep in mind the size of the box should be appropriate for the number of students in a group)
- A styrofoam bowl for each group of students.
- Foam or sponges (assortment of various colours and sizes)
- Scissors
- Straws
- Tape
- Yellow food colouring
- Blue food colouring
- Plastic wrap
- One recycled plastic water bottle (.5 litres)
- Soil/dirt (optional)
- Plastic Water bottles

Ask students to bring in any appropriate sized boxes they have lying around their house ahead of time for the activity. Depending on the number of boxes the groups for the activity will permit. Boxes can also be obtained from local grocery stores. Groups of three or four would be efficient. Poke a hole in the top of the plastic water bottle (this is for teacher's use only).

BACKGROUND INFORMATION

Eutrophication results from nutrient pollution. Nutrients cause algal growth which affects aquatic plants and fish. These excess nutrients are nitrogen and phosphorous. In fresh water phosphorous is the limiting nutrient because it is the nutrient in shortest supply. Excess nutrients can cause an increase in algae and aquatic vegetation. The lack of phosphorus "limits" the growth of floating aquatic plants. Visible algae blooms form, due to rapid growth and spread of algae. The algae settle to the bottom of the water body where they decompose and in the process deplete the oxygen to the point that fish cannot live. This effects the ecosystem as oxygen is depleted, having negative effects on fish populations. A potential result of eutrophication is a cloudy green lake colour. The blue-green algae can be toxic, representing a health risk of eutrophic lakes and rivers when they are a source of drinking water. Pollution sources which cause eutrophication include wastewater from municipal and industrial sources, runoff and leaching from waste disposal systems, runoff and infiltration from animal feedlots, runoff from mines, oil fields, unsewered industrial sites, overflows of combined storm and sanitary sewers, runoff from construction sites, untreated sewage, runoff from agriculture, runoff from pasture, urban runoff from areas that are not properly sewered, septic tank leaching, runoff from abandoned mines, atmospheric deposition over a water surface and other land activities generating contaminants. Buffer zones of plants such as grasses, shrubs and most effectively trees can help delay run off from entering aquatic ecosystems and remove some of the pollutants.

TIMELINE AND WORK PLAN

Give an example of a eutrophic lake in your community. For example, Three Mile Lake in Muskoka, Simcoe Lake in the Trent Severn Waterway, Sturgeon Lake in City of Kawartha Lakes, Head Lake or Elephant Lake in Haliburton County. Ask the class what might cause these lakes to turn green. Brainstorm ideas and write them on the chalk board. **(10 minutes)**

Give an explanation of eutrophication. **(5 minutes)**

Eutrophication is caused when there are excess nutrients in a lake or river. Explain that these nutrients include nitrogen and phosphorous and identify the pollution sources that they can come from.

Brainstorm pollution sources on chalk board. Assign each group a pollution source such as agricultural run off, lawn fertilizer and sewage. **(5minutes)**

Refer to pollution sources locally. For example, Sturgeon Lake in City of Kawartha Lakes, agriculture comprises half of the land draining into the watershed, making excessive nutrients such as phosphorous an issue of concern. Three Mile Lake also has significant agricultural lands surrounding the watershed as well as residential development which could result in septic pollution. Lake Simcoe is impacted by rural and urban watershed development and agriculture. Fish habitat has become a concern and aging infrastructure have been of high concern. Head Lake in Haliburton would have concerns of municipal run off since the village of Haliburton is located on this lake.
Steps of Activity: **(30 minutes)**

CREATE A LAKE ECOSYSTEM

1. A circle slightly larger than the bowl will be cut out of the bottom of the box.

2. Place the bowl within the holder in the box the rim of the bowl will keep it in place.

3. Line the rest of the box with plastic wrap.

4. Fill the bowl with a small amount of water with a small amount of blue food colouring. Stir with a straw to mix in the food colouring.

5. Students will develop a model of a lake ecosystem impacted by a pollution source. For example, sewage can be demonstrated by using the straws to represent sewage pipes, or make a cow from sponge and foam material (refer to photo in step 6). Each group will get pieces of foam or Bristol board to cut out aspects of the landscape such as plants, animals and any infrastructure. Other aspects can be included in the lake ecosystem model such as plants, fish, buildings, etc.

6. Yellow food colouring will be added to the model where the pollution sources are located. It will represent the various pollution sources such as chemicals, animal waste or fertilizers. Once students have completed their lake model the teacher will approach each group and apply the food colouring to the pollution source for each group (example: sewage pipe, agriculture, etc.). Dirt or soil can be added if desired.

7. The teacher will poke a hole in the top of the water bottle. The water bottle will be used to apply water onto the model to transfer the yellow food colouring from the pollution source to the body of water, representing run off (refer to photo). This will cause a green colour in the model lake (refer to photo).

WRAP UP

- Ask students to write down their observations. (5 minutes)
- Explain to the students that the lake is unhealthy when it turns green, which effects the fish population and your drinking water that comes from that lake. (5 minutes)
- Ask the students how we can prevent the pollution from getting to the lake. (5 minutes)
- Explain the idea of buffer zones and how vegetation can decrease run off. (5 minutes)
- Ask students to cut out trees from the sponges and put them around their lake system as a barrier to absorb the run off. (10 minutes)
- Students will write down how they will commit to prevent pollution from entering their lakes and rivers. Have a copy for each student to sign and leave a blank line for them to write why they shouldn't pollute their lakes and what they will do to help their lakes. For example, reading labels and avoiding products that are toxic and hazardous, never putting chemicals such as cleaners, solvents and pharmaceutical products down drains or sewers, respecting regulations or by-laws regarding the use of fertilizers and pesticides and carefully following instructions when applying chemical fertilizers and pesticides on lawns and gardens, not applying chemical fertilizers and pesticides near waterways, maintaining trees and shrubs along shorelines, and properly installing and maintaining household septic systems by educating others.

EXAMPLES OF A COMMITMENT

- I will encourage my family to use natural cleaners and will read labels on the bottles to prevent any harmful chemicals to pollute our lakes.
- I will plant a tree near the shoreline in our backyard to decrease run off into the lake. (10 minutes)

Students will bring their commitment home and will be encouraged to show their family and put it on their fridge.

REFERENCES/RESOURCES

- US Environment Protection Agency: Water Quality Criteria for Phosphorous and Nitrogen
  http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/
- Environment Canada: Water Quality
  http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=FC756737-1
- Ministry of the Environment: Lake Simcoe
  http://www.ene.gov.on.ca/environment/en/local/lake_simcoe_protection/index.htm
- Kawartha Conservation: Sturgeon Lake
- **http://www.kawarthaconservation.com/sturgeonlake/aboutsturgeonlake.html**
- Muskoka Watershed Council
  http://www.muskokaheritage.org/watershed/index.asp
- Health Canada: Water Quality
  http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php
- Fisheries and Oceans Canada: Protecting the Health of Canada's Lakes
  http://www.dfo-mpo.gc.ca/regions/central/pub/ela-rle/index-eng.htm

FEEDBACK

We appreciate the feedback! Please let us know…

- Did this activity continue the learning your students engaged in at the Water Festival?
- What curriculum requirements did this activity satisfy?
- Was the activity easy to facilitate to your class?
- Did students have fun and learn something new about water?
- Please send photos of your class using these activities!
- Send us a copy of your classes commitment!

Please send comments and photos to: **iheaven@outtolearn.ca**

Haliburton-Muskoka-Kawartha children's water festival

Pollutants in ground & surface water: WATER SCIENCE

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka.

OBJECTIVES

- To demonstrate how water and pollutants move though ground materials into ground and surface water from different sources.
- To engage students on the issue of how human activities cause pollutants

CURRICULUM LINKS

Grade Four:

Science:

- 1.1 analyse the positive and negative impacts of human interactions with natural habitats and communities.

Grade Five:

Science:

- 1.1 assess the effects of social and environmental factors on human health, and propose ways in which individuals can reduce the harmful effects of these factors and take advantage of those that are beneficial

Grade Six:

Science:

- 1.1 analyse a local issue related to biodiversity.

MATERIALS

- Aquarium stones
- Clear plastic container
- Damp Sand
- Tap water
- Perforated Cup with holes for watering/ simulating rain
- Coloured sugar or jello crystals

BACKGROUND INFORMATION

Human activities can cause problems for our ground water, surface water by point source and non-point source. Ground water is defined as water that comes from rain, snow, sleet, and hail that goes into the ground. The water moves down into the ground because of gravity, passing between different layers of soil, sand, gravel, or rock until it reaches an impervious layer where water accumulates. The area that is filled with water is called the saturated zone and the top of this zone is called the water table where some people's drinking water comes from. Drinking water can also come from surface water which is water that collects on the surface of the ground like a pond or lake which is easier to access. It is important to realise that ground water often doesn't originate directly above where it falls as water can travel long distances underground from recharge zones. In the activity proposed there can be two sources of pollution that can affect surface and ground water which are point and non-point sources. Point sources are sources that have a specific outlet or discharge point where contamination enters the environment. Commercial and industrial businesses use hazardous materials in manufacturing or maintenance, and then discharge various wastes from their operations straight into the water systems. Whereas non-point source pollutants generally result from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification from a large undefined unmeasured area of land. Some examples of non-point pollutants are excess fertilizers from agricultural lands and residential areas or oil, grease and toxic chemicals from urban runoff and energy production, sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks, salt from irrigation practices and acid drainage from abandoned mines, bacteria and nutrients from livestock, pet wastes and faulty septic systems and atmospheric deposition.

TIME LINE AND WORK PLAN

Get all the materials set up at different tables for the activity fig 1. Then have the students come up to the front and brainstorm all the important things they use water for in their lives. Then give the students an overview of the background information about ground and surface water and point and non-point source sources but have them brainstorm what human activities are polluting our water. **(20 mins)** (try and use local examples of pollutants)

Figure 1:
Assign the students groups of around 3 or 4 at the different table set ups with all the materials. The instructions will then be explained that there will be two experiments of point and non-point pollutants.

THE FIRST ACTIVITY STEPS: NON-POINT SOURCE POLLUTION

Step1: Put the aquarium stones in the plastic container. Slope the stones to form a lake at one end as an aquifer model.

Step 2: We can't see the water table and ground water because they are underground, so add a layer of sand over top then pat the sand down a bit.

Step 3: Sprinkle some spoonfuls of coloured sugar or jelly crystals onto the sand to represent the pollutant you are using on the ground. (example, say you want a nice lawn so you're spreading some fertilizer)

Step 4: Have the students write down predictions of what will happen with the pollutants.

Step 5: Now using water in a cup with holes punched in the bottom to provide a gentle flow, pretend it is raining.

Step 6: The rain dissolves the coloured sugar and takes it down through the soil into the ground water, and some of the sugar runs off into the surface. Then have the students describe how the pollutants reacted to the simulated rain water and how this affects the water. Water with about half a cup of water then wait about 2 mins to see the "lake" change colour.
(Estimated activity time: 20 mins)

The second activity steps: point source pollution

Step 7: Set up the aquifer model using stones and sand again. The sand layer at the top of the model needs to be a little thicker this time.

Step 8: Make a small hole in the sand and add some coloured sugar.

Step 9: Then cover the sugar with the sand and pat it down again as this represents for example an old landfill or other brainstormed point of pollution. Have students predict how the pollutants will react in this second activity.

Step 10: Now make it pretend rain again. Nothing may appear to happen at first. Water the model with about half a cup of water.

Step 11: It takes time for the water to dissolve the pollutants in the "landfill", but eventually, the colour change will be apparent in the lake and ground water. Students will need to lift up the container and look underneath to see the colour change.
(20 mins estimated activity time)

After both experiments, have the students explain they understand how pollutants get into water sources and how humans effect these relations and that these pollutants can cause algae blooms and contamination of drinking water causing harm to humans and species in water habitats. **(10 mins)**

Create a plan for follow up, sharing and/or celebration at the end of the challenge

Have the students make posters on the information that they have learned about point and non-point source pollutions that they can put up in the school hallways to inform other students. Or send the posters back to the Haliburton-Muskoka-Kawartha Children's Water Festival along with pictures of the experiments. (Example: what are household pollutants that they can be aware gets into their drinking water or aquatic habitats)

Or

Have students create a debate to present to their parents if they use fertilizers about how household pollutants get into their drinking water and possible create a video of the debate to send back to the Haliburton-Muskoka-Kawartha Children's Water Festival.

RESOURCES/REFERENCES

- http://hmwaterfestival.ca/
- http://www.groundwater.org/kc/whatis.html
- http://www.waterencyclopedia.com/Po-Re/Pollution-Sources-Point-and-Nonpoint.html
- http://water.epa.gov/polwaste/nps/whatis.cfm
- http://pangea.stanford.edu/~keith/111.pdf
- http://www.sciencelearn.org.nz/layout/set/lightbox/Contexts/H2O-On-the-Go/Teaching-and-Learning-Approaches/Walking-on-water

FEEDBACK

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Ground Water Take Home: WATER SCIENCE

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka

OBJECTIVES

- To construct a take-home hanging water filter for the students to use outside and inside
- To engage students on the issue of water science and how water and pollutants interact with the earth

CURRICULUM LINKS

GRADE FOUR:

Science:

1.1 analyse the positive and negative impacts of human interactions with natural habitats and communities.

GRADE FIVE:

Science:

1.1 assess the effects of social and environmental factors on human health, and propose ways in which individuals can reduce the harmful effects of these factors and take advantage of those that are beneficial

GRADE SIX:

Science:

- 1.1 analyse a local issue related to biodiversity.

MATERIALS

- Two-litre plastic water bottle
- Cotton batting sheets
- Fine and large grain gravel
- Fine and large grain Sand
- Paper coffee filter
- Activated charcoal granules (would have to be ordered online)
- Funnel (cheaper option: construction paper wrapped in saran wrap)
- String

BACKGROUND INFORMATION

Ground water is defined as water that comes from rain, snow, sleet, and hail that goes into the ground. The water moves down into the ground because of gravity, passing between different layers of soil, sand, gravel, or rock until it reaches an impervious layer where it accumulates. The area that is filled with water is called the saturated zone and the top of this zone is called the water table where some people's drinking water comes from. The soil layers in the ground act as filters to get rid of pollutants before they get into the water table. Water has been filtering through these substances underground for millions of years. The result is spring water, some of the cleanest water on Earth.

Spring water is pure because it has filtered through porous layers of sediment. Surface water, however is much more readily available, but it often contains contaminants, including disease-causing organisms and toxic chemicals. In many places, groundwater is similarly contaminated because the soil only has a certain filtering capacity so if there are too many pollutants they can eventually get into our ground water. To make water from these sources safe to drink, most treatment facilities use processes and materials similar to those that remove contaminants in natural sediment filters. The objective of artificial filters is to speed the filtration process and decrease the amount of space required for purification.

TIME LINE AND WORK PLAN

Set up the activity at the tables.

Before you start the activity, have the students discuss questions such as:

1. What are some things that go into the ground that you would not want to drink?
2. If you were camping and had run out of water and there were no pure water sources how would you get water?
3. Discuss what ground water is and how soils can act as agents in cleaning water moving though the earth.

(20 mins)

Start explaining the steps of the activity. See figure 1 which will make steps clearer to understand:

Step 1: cut off a one inch section of the bottom of a two-litre water bottle. Then make a hole in the lid of the bottle so that a straw may fit and stay in place. Then make two holes in the top sides of the bottle and attach a string so the filter can be hung outside to collect rain water.

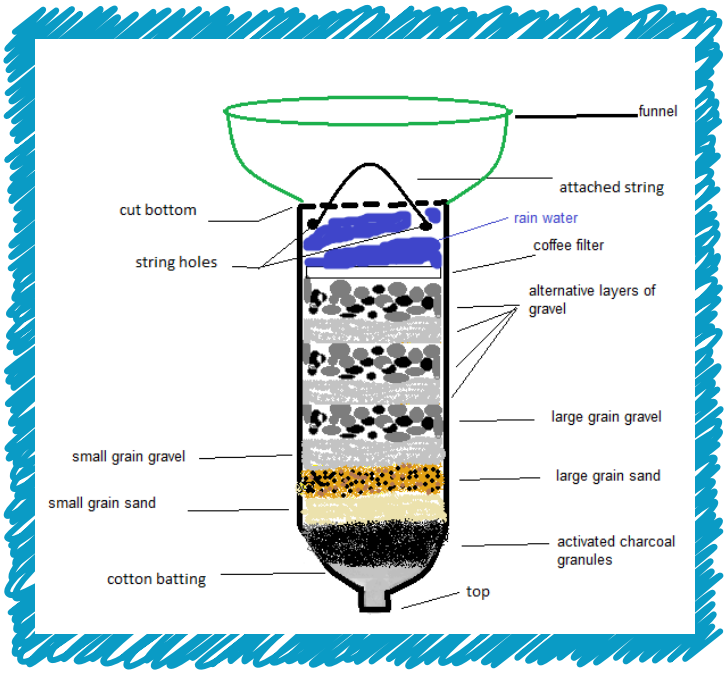
Step 2: Place the cotton batting at the top of the two-litre bottle; this will serve as the lining for your purifying system.

Step 3: Then place a layer of activated charcoal granules on top of the cotton. Next, place a layer of fine grain sand followed by a layer of large grain sand.

Step 4: Follow the layers of sand with a layer of fine grain gravel then larger grain gravel. Alternate these layers until you reach the top of the bottle.

Step 5: Top the filtration system with the coffee filter.

Step 6: Add the funnel to the top of the bottle.



The untreated water will work through the layers of sediment to wick away the impurities in the water. The cotton batting catches particulates from the sediment and acts as a final buffer.

Aftermath: discuss that you will have to clean the top layers of debris and change the filter every once in a while.

(30 mins)

CREATE A PLAN FOR FOLLOW UP, SHARING AND/OR CELEBRATION AT THE END OF THE CHALLENGE:

To create a long term understanding of soils and to promote the awareness of pollutants it is being proposed that the students make a pledge to not use lawn fertilizers or explain to their parents why they shouldn't use them. The students with the most pledges collected to not use fertilizers could maybe win a pizza party. The teacher could then send all the pledges into the Haliburton-Muskoka-Kawartha Children's Water Festival to show how they are doing their part. Or all of the pledges can be tallied up and sent on a post card made by the students back to the Haliburton-Muskoka-Kawartha Children's Water Festival.

RESOURCES/REFERENCES

- http://hmwaterfestival.ca/
- http://www.freedrinkingwater.com/water_quality/quality1/1-how-water-is-filtered-in-nature.htm
- http://www.groundwater.org/kc/whatis.html
- http://nyshooters.net/forum/archive/index.php/t-1193.html
- http://www.buzzle.com/articles/homemade-water-filter.html
- http://water.ygoy.com/homemade-water-filter/

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Please send comments and photos to: iheaven@outtolearn.ca

Wetland Warriors:
WATER SCIENCE & TECHNOLOGY

AREA BEST LINKED TO
City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka

OBJECTIVES
- Enhance students' understanding of the importance of wetlands and the many roles they play in our environment.
- Involve students in a community initiative to restore a local wetland.

CURRICULUM LINKS
Grade Four:

Science:
- 1.1: Analyse the effects of human activities on habitats and communities
- 3.10 describe ways in which humans are dependent on natural habitats and communities (e.g., for water, flood control in wetlands and leisure activities)

Grade Six:

Science:
- Assess human impacts on biodiversity, and identify ways of preserving biodiversity
- Demonstrate an understanding of biodiversity, its contributions to the stability of natural systems, and its benefits to humans

MATERIALS
Lesson:
- Lesson materials (See Instructions and Resources sections below)

Wetland Restoration:
- Shovels and trowels
- Work gloves
- Native Wetland/riparian plants
- Permits to do work (where appropriate)

BACKGROUND INFORMATION
Wetlands are unique ecosystems that play many important roles in our environment. They are areas where terrestrial and aquatic ecosystems meet, which creates a distinctive environment. Many wildlife species ranging from insects and fish to mammals and birds use wetlands as part of their habitat, for feeding, shelter, breeding grounds and migration.

Wetlands are also very important to humans because of the unique functions that they provide. Wetlands act as a giant sponge and have the ability to hold back large amounts of water after a heavy rainfall or spring melt, and release it slowly over time. This protects our homes and cities from flooding and helps to regulate water levels in lakes and rivers. The plants that grow in wetlands also provide a very important service to us by filtering out contaminants that would otherwise pollute our waterways.

Unfortunately, people have not always realized the great value of wetlands. In fact, part of the reason we now know why wetlands are so important is because so many of them were destroyed, leaving communities to deal with flooding problems and contaminated water. Wetlands have historically been drained and filled in to allow for development of cities and roads or to make more room for agriculture fields. There is legislation in place that protects wetlands from further destruction, however an astonishing percentage of the wetlands in Ontario are already gone.

Nature tends to repair itself, however sometimes enough damage has occurred to an ecosystem that it needs a helping hand to return to a similar version of it's former self. Restoring wetlands by planting native wetland plants and allowing water to assume its natural course helps to bring back diversity to the landscape. Eventually, wildlife will return to the area and natural wetland functions will reestablish.

This activity guides instructors through the process of planning a wetland restoration planting event through partnering with a local environmental agency. Students will learn about the value of wetlands in the classroom, and then have the opportunity to take part in the restoration of

INSTRUCTIONS

This activity includes two main components: a lesson and a wetland restoration planting event. It is recommended that teachers collaborate with local environmental groups or government agencies for both components of this activity. There are many organizations that have public outreach and education as well as restoration as part of their mandate, and would gladly partner with schools and teachers to promote wetland awareness. It is likely that the same organization could provide a guest speaker to give an age-appropriate presentation on wetlands to your class, as well as help in the coordination of the planting event. A list of organizations found in most regions that may be able to assist in the delivery of this activity follows:

- Conservation Authority (**www.conservationontario.ca**)
- Naturalist/Nature Club (**www.ontarionature.org**)
- Stewardship Council (**www.ontariostewardship.org**)
- Community Stream Stewards (Ontario Federation of Anglers and Hunters) (**www.ofah.org**)
- Ducks Unlimited Canada (**www.ducks.ca**)
- Municipality (Environmental Department)
- Ministry of Natural Resources (**www.mnr.gov.on.ca**)
- Local environmental initiatives

Lesson:

The lesson could be delivered by teacher(s), by a special guest who is an expert on wetlands, through use of media or some combination of these. The lesson should cover the following topics:

- What is a wetland?
- Why are wetlands important? / What do they do for us and other organisms?
- Why restore wetlands?

Refer to the resources section for many great sources of information to help plan the lesson. Partner agencies will also be a big help in delivering this component of the activity.

Wetland Restoration:

- Make contact with an environmental group or government agency that has knowledge and experience working with wetlands and restoration. Your partner will be a key player in delivering this activity. They will likely be involved in all of the steps described here. Many of the groups listed in the introduction of the 'Instructions' section carry out restoration activities with community groups and provide educational talks as part of their regular activities. In some cases, your partner may be able to take on some, or even all of the steps listed below, or at least be able to provide you with guidance.
- Select a site for the restoration to take place. Perhaps there is a degraded wetland on your school property or in a local park that could use some rehabilitation. Riparian (shoreline) areas are common sites where a wetland existed naturally but was removed for ease of access or other reasons. Your partner agency will likely be able to suggest some possible restoration sites as well.
- Secure appropriate permits. Depending on the site you choose to do the planting at, a permit may be required from one or more of the following agencies: municipality, conservation authority, Ministry of Natural Resources, Parks Canada or others. Your agency partner will likely be able to facilitate the permitting process and know the appropriate parties to contact. Be sure to secure all necessary permits before going ahead with any work.
- Set a date and make a plan for your event. Select the day and time for the restoration planting event. (Plantings are best done in the spring or early fall.) Will it be during school hours or on a weekend? Decide who will be invited to the event – other classes, students' families, the local community, etc. Be sure to arrange for appropriate advertising.

- Order plants and organize materials. Place an order for native wetland plants from a local nursery or plant supplier who is knowledgeable about native species. Your partner will also be able to advise on which species are best suited to your site (they may even take care of this step, as they likely have established relationships with reputable plant suppliers). Determine how this will be paid for – by the partner agency, from the school budget, from fundraising done by the class, etc. Also be sure that other materials needed for the event are organized (shovels, work gloves, refreshments, etc.)
- Take part in the event! Enjoy the day with the students – be sure to take lots of photos and acknowledge the hard work of all those involved. Consider inviting local media to the event, it may generate awareness about wetland restoration as well as promote the activities of your school and partner agency.
- Arrange for aftercare of the site. After restoration work has been done, the site needs to be monitored. This could become an annual project for a class or your school – students could be involved in assessing the survivorship of plantings and plan future restoration activities at the site. Aftercare may also be something that your partner is willing to take on as their responsibility.

RESOURCES/REFERENCES

- Video: Bill Nye the Science Guy – Episode #57 – "Wetlands"
- "Wetlands" Author: Lynn M. Stone, Publisher: Rourke Enterprises, 1989
- "Wetlands" Author: Emile U. Lepthien, Publisher: Children's Press, 1993
- Ministry of Natural Resources – Wetlands Webpage
  http://www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/STEL02_167268.html
- Environment Canada – Wetlands Webpage (with lots of links to other information sources about wetlands)
- **http://www.ec.gc.ca/default.asp?lang=En&n=540B1882-**1
- Wetlands International: **www.wetlands.org**

FEEDBACK

We appreciate your feedback! Please let us know…

- Did this activity continue the learning your students engaged in at the Water Festival?
- What curriculum requirements did this activity satisfy?
- Was the activity easy to facilitate to your class?
- Did students have fun and learn something new about water?
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Water use in the 21st century: WATER TECHNOLOGY

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka.

OBJECTIVES

- Increase students' awareness of the many ways we use water, both directly and indirectly.
- Explore, through research and discussion, how water is used in different sectors.

CURRICULUM LINKS

Grade Four:

Arts:

- D1.1: Create two- and three-dimensional works of art that express feelings and ideas inspired by their interests and experiences
- D1.3: Use elements of design in art works to communicate ideas, messages, and understandings

Science:

- 1.1: Analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials), taking different perspectives into account (e.g., the perspectives of a housing developer, a family in need of housing, an ecologist)

Grade Six:

Arts:

- D1.1: Create two-dimensional, three-dimensional, and multimedia art works that explore feelings, ideas, and issues from a variety of points of view

MATERIALS

- Chart paper or mural paper (1 piece per group)
- Markers (1 package per group)
- Old magazines
- Scissors (class set)
- Glue sticks (class set)
- Resources for student research (books, encyclopedias, internet access, etc.)

BACKGROUND INFORMATION

During this activity, students will be thinking about and discussing the many ways that we use water in our society. Often when we think about this, we think of every day personal uses, such as drinking and washing. In reality we use water directly and indirectly for just about everything we do, from brushing our teeth to putting gasoline in our vehicles to turning on a light.

To broaden students' awareness of the topic, water use within four or five major sectors of society will be discussed: residential, commercial, industrial and agriculture (transportation can be used as a fifth sector if required to make group size manageable).

Related HMCWF Activity Centres:

- Doing the Laundry, How Much Water Does It Take?
- Just Dam It!, Three Times A Day

DISCUSSION, RESEARCH AND CONSTRUCTION

This activity contains three main components: class discussion, research and mural construction, and presentations. All three components can be completed all at once (i.e. over the course of an afternoon) or broken up over a longer period of time to fit your schedule.

DISCUSSION

Engage class in a discussion about how they use water. Start with a broad opening question. Expect answers relating to personal consumption and sanitation (drinking, cooking, showering, etc.) Then broaden the discussion to include water use in manufacturing goods and services we use everyday (e.g. gasoline, electricity). See chart below for questions to encourage discussion and brainstorming.

Opening Questions	Expanding Questions
• How have you used water today/how do you use water everyday? • How does your family use water? • How does our school use water?	• How did you get to school today? How was water used in this process? • What did you eat for breakfast/lunch today? How was water used to make/grow that food? • Look around the classroom – how is water used to make the items you use here?

Guide the discussion to cover water uses in the sectors you have chosen to explore. Examples are provided below to facilitate this part of the discussion.

Sector	Water Use Examples
Residential (E.g. private homes, apartment buildings)	• Personal sanitation • Consumption • Cleaning • Gardens and lawns (irrigation) • Hydro-electricity
Commercial (E.g. office building, shopping mall)	• Landscaping/decoration (i.e. fountains) • Hydro-electricity • Consumption • Cleaning
Industrial (E.g. Factory)	• Manufacturing • Cooling (of machines, etc.) • Hydro-electricity • Consumption • Cleaning
Agriculture (E.g. farms – crop and livestock)	• Crop irrigation • Livestock watering (drinking) • Cleaning • Hydro-electricity
Transportation (E.g. personal transport and public transit)	• Cleaning • Fuel manufacturing • Transportation method (i.e. ferry, canoe) • Hydro-electricity

RESEARCH & MURAL CONSTRUCTION

- Split class into 4 or 5 groups; assign each group a sector to research.
- Provide designated class time for groups to research their sector. Encourage the use of different types of research materials. Students may incorporate personal experience.
- Provide designated class time for groups to assemble/create their mural. Students may draw and collage images to represent water use in their sector.

PRESENTATIONS

- Hang murals on the blackboard, or in a location clearly visible for the whole class.
- Have each group take turns standing up to present their mural. Ask them to explain how their drawings/collage relate to how water is used in their sector.
- Ask each group to name a use of water in their sector that they were unaware of before they did their research.
- Encourage questions from the other groups and class discussion about each sector as the groups present.
- Continue to display the murals around the classroom as a reminder of the many ways that we use water in our society.

RESOURCES/REFERENCES

- Environment Canada's Water Webpage:
  http://www.ec.gc.ca/eau-water/
- The Atlas of Canada – Water Consumption:
  http://atlas.nrcan.gc.ca/site/english/maps/freshwater/consumption/1

FEEDBACK

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Haliburton-Muskoka-Kawartha children's water festival

Being clean on a clean conscience: WATER TECHNOLOGY

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and the District of Muskoka

OBJECTIVES

- To enhance students' awareness of the environmental contamination, and more specifically the contamination of water resources, that is a result of regular household cleaning products.
- Facilitate student learning and the learning of the surrounding regions' residents through the students about household cleaners that are less harsh on our water sources

MATERIALS

- Small containers
- Newspapers
- Rubber gloves
- White vinegar, baking soda, water, borax, etc (these items will vary depending on recipes selected)
- Small spray bottles
- Sponges
- Markers
- Poster paper and board
- Fold up tables
- School gymnasium or an adequate space to hold your workshop and guests
- Label stickers the appropriate size for containers and spray bottles

CURRICULUM LINKS

GRADE FOUR:

Arts:

- D1.2 demonstrate an understanding of composition, using selected principles of design to create narrative art works or art works on a theme or topic
- D1.3 use elements of design in art works to communicate ideas, messages, and understandings

Science:

- 1.1: Analyse the positive and negative impacts of human interactions with natural habitats and communities
- 2.1: Follow established safety procedures for working with soils and natural materials (e.g., wear gloves when handling soils to set up a working terrarium)
- 2.6 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes
- 3.10 describe ways in which humans are dependent on natural habitats and communities (e.g., for water)

Mathematics:

- compare and order fractions (i.e., halves, thirds, fourths, fifths, tenths) by considering the size and the number of fractional parts (eg., 4/5 is greater than 3/5 because there is more parts in 4/5; 1/4 is greater than 1/5 because the size of the part is larger in 1/4)
- compare fractions to the benchmarks of 0, 1/2, and 1 (eg. 1/8 is closer to 0 than to 1/2; 3/5 is more than 1/2)

GRADE SIX:

Arts:

- D1.2 demonstrate an understanding of composition, using selected principles of design to create narrative art works or art works on a theme or topic
- D1.3 use elements of design in art works to communicate ideas, messages, and understandings

Science:

- 2.5 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes

BACKGROUND INFORMATION

BACKGROUND INFORMATION:

Throughout the City of Kawartha Lakes, the County of Haliburton and the District of Muskoka a disconnection and lack of understanding regarding the treatment and distribution process that wastewater and drinking water undergoes is prevalent. Some individuals of these regions are unaware of what it takes to maintain good quality water and therefore do not recognize how some activities they take part in might be damaging to the environment.

Many common household products used for cleaning our homes and bodies have the opposite effect on our water. Whether we put it in our hair or in our toilet, items like dyes and detergents for example, regularly contaminate aquatic ecosystems placing a burden on our aquatic plants, fish and wildlife. Many household cleaning materials are of the most toxic substances found in the average home! They can also be difficult to remove during wastewater treatment processes and can even be detrimental to the health of beneficial bacteria that live and are used at wastewater treatment facilities and in septic tanks to help digest pathogens. To make matters worse, disposable "convenient" counter, stove, toilet etc. wipes are becoming increasingly popular to use and... You guessed it, flush. This is not only wasteful; all of these products need to be removed from wastewater.

This activity is meant to introduce students to recipes for homemade alternatives to harsh household products that we commonly use for everyday hygiene and cleaning. They will then share their new knowledge and recipes with their school and broader community through a fun and informative workshop.

INSTRUCTIONS

This activity is centered around two major components; that of making environmentally friendly products from scratch and organizing a work shop to engage and educate the broader community about the benefits of these alternatives and how to make them. Discussion with the students regarding the workshop guests, advertising, location, etc is fundamental and possibly a lengthy process and should be the first step.

OPENING DISCUSSION

- Describe the impact of household products on aquatic ecosystems and overall water quality. Introduce the option of making alternative products from common household items and the environmental advantages of doing such. See the table provided.
- Discuss with class the idea of educating the rest of the community through an open information workshop. Begin to brainstorm where the workshop could be held, how it should be advertised, what audience they wish to target (fellow students, parents and the general public, all ages, etc.), how they will delegate responsibilities and so forth.

ORGANIZE WORKSHOP

- Decide the nature of the workshop. This decision will be influenced by the desire of the teacher and students. There may be separate workshop stations where a different product can be featured at each table or the class may decide to do a demonstrative presentation for example. Tailor the workshop style to the class' strengths and the desired audience.
- Determine and finalize who, where, when and how everything that was discussed in step 2 above will be addressed. For more information on making the right choice regarding guests, how to appeal to your desired audience, selecting the right location, etc. see the "Additional Resources" section below.
- Advertise. Create workshop flyers and start informing the rest of the school and community of this event.
- Select which alternative cleaners would be most feasible to distribute. Prepare cleaner samples and kits using the recipes below, spray bottles, containers, sponges and appropriate labels.
- Develop an educational handout for workshop participants. This document would outline information that the class deems most important for workshop participants to take home with them.

ENVIRONMENTALLY SOUND PRODUCTS

Product	Recipe	Use
All Purpose Cleaner	• ½ cup vinegar • ¼ cup baking soda (or 2 tsp borax) • 2 litres water	Can be stored and kept. Use on shower door windows, mirrors, windows, facets, etc.
Deodorizer	• 1 tsp baking soda • 2tbsp lemon juice • ½ cup vinegar • Enough water to fill the rest of bowl	Put small bowls of mixed deodorizer around the house to absorb unwanted odours.
Drain cleaner	• ½ cup salt • 4 litres hot water • Or for tougher to clean Metal drains: • ½ cup baking soda • ½ cup vinegar	Mix and pour down drain For second recipe, pour vinegar and baking soda directly down drain. Wait for 15 minutes and pour boiling water into drain.
Furniture Polish	• 1 cup olive oil • ½ cup lemon juice	Pour ingredients into a spray bottle and shake. Spray onto rag and wipe evenly over wooden furniture.
Oven cleaner	Baking soda and vinegar	Generously sprinkle baking soda over area. Apply vinegar from spray bottle (enough to moisten baking soda). Let set and scrub with a scrub pad
Spot remover for linens	Club soda	Apply directly to spots on linens, clothes and carpets. Dab to dry.
Glass and window cleaner	Vinegar and newspaper	Crumple up newspapers into ball and spray vinegar from a spray bottle onto windows and mirrors. Wipe in circular motions.

RESOURCES/REFERENCES

- Frugal Homemade Household Products Guide: **http://www.frugalicity.com/home-made.html**
- Non-toxic Home Cleaning: **http://eartheasy.com/live_nontoxic_solutions.htm**
- Home Made and Eco Friendly Cleaning Solutions: **http://mommyfootprint.com/home-made-eco-friendly-cleaning-solutions/**
- Planning a Workshop: **http://www.mindtools.com/pages/article/PlanningAWorkshop.htm**

FEEDBACK

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- What curriculum requirements did this activity satisfy?
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Above activities researched and organized byTamara Tucker and Lauretta Dunford, Trent University.

Funky & Fun Filteration: WATER TECHNOLOGY

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and the District of Muskoka

OBJECTIVES

- Provide students with fundamental knowledge about the challenging treatment process their wastewater must go through.
- Briefly introduce students to the importance of water quality guidelines.
- Through this trial and error activity, instil an appreciation for clean, clear water and the facilities available in the City of Kawartha Lakes, the County of Haliburton and the District of Muskoka that help to provide this resource.

CURRICULUM LINKS

Grade Four:

Science:

- 1.1: Analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials)
- 2.1: Follow established safety procedures for working with soils and natural materials (e.g., wear gloves when handling soils to set up a working terrarium)

Grade Six:

Arts:

- D1.4: Use a variety of materials, tools, techniques, and technologies to determine solutions to design challenges

MATERIALS

- Rubber gloves (1 pair per student)
- Cut triangles of wire mesh screen (1, 12x12x21 inch triangle per group)
- Cut squares of nylon/panty hose (1, 11x11 inch square per group)
- Coffee filters (3 per group)
- Empty 2 litre drinking bottles (pop, water, etc) with labels removed (4 per group)
- Muddy "soiled" water (approximately 1.5 litres per group)
- Plastic pitchers (1 per group)
- Scissors
- Tape
- Elastic bands
- Resources for student research (books, encyclopedias, internet access, etc.)

BACKGROUND INFORMATION

Throughout the City of Kawartha Lakes, the County of Haliburton and the District of Muskoka lives a mixture of both rural and urban residents. Those that live in urban areas have their wastewater treated by the nearest local wastewater treatment facility. This is a complex facility designed to remove harmful substances from municipal wastewater utilizing a series of system components such as settling tanks, aeration (pumping air into the water), microorganisms (bacteria that break down waste present in the water), flocculants (chemicals that cause the waste in the water to form larger masses of sludge that can be more easily removed), etc. All of this is done to ensure that the water being released from the wastewater treatment facility meets the regulatory water quality guidelines to mitigate hazards to human and environmental health.

Another portion of the residents in these regions live on septic systems that act as personal household wastewater treatment facilities. Generally in these systems water that has been used in the tub, tap or toilet is pumped into a septic tank where beneficial microorganisms work to break down harmful pathogens. It is then released into the soil for further natural treatment that occurs as it leaches through the ground and back to the household well.

A few alterations to these two common systems exist. One of which involves municipalities that may have one or more households drawing water from a single well in place of one household only obtaining water from a personal well that they are responsible for tending to. A second variation exists on rural properties that may not have a septic tank but instead have a holding tank where household wastewater is simply retained until it is pumped out periodically. This hands-on activity is meant to engage students in the wastewater treatment process by creating their own filtration system utilizing a few simple and common items.

OPENING DISCUSSION

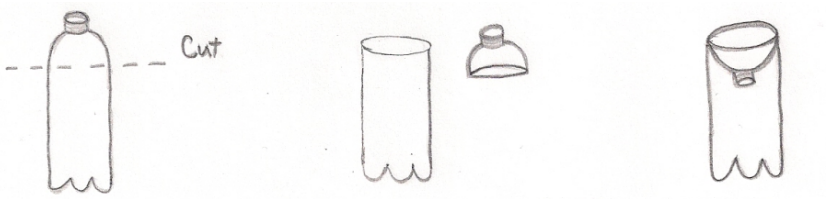
- Ask the class to consider and discuss what it is that they think happens to their wastewater?
- Discuss with the students whether they are aware of which wastewater treatment process their household makes use of?
- Encourage the class to describe what they are familiar with about their water system and inform them of what they are unaware of (see background information).
- Facilitate discussion surrounding some of the common sources of water contamination generated by households (i.e. cleaners, hygienic products, human waste, pharmaceuticals, etc.).

WATER FILTER CONSTRUCTION

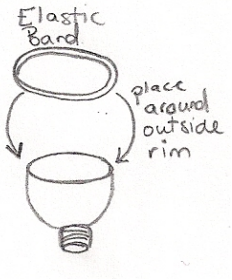
This activity would be best attempted by splitting the class into smaller groups and distributing the materials accordingly. The list of materials provided is a simple guide and can be expanded on to accommodate the teacher's available resources and ideas. Begin by asking the students to put on their rubber gloves.

1. Obtain 1, 2 litre bottle/group of dirty water. It is best if it is approximately ¾ full. This is to resemble wastewater and should have some soil, plant matter and gravel in it to allow students to clearly observe the filtration process. Give 1 of these to each group of students and ask them to agitate the mixture by shaking it. Place this bottle aside.

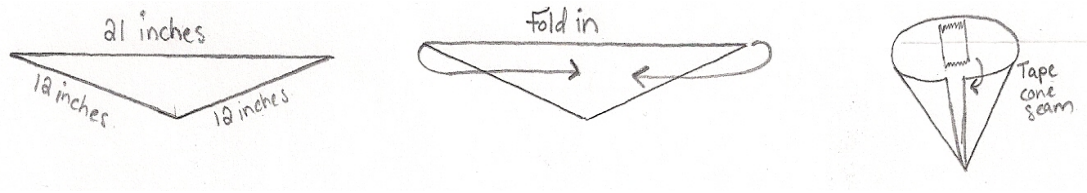
2. Provide each group with 3 empty 2 litre bottles. The teacher is encouraged to prepare these before class by doing the following. Un-lid the bottles and pre-cut the top "neck" portion off in a way that the students can turn it upside down and place it in the bottom portion of the bottle. Try to cut them as near the top as possible to ensure the coffee filters will fit in them properly.



Also, if it becomes a challenge to make them fit as seen in the diagram, try wrapping elastic bands around the outside of the cut, top portion of the pop bottle to secure it in place. Refer to the image to the right.

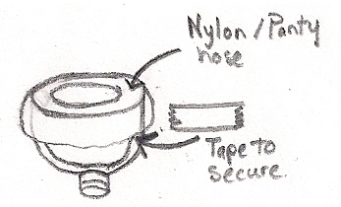


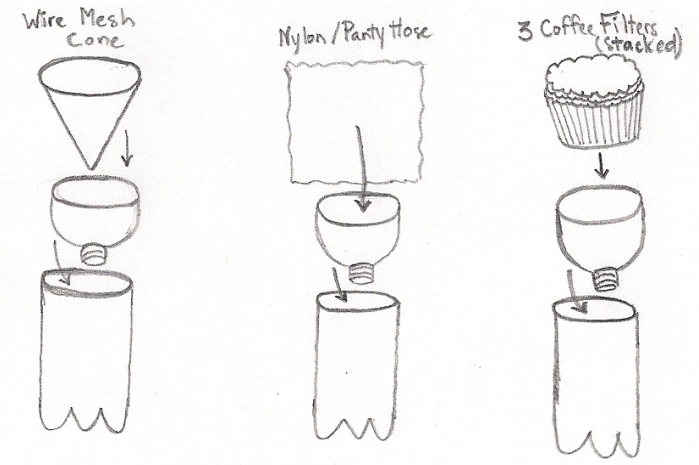
3. Distribute a set of the three different water filters to each group (i.e. 1 wire mesh cone, 1 nylon/panty hose square and 3 coffee filters per group). Before class prepare the wire mesh triangles and fold them into cones. Fasten them with tape ensuring that there is no hole at the narrow end of the cone that large pieces of material in the water can escape through. Refer to the image below. Cut excess mesh that protrudes and does not contribute to the shape of the cone.



4. Ask each group to place their un-lidded bottle tops upside down in the bottle bottoms. Tape them in place if they do not remain stable.

5. Situate the wire mesh cone in the top of one of the bottle structures, the nylon in the second and approximately 3 coffee filters in the other. See the illustration below.





The nylon pieces should be relatively loosely fastened using tape so that they reach the bottom of the bottle top funnel. Refer to the above-right for an illustration of this. Make sure that each group has their separate filters in the order of wire mesh, nylon and then coffee filters.

1. Refer back to the, what should now be partially settled "wastewater." Ask the class to comment on how it appears different from when they shook it. Most of the heavy material should be settle to the bottom much like what happens at municipal wastewater treatment facilities.
2. Slowly pour the water through the wire mesh filter system being careful to disturb as little of the bottom as possible. Once all of the water has been filtered through this first system remove the bottle top funnel and pour the water from the large bottom portion of the cut 2 litre pop bottle into the plastic pitcher.
3. Pour the partially "treated wastewater" through the nylon filtration system from the plastic pitcher. Proceed to pour the water into the rinsed plastic pitcher from the bottom cut portion of the pop bottle after it has been filtered by the second nylon/panty hose system.
4. Repeat with the final coffee filter filtration system. Leave the "treated wastewater" in the bottom of this system (the bottom of the pop bottle) so the class can observe and refer back to it to make comments throughout the discussion period.

DISCUSSION QUESTIONS

- What did you notice when pouring the dirty water through the different strainers of the filtration system?
- Consider the difficulties of removing things that cannot be seen from the water. Do you think this might change the way you question what you put down the drain? Why?

RESOURCES/REFERENCES

- Ministry of the Environment, Drinking Water Ontario:
  http://www.ontario.ca/ONT/portal61/drinkingwater
- The City of Kawartha Lakes:
  http://www.city.kawarthalakes.on.ca/residents/water-and-wastewater
- Canada Mortgage and Housing Corporation:
  http://www.cmhc-schl.gc.ca/en/co/maho/gemare/gemare_009.cfm
- Ontario Clean Water Agency:
  http://www.ocwa.com/
- The Atlas of Canada – Water Consumption:
  http://atlas.nrcan.gc.ca/site/english/maps/freshwater/consumption/1

FEEDBACK

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Flush and Save:
WATER CONSERVATION

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka

OBJECTIVES

- Learn to be creative in conserving water
- Raise awareness about the amount of water used by the average toilet
- Understand the importance of water conservation

CURRICULUM LINKS

GRADE FOUR:

Arts:

- D1.1: Create two- and three-dimensional works of art that express feelings and ideas inspired by their interests and experiences
- D1.3: Use elements of design in art works to communicate ideas, messages, and understandings

Science:

- 1.1: Analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials), taking different perspectives into account (e.g., the perspectives of a housing developer, a family in need of housing, an ecologist)

GRADE SIX:

Arts:

- D1.1: Create two-dimensional, three-dimensional, and multimedia art works that explore feelings, ideas, and issues from a variety of points of view

MATERIALS

- Any 1-liter plastic pop, juice or milk bottle with screw cap
- Sand or gravel
- You can use two 1-liter bottles or even a 2-liter bottle depending on toilet tank size

BACKGROUND INFORMATION

This activity looks at how we can conserve water when we flush our toilets. Toilets make up for the highest amount of water used in a home in any given day including laundry day. The average person flushes a toilet 8-10 times a day. Older larger toilets can flush 13 litres of water per flush; slightly newer toilets can flush 6 litres of water per flush. The average number of people in a household is four creating 36- 40 flushes a day per family. In terms of water conservation most people are not doing a very good job at it. This activity is a simple way to improve the efficiency of almost any toilet. We can reuse simple materials that are found in recycle bins to help conserve water on a daily basis. Modern, high efficiency toilets can use as little as 1.6 litres of water per flush. But until toilets are replaced, try this simple activity under your parent's supervision to conserve water when you flush your toilets at home.

TOILET TANK CONVERSION

- **Step 1:** take the plastic bottle remove any paper or plastic on outside of bottle.
- **Step 2:** add sand or gravel to the bottle and fill about ¼ of the bottle.
- **Step 3:** fill the rest of bottle with water and replace lid (make sure to rinse off any excess dirt on outside of bottle).
- **Step 4:** with your parents help remove lid to toilet tank and carefully add bottle to side of tank free of any mechanisms (drop it in slowly to not spill any water).
- **Step 5:** replace lid!

You are now done! Your toilet will save 1-2 litres of water for every flush! This can convert your 6-liter flushing toilet into a 4-liter flushing toilet!

This simple activity will not only save up to 80 litres of water a day (for large toilets that can take 2 litre bottles) but will save the amount of times the septic tank has to be emptied a year, saving your parents money on utilities and septic services.

Congratulations not only did you reuse materials that would have been recycled but also you are doing your part to conserve water use in the bathroom.

RESOURCES/REFERENCES

- http://www.toiletabcs.com/toilet-water-conservation.html
- http://www.wikihow.com/Convert-Any-Toilet-to-a-Low-Flush-Toilet

FEEDBACK

We appreciate your feedback! Please let us know…

- Did this activity continue the learning your students engaged in at the Water Festival?
- What curriculum requirements did this activity satisfy?
- Was the activity easy to facilitate to your class?
- Did students have fun and learn something new about water?
- Please send photos of your class using these activities!

Please send comments and photos to: iheaven@outtolearn.ca

Water on earth:
WATER CONSERVATION

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka

OBJECTIVES

- Raise awareness about the importance of conservation of water
- Learn about how much of our Earth is water and how much is accessible to humans
- Understand the role humans play in the amount of water we have

CURRICULUM LINKS

GRADE FOUR:

Arts:

- D1.1: Create two- and three-dimensional works of art that express feelings and ideas inspired by their interests and experiences
- D1.3: Use elements of design in art works to communicate ideas, messages, and understandings

Science:

- 1.1: Analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials), taking different perspectives into account (e.g., the perspectives of a housing developer, a family in need of housing, an ecologist)

GRADE SIX:

Arts:

- D1.1: Create two-dimensional, three-dimensional, and multimedia art works that explore feelings, ideas, and issues from a variety of points of view

MATERIALS

- 4 plastic tubs
- 4 small buckets/pails
- 4 label's
- 1 permanent marker
- 1 measuring cup

BACKGROUND INFORMATION

Water on Earth is composed of 97% salt water and 3% fresh water. Only 1% of the fresh water is accessible for human consumption and the rest is found in ice caps, air, soil, and underground water (Ward 2003). With only 1% of fresh water accessible for human consumption, it is a critical issue that needs to be addressed. The average Canadian uses approximately 350 litres of fresh water per day (Draper & Shrubsole 2007). If everyone only used the amount they needed then there would be enough for everyone, but the truth is that people use more water than necessary. The purpose of this activity is to show students how much water is actually available on earth for human consumption and how important it is for us to conserve it.

PROCEDURE

Teachers should start out by asking the students some questions.

Water comes in three forms: gas (vapour), solid (ice), and liquid (water). Identify as many places as possible where we can find water on earth.

- **Ask: What percentage of the water on Earth is available for humans to use?**
  Have a discussion about this without telling them the answer as it will be demonstrated later on in the activity.
- **Ask: How much water does each of you use a day?**
  The average Canadian uses approximately 350 litres of water per day (Saccoccio 2007). Explain how we use more water each day than we really should.

To visually demonstrate how much water is on earth to students. Use 4 small tubs to represent the percentage of water in oceans, in fresh waters (glaciers/lakes/rivers), and the amount of fresh water available for human consumption. This activity is best done outside since there is water involved and will provide more space for the activity. The steps are as follows:

1. Label 4 different small tubs: Salt Water (Oceans), Fresh Water (Lakes & Rivers), Fresh Water (Glaciers, Air & Groundwater), and Freshwater (For Human Use). Place each container a few feet apart from each other.
2. Split the class into 4 groups and give each group a bucket of water. Ask them to discuss within their groups how much water should go into each labelled tub. Then allow each group, one at a time, to pour the amount of water from their bucket into the 4 labelled tubs that they chose for each. After each group does this, ask them why they chose the amount they did for each labelled tub. Do this for all 4 groups.
3. After each group has gone, pour the water from the tubs back into the buckets.
4. Using a measuring cup, measure 970mL of water and pour it into the Salt Water Tub. This represents 97% of the Earth's water being salt water. Measure 30mL of water and pour it into the fresh water tub. From this tub take 10mL and pour it into the glaciers/river/lakes tub, and take 10mL from this and pour it into the fresh water for humans tub. Each of these 10mL's represents 1% of the Earth's fresh water.
5. Explain to the kids that each amount of water in the tubs represents a percentage of water, and all the tubs added together represent all the water on Earth. A discussion about what they have learned can then be done. Throughout this discussion or before you can give the kids some information:

Our bodies are approximately two-thirds water and all living things, fruit, and vegetables need water and it is home to all kinds of life forms (Environment Canada 2009). A non-renewable resource is something that could one day be gone forever with no way of bringing it back. The fresh water on earth could be seen as a non-renewable resource. This is why we need to use the small amount of water we do have available to us very wisely. There are many ways we can conserve water and it all starts with every one of you in your everyday lives. To help conserve water at home you can take shorter showers, not leave the tap on while brushing your teeth, and use the hose to water your plants a lot less. Living in Canada we are very lucky because every day we have clean, safe water that we can use, but there are people in other countries that do not have this luxury. Water is extremely important and we should not take it for granted by doing everything we can to conserve it.

After a discussion, have the children use the water to water plants or trees in the school yard. This will help them begin their new found journey of water conservation by using that water for something useful rather than pouring it down the drain. This could also be used as a brainstorming idea for re-using water. There are many instances in life where water can be re-used, for example instead of putting a glass of water or water from a bottle down the drain when you don't want any more you can water some plants with it or put it in your dogs water dish. Ask the children if they can think of any other situations where they can re-use water instead of wasting it.

RESOURCES/REFERENCES

- Draper, Dianne & Shrubsole, Dan (2007). Water Use and consumption in Canada. EAU Canada, Ed. UBC Press. Retrieved 20 March 2011. **www.watergovernance.ca/Factsheet/pdf/fs_water_use.pdf**
- Environment Canada (2009). Topic 6: Water Conservation—Every Drop Counts. Retrieved 19 March 2011. **http://ec.gc.ca/eau-water/default.asp**
- Saccoccio, Sabrina (2007). In Depth Water: What's in a glass of water? CBC News. Retrieved 12 April 2011. **http://www.cbc.ca/news/background/water/tapwater.html**
- Ward, Alan (2003). Weighing Earth's Water from Space. Earth Observatory. NASA Space Flight Centre. Retrieved 20 March 2011. **http://earthobservatory.nasa.gov/Features/WeighingWater/**

FEEDBACK

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The Rain Collector: WATER CONSERVATION

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka

OBJECTIVES

- Learn to be creative in conserving water
- Raise awareness about the amount of water wasted from running a hose or tap
- Understand the importance of water conservation

CURRICULUM LINKS

GRADE FOUR:

Arts:

- D1.1: Create two- and three-dimensional works of art that express feelings and ideas inspired by their interests and experiences
- D1.3: Use elements of design in art works to communicate ideas, messages, and understandings

Science:

- Analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials), taking different perspectives into account (e.g., the perspectives of a housing developer, a family in need of housing, an ecologist)

GRADE SIX:

Arts:

- D1.1: Create two-dimensional, three-dimensional, and multimedia art works that explore feelings, ideas, and issues from a variety of points of view explore feelings, ideas, and issues from a variety of points of view

MATERIALS

- Large container (ie. Garbage pail, drum) it is suggested that a 55gallon drum be used.
- 1 plastic faucet
- 1 female coupling
- 1 skimmer basket
- Teflon tape
- All purpose caulking or plumbing sealant
- 1- 5ft. Section of a garden hose
- 4 hose couplers
- One 12"x 12" piece of fibre glass window screen
- Drill bit or saw

Rain barrels can be made simple using just a garbage pail at the bottom of a downspout or they can be made more efficient where it stops debris and insects from getting inside, as well as a partial hose coming out of it to ensure nothing gets inside. Both ways work and both will help conserve water.

BACKGROUND INFORMATION

The amount of water from a hose a household uses to water plants and wash their car is approximately 40% of the total household water use during the summer months (Environmental Protection Agency 2009). Not only is a large amount of water wasted in a day from using a hose, but also from the whole water system it is hooked up to. It is important to find alternative ways to water plants or wash a car that does not waste so much water. One way is by using a rain barrel. A rain barrel is a container that collects and stores rainwater that comes off rooftops or from downspouts (Environmental Protection Agency 2009). The water collected can be used to wash your car or water your plants. Using rain barrels can potentially help lower water bills and improve the vitality of plants, lawns and trees.

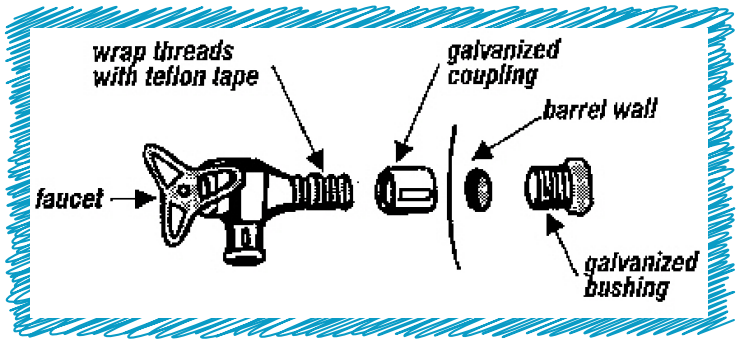
CREATING A RAIN BARREL

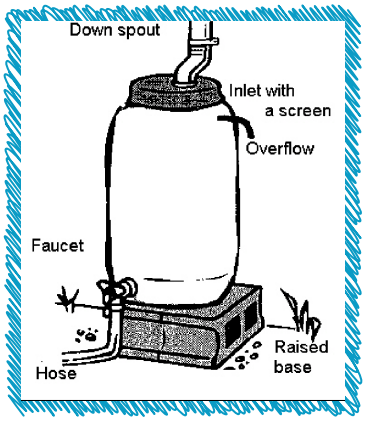
This is a take home activity that the children can create at home with their parents. As the teacher you can give them the information they need in order to create a rain barrel after teaching them a few things about water conservation. Explain to the students the importance of water conservation and that there are very simple things they can do at home with their parents that can help them conserve water. Building a rain barrel and painting it, is an easy and fun activity that teaches children they can be creative at the same time as conserving water. Creating a rain barrel incorporates the importance of water conservation in the curriculum and also the arts aspect of the curriculum. Not only do children learn about water conservation at school but they can take what they have learned and teach their parents. Having this knowledge to give to their parents will engage the students in a serious issue and could potentially encourage the whole family to find new ways of conserving water on a day-to-day basis.

This take-home activity could be greatly expanded to a community rain barrel making workshop. Students, supervised by the teacher, could conduct a workshop for anyone in the community who wants to participate in creating their own rain barrel. The students can use what they have learned in the classroom and teach the community the importance of water conservation and how a rain barrel can help create a source of useable water for their families. The workshop would include creating rain barrels and painting them to demonstrate the fun creative part of water conservation. A contest of the best decorated rain barrel could also be considered.

Steps to Creating a Rain Barrel:

- Buy the materials stated under the materials section or develop similar materials.
- Using a saw or a drill cut approximately a 6 inch (or the size of the skimmer basket) hole in the top of the 55gallon drum. An adult should do all the necessary cutting for this activity.
- Place the skimmer basket in the hole and use glue to keep it in place. The skimmer will keep debris and insects from getting into the rain barrel.
- Drill a ¾ inch hole near the bottom of the 55 gallon barrel so the faucet can be placed there.
- Drill another hole about 2 to 3 inches from the top of the barrel for the overflow. Insert a hose here for when the barrel fills up, water will come out here and another bucket can be placed underneath.
- Wrap Teflon tape around the faucet threads to ensure a good seal. Clamp the coupling in a vice, and with a pipe wrench screw the faucet into the coupling.
- From the inside of the barrel push the bushing through the bottom hole and tightly attach the faucet unit from the outside. Attach a hose to the faucet if wanted.
- Place silicon along the barrel wall and the coupling to ensure a tight seal.
- Depending on if the barrel is created at home or not, you will need to figure out where to cut the downspout so it goes into the barrel. Many rain barrels are also placed on a base so the barrel is higher up allowing space for a bucket under the faucet.





RESOURCES/REFERENCES

- City of Ottawa (2011). How to Build a Rain Barrel. Retrieved 12 April 2011. **http://www.ottawa.ca/residents/water/waterwise/outdoors/lgt/rain_barrel_en.html**
- Environmental Protection Agency (2009). What is a Rain Barrel? Environmental Assessment and Innovation division. Retrieved 12 April 2011. **http://www.epa.gov/region3/p2/what-is- rainbarrel.pdf**
- Uswitch (2011). How much water do you use? Uswitch, Usave, Usmile. Retrieved 21 April 2011. **http://www.uswitch.com/water/how-much-water-use/**

FEEDBACK

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Water Conservation Experiments:
WATER CONSERVATION

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka

OBJECTIVES

- Help students to become aware of their water consumption and waste in their everyday lives
- Raise awareness of what students can do to conserve water at school and at home
- Increase understanding of the need for watershed protection through conserving water

CURRICULUM LINKS

GRADE FOUR:

Arts:

- D1.1: Create two- and three-dimensional works of art that express feelings and ideas inspired by their interests and experiences
- D1.3: Use elements of design in art works to communicate ideas, messages, and understandings

Science:

- 1.1: Analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials), taking different perspectives into account (e.g., the perspectives of a housing developer, a family in need of housing, an ecologist)

GRADE SIX:

Arts:

- D1.1: Create two-dimensional, three-dimensional, and multimedia art works that explore feelings, ideas, and issues from a variety of points of view

BACKGROUND INFORMATION

Water is everywhere and almost everything is made up of water. Potatoes are made up of 80% water; a cow is made up of 74% water. There is not much more to a tomato then 95% water. Humans are about 65%-70% water meaning we are more liquid then solid. (Bryson B. 2003) That being said it is obvious that we need fresh water to survive. It is important that we teach and practice water conservation. Every water molecule that was present when the earth's oceans were formed is still present here today. It's present in one of three forms, a gas (steam, vapour, clouds) a liquid (water) or solid (ice). Water molecules move in various ways and speeds through the water cycle. Water in gas form may stay in our atmosphere for about 9 days. Water in ice form (solid) can stay frozen in polar ice caps for 10,000 years. This is why most of the world's fresh water is present in the ice caps. This leaves the remaining majority of fresh water in groundwater. This water is located in aquifers underneath the earth's surface. In North America we use some of this groundwater for our daily lives. Unfortunately this water taken is not returned immediately to the groundwater system but passed down sewers to water treatment plants and then passed into rivers and lakes. From rivers and lakes that water eventually makes its way to the ocean or atmosphere. Groundwater is renewed from water slowly percolating through soil and bedrock making its way back into these groundwater aquifers. Shallow groundwater has an average renewal rate of 300 years while deep groundwater (deeper than 1,000 meters) can take about 4,600 years to renew. (Canadian Wildlife Federation 1988) When vast amounts of water are removed from the water table it can have grave effects on ponds marshes and streams. The groundwater levels drop, drying out wetlands and potentially killing aquatic wildlife like fish, turtles and frogs and removing other aquatic functions that are preformed in these important ecosystems. Wetlands help clean polluted water before passing the water through the soil into the water table. If wetlands dry up due to low water tables, there is a greater chance that the remaining ground water will become contaminated by pollution. If we practice personal water conservation and water quality practices we could make a positive difference on these fresh water systems.

The following are a series of small experiments that will teach students and their families simple things that can save thousands of litres of water a day collectively. systems.

EXPERIMENT 1: THE LEAKY FAUCET

This experiment will look at how much water a leaky faucet wastes a day. Leaky taps can waste many litres of water a day and a relatively inexpensive repair can save the faucet owner the cost of the repair many times over on the utility bill.

MATERIALS

- Sink with working faucet
- Timer/ clock/stopwatch
- Plastic bin/tub that will fit in sink
- Graduated cylinder / measuring cup

Procedure:

- **Step 1:** turn tap on so that it is just dripping.
- **Step 2:** get ready to place plastic tub under the dripping tap once the timer is ready.
- **Step 3:** place plastic tub under dripping tap and start timer.
- **Steps 4:** wait 30 min as the tub collects water.
- **Step 5:** stop tap or remove plastic bin at the 30 min mark. (if time is a factor can reduce time to 10 or 15 min)
- **Step 6:** pour water into graduated cylinder or measuring cup and measure how many mL's dripped in the allotted time (may have to add up multiple full graduated cylinders/measuring cups to get the total)
- **Step 7:** multiply the amount of water by two if you used the 30 min time. (Multiply by 6 for ten min and by 4 for 15 min) this will give you how much a leaky faucet will leak in an hour.
- **Step 8:** multiply how much water leaked in an hour by 24 to get the amount of water that was wasted in a day.
- **Step 9:** (optional) you can take this further by multiplying the number found above by the amount of students in your class to show how much water would be wasted if all their households had leaky faucets. Or take it further to calculate how many days it would take to fill and Olympic sized swimming pool (2,500,000 litres of water) if all of the students in the school had leaky faucets. These steps can be explored to illustrate how much water can be wasted in a community.

Note: Inform the students that these values are only a guideline as no two taps leak at the same rate.

You are now done!

This simple activity shows children that a leaky faucet/tap can waste many litres of water a day and/or show how many days it would take to fill an Olympic sized swimming pool if many leaky faucets go unattended. This will hopefully encourage their family and friends to fix and replace leaky taps in their households.

FEEDBACK

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EXPERIMENT 2 & 3: TURN OFF THE TAP!

In this experiment we will look at how much water gets wasted when we leave the tap running while brushing our teeth or washing our hands. Most people don't realize how much water gets wasted while they leave the tap on. This is two experiments in one, but both will look at how much water is wasted while the tap runs.

MATERIALS

- Sink with working tap
- New Toothbrush
- Toothpaste
- Plastic tub
- Graduated cylinder/ measuring cup
- Hand soap

Procedure:

- **Step 1:** place bin under tap in the sick basin.
- **Step 2:** ask a volunteer to brush their teeth as they always would (if they do shut the tap off while doing this you can use this sample and compare it to leaving the tap running while they brush again)
- **Step 3:** take water from bin and measure in the graduated cylinder/ measuring cup. This shows how much water was used while the tap was left running.
- **Step 4:** repeat step three with the taps turned off so students can see the difference in how much water gets used.
- **Step 5:** repeat experiments but use hand soap this time (Ontario health unit suggest lathering for 15 seconds before rinsing).
- **Step 6:** collect and record samples from both running sample and the sample where tap was turned off.
- **Step 7:** compare the results and discuses with the class what they think about wasted water and what they can do to minimize its waste.

This activity will not only show students how much water can be wasted but have them think about what they can do in their daily lives to conserve water.

RESOURCES/REFERENCES:

- Bryson, B. 2003. A Short History of Nearly Everything. USA: Broadway Books. ISBN 0-7679-0817-1. Retrieved 20 April 2011.
- Canadian Wildlife Federation 1988. Project Wild Elementary Activity Guide. 1988 by the Western Regional Environmental Education Council. Printed in Canada. Founded by the Canadian Wildlife Federation. Retrieved 15 April 2011.

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Garlic Mustard Mayem: WATER PROTECTION

AREA BEST LINKED TO

City of Kawartha Lakes, County of Haliburton and District Municipality of Muskoka.

OBJECTIVES

- Understanding the basic needs of plants.
- Understanding the adaptive advantages that allow species to become invasive.
- Understanding the consequences of introducing an invasive species into an ecosystem.

CURRICULUM LINKS

Grade Four:

Science:

- 1.1 analyse the positive and negative impacts of human interactions with natural habitats and communities.

Grade Five:

Science:

- 1.1 assess the effects of social and environmental factors on human health, and propose ways in which individuals can reduce the harmful effects of these factors and take advantage of those that are beneficial

Grade Six:

Science:

- 1.1 analyse a local issue related to biodiversity.

MATERIALS

- 4 pylons to mark boundaries for the game
- 4 sets of (pinnies, bandanas etc.) or other means to identify players
- Sun, Water, and Nutrient cards (Print and cut out 15 of each card, may wish to stabilize cards by gluing to poster board.)

BACKGROUND INFORMATION

Invasive species are a serious threat to ecosystems, biodiversity, and agriculture.

Introduced invasive species is a species of plant, animal, or fungus that has become established in an area outside its native range.

How do they get here: Pathways describes the modes by which invasive species move from one place to another. These pathways can be natural caused, as when species are moved on ocean currents, or wind currents, or carried by an animal from one place to another. Alternatively, some pathways are human-induced, and can be intentional or non-intentional

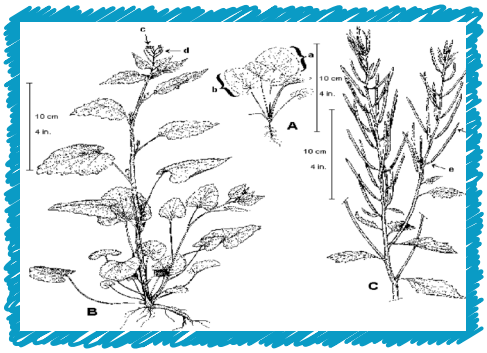
Natural pathways that allow for the movement of species have been in existance since the dawn of life on Earth (ie/ migration of mammoths across the Bering land bridge that connected Alaska to Russia). The unintentional introduction of invasive species by natural pathways is rare.

Human-induced pathways are pathways created or enhanced by human activity. They are the source of most species invasions and continue to increase in frequency and severity.

Intentional introductions – Many species purposefully imported into North America have become invasive. Some of these introduced species were brought for agricultural purposes, horticultural purposes, and as pets. Some were used to combat other invasive species.

Invasive species can also have a negative effect on the economy. Damage and control costs can reach up to the billions annually.

BACKGROUND ON GARLIC MUSTARD: (ALLIARA PETIOLATA)



General Description: Garlic mustard is native to Europe and was introduced to North America in the late 1800's by early settlers. It is a cool-season biennial herb and produces rosettes of green leaves that grow close to the ground in their first year, remain green all winter and develop into mature flowering plants the following spring which gives it a head start on other perennials. New leaves emit the distinctive odour of garlic when crushed and fades as the plant matures. It was useful for medicinal purposes such as treating gangrene, ulcers, utilized for its high Vitamin A and C content. Garlic mustard spreads entirely by seed, producing hundreds per plant. (OFAH, 2011).

Stems & Roots: Stems up to 1m tall, simple or little branched, smooth or with a few simple hairs (OMAFRA, 2011).

Leaves: Rosettes leaves; kidney-shaped with a broad rounded tip. Their margins toothed with shallow, coarse teeth; lower stem leaves alternate (OMAFRA, 2011).

Flowers: Small and white, with 4 petals 3-6mm long and wide. The whole plant has a distinctive onion-like or garlic-like odour. Garlic Mustard flowers from May to June (OMAFRA, 2011).

Distribution and Habitat: Garlic Mustard is now found within the Trent Severn Watershed, it affects The City of Kawartha Lakes, County of Haliburton and the District Municipality of Muskoka. It grows in upland and floodplain forests, gardens, and along roadsides. Its primary habitat needs are shade, and relatively high fertility. It cannot tolerate acidic soils and is not commonly found in sunny habitats. The invasion of woodlands usually begins along trails or woodland edges where it can quickly invade any disturbed site when seeds have been transported on boots or within the treads of vehicle tires (OFAH, 2011).

Ecological Impacts: This invasive plant has become naturalized (non-native plant that has been introduced and have become established as part of the landscape, some become invasive and threaten native flora and fauna); it can enter and establish itself within a stable, healthy forest site. Its ability to form dense monocultures affects indigenous wildflower populations. Once garlic mustard moves into an area, it steals away available light, water and space from native flowers, as well as choking out forest understory growth. In southern Ontario, seed may remain viable in the soil for up to five years (OFAH, 2011). Allelopathy is a biological phenomenon by which an organism produces one or more biochemicals that influence the growth, survival, and reproduction of other organisms. Research has demonstrated that the allelopathic toxic chemicals produced by the roots of garlic mustard interfere with the microscopic fungi in the soil needed to stimulate the growth of native plants (CLOCA, 2011).

Control Options: The most effective method of controlling Garlic Mustard is to prevent its initial establishment. But once Garlic Mustard is established, prevention and detection strategies must be augmented with control treatments.
Garlic mustard control will produce good results if the plant is removed before it sets seed. Cutting the flowering plants at ground level is effective in killing the plant and removes the future seed source, whereas cutting 10cm above the ground allows some of the plants to survive and release seed (OFAH, 2011).

Garlic Mustard plants can produce viable seed even when they are pulled/cut before their fruit have substantially developed (Solis, 1998) Therefore, pulled/cut vegetation with maturing to mature seeds should be bagged and removed from site.
While several herbicides may effectively kill Garlic Mustard (e.g. Bentazon, 2,4-D and Aciflourfen), their non target effects, ability to spread offsite through water, and/ or residual life time make them unsuitable for use.

Currently biological control methods for Garlic Mustard are unavailable for use in most public Ontario properties as they are still in the research stage and have unknown levels of risk and effectiveness.

WHY INVASIVE PLANTS ARE PROBLEMS

- Produce large numbers of new plants each season.
- Tolerate many soil types and weather conditions.
- Spread easily and efficiently, usually by wind, water, or animals.
- Grow rapidly, allowing them to displace slower growing native plants.
- Spread rampantly as they are free of the natural checks found in their native range

BACKGROUND TO GAME

All plants need sun, water, nutrients and space and avoid being eaten to survive and reproduce.
Any plant that can do any of these things better than the other plants around it has a huge advantage and may come to dominate the landscape. This game simulates the introduction of one non-native invasive species, garlic mustard, into the landscape and the resulting changes in the plant community.

Note: This game is played in several rounds. Each round will simulate different conditions in the forest ecosystem.

The next step for students is to generate a list of native and non-native species they expect to find in their local forest community.

For a list of Native plants in Ontario visit The Native Plant Database- http://nativeplants.evergreen.ca/search/guided.php?province=ON From there you can choose, trees, shrubs, ground cover anything you can think of and it gives common and scientific names. From Same page you can access invasive species in the Province as well, look for: "(Search for invasive species in this province)"

Introduce the idea that some plants are native to an area and others are introduced. Generate a list of native and non-native plants. Discuss what might happen to plants that come to live in a new environment.

DISCUSSION QUESTIONS:

- Define an invasive species.
- What makes a species invasive?
- How do invasive species come to be in an area?
- How can the addition of an unnatural species impact an ecosystem?
- What ways can you suggest to help control invasive species? Consider both preventative measures and methods of removal.
- What would happen to forest plants if garlic mustard completely covered the forest floor?
- If garlic mustard takes over, what will happen to the animals, birds, amphibians, reptiles, and invertebrates that live in that ecosystem?

HELPFUL HINTS TO DISCUSSION QUESTIONS

What is an invasive species? A species which is not native to an area. These organisms can impact native ecosystems by being better competitors, eating native species, or by changing the environment.

Mechanical control involves removing the species either by hand or with a machine. Mechanical control is labour intensive, requiring detailed work over a long period of time. Oftentimes, multiple efforts are required to ensure proper control.

Chemical control uses chemical compounds to control invasive species. While this method is useful for both small and large areas, it is not target-specific and can contaminate nearby land and water resources, threatening the health of plants, animals and humans in the area. Another difficulty with chemical control is that target species may develop a resistance to the chemical compound, thereby rendering this method ineffective. Chemicals used to control invasive plant species are called herbicides and can be applied directly on the target plant species, around the soil on the plant's base, or in the soil before the seeds of the plant fertilize.

Biological control refers to a specific species being released into the environment to control an invasive species. It is a chemical-free method and can be environmentally friendly. Without proper research and planning, the introduced control species can become an invasive species itself, exacerbating the original problem.

Prevention is often the best method for controlling invasive species. This requires the work of government agencies and the public joining forces to address the problem. The public can participate by educating themselves on invasive species and by taking steps to control the spread of species in their communities through awareness.

SET UP FOR THE GAME...LET'S BEGIN!

Play Round 1 – The Undisturbed Forest

1. Distribute Sun, Water and Nutrient cards at one end of the playing area.
2. Five students will start as native plants at the opposite end of the play area.
3. One student will be a herbivore in the middle.
4. Remaining students start on the sidelines but will be brought into the game quickly.
5. In order to survive the first round, plants must collect one each of the Sun, Water and Nutrient cards. They may only pick up one card each trip down the field. They must avoid being eaten (tagged) by the herbivore.
6. The herbivore may tag the native plants when they are between the pylons. They must escort tagged plants to the sidelines before they may tag another plant.
7. The round ends when all the plants have been caught or collected three cards, whichever comes first.
8. Surviving plants reproduce. For each plant that survives, one student from the sidelines will join the game as a reproduced native plant.

Play Rounds 2 & 3 – The Invader Arrives

1. Redistribute the cards to one play area at end of the field again. The surviving and new reproduced native plants are at the opposite end.
2. Add one student as the garlic mustard plant, newly arrived in the area.
3. One student will be a herbivore in the middle.
4. In order to survive the first round, plants must collect one each of the Sun, Water and Nutrient cards. They may only pick up one card each trip down the field. They must avoid being eaten by the herbivore.
5. The herbivore may only tag the native plants when they are between the pylons. They must escort tagged plants to the sidelines before they may tag another plant. The herbivore does not recognize garlic mustard as food or does not like its taste and therefore leaves it alone.
6. The round ends when all the native plants have been caught or collected three cards, which ever comes first.
7. Surviving plants reproduce. For each native plant that survives, one student from the sidelines will join the game as a native plant. Plants survive by collecting one of each of the Sun, Water, and Nutrient cards. Garlic mustard produces large numbers of seeds so two students from the sidelines will become garlic mustard plants in the next round for each garlic mustard that survives.

Round 3

8. Redistribute the cards and repeat another round.
9. At the end of this round, some plants may not survive because there is not enough sunlight, water or nutrients to go around. Any plant not getting one of each card does not survive and moves to the sidelines.

Play Round 4 – The Competition

1. Redistribute the cards in the playing area.
2. Garlic Mustard is a biennial which means that its life cycle takes two years to complete. It overwinters as a rosette of leaves under the snow. This gives it a head start in spring - most native woodland species are either annuals, starting from seed each year, or perennials that start from roots or bulbs underground. It grows quickly and spreads rapidly, crowding out native species. To simulate this, in this round, the surviving garlic mustard plants get a 15-second head start on the native plants.
3. If there are any native species left at the end of the round, go on to play round five. Other wise skip to the Discussion 1.

Play Round 5 – The Domination

1. Redistribute the cards.
2. Garlic mustard plants release a chemical into the soil that kills soil fungi. This inhibits the formation of connections between the roots of native plants and fungi in the soil that help them absorb water and nutrients. This gives garlic mustard a huge advantage. To simulate this, the garlic mustard players may pick up both Water and Nutrient cards on the same trip.

DISCUSSION 1

WHAT HAPPENED DURING THE GAME:

a. What advantages does garlic mustard have over native species?
b. What would happen to the herbivores after all the native species are gone?
c. What can be done to control garlic mustard?

EXTENSIONS:

In additional rounds add in one or more of the following possible controls;

a. Human cutting. Add one or more people to the middle to tag the garlic mustard players. This represents people manually cutting the plants before they flower to prevent them from reproducing. Eventually the seed supply will be exhausted and garlic mustard will be controlled, but this takes several years.
b. Bio-Control. Add one or more people to the middle to tag the garlic mustard. This represents the possible outcome of research that is currently underway to find something that will eat garlic mustard but not everything else.
c. Fire. Add many people to the middle during the first 15 seconds of the round. They may tag garlic mustard, even out of bounds. This represents the use of controlled burn fires in the early spring when garlic mustard has begun to grow, but native plants are still dormant.

DISCUSS:

a. Do the controls work?
b. What are the limits/risks of the controls?
c. Is it easier to prevent the introduction of an invasive species or to try to control it after it has escaped?

FEEDBACK

We appreciate your feedback! Please let us know…

- Did this activity continue the learning your students engaged in at the Water Festival?
- What curriculum requirements did this activity satisfy?
- Was the activity easy to facilitate to your class?
- Did students have fun and learn something new about water?
- Please send photos of your class using these activities!

Please send comments and photos to: iheaven@outtolearn.ca

Nutrients	Nutrients	Nutrients	Nutrients
Sunlight	Sunlight	Sunlight	Sunlight
Water	Water	Water	Water

Haliburton-Muskoka-Kawartha
children's water festival

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www.hmwaterfestival.ca