



Great Basin Outdoor School

At-Home Activities for Kids

Water Quality and Pollution

Lesson Plan

The widespread pollution of our Earth's water from chemicals, waste, plastic, and other pollutants is a serious problem for the environment and human health. The chemical properties of water are such that it is a "universal solvent" – it is able to dissolve more substances than any other liquid on Earth. Unfortunately, this makes it very vulnerable to pollution. Living in America, it is rare for us to witness sickness and death from unsafe water, but it still kills – it caused 1.8 million deaths in 2015, for example. Around the world it kills more people each year than war and all other forms of violence combined and sickens about 1 billion people every year.

The water on Earth can be separated into two different types: groundwater (the water that seeps deep into the Earth and into underground storehouses called aquifers) and surface water (the water that fills our oceans, lakes, rivers, streams etc.). Both are being significantly polluted. There are two different classifications for sources from where pollution comes. A *point source* pollutant is something that comes from a single source, such as an oil refinery or wastewater treatment facility. *Nonpoint source* pollution is contamination from many different sources, such as a combination of agricultural runoff and stuff blown into water from land. Nonpoint source pollution is the leading cause of water pollution in U.S. waters, but it's difficult to regulate, since there's never a single, identifiable culprit. The most common sources of water pollution are agricultural runoff, sewage and wastewater, oil pollution, and radioactive substances.

Water pollution is very harmful to the environment. Since ecosystems are comprised of a complex web of organisms, harm to one organism can create a chain reaction that can harm entire aquatic environments. When fertilizers get swept into water, they deposit nutrients, and *eutrophication* may occur. Eutrophication is when an oversupply of nutrients cause an algal bloom in a lake or marine environment, which can decrease oxygen levels. Without oxygen, it is hard for life to exist, so the area becomes a "dead zone" where no organisms can live. Sometimes, these harmful algal blooms can also produce neurotoxins that affect wildlife, from whales to sea turtles. Toxic chemicals from wastewater can often reduce an organisms' lifespan and ability to reproduce. Marine ecosystems are also threatened by trash, which can strangle, suffocate, and starve animals. There is so much trash in the oceans that there are huge floating garbage patches (look up "Pacific Garbage Patch"). Meanwhile, oceans are becoming more acidic from climate change. This process makes it harder for shellfish and other species to build shells and may impact the nervous systems of sharks, clownfish, and other marine life.



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Lake Tahoe, our local gem, is currently being affected by water pollution. Its remarkable clarity has been diminishing - it has lost 1/3 of its clarity during the last 40 years! Pollution of the lake comes mostly from the more urbanized areas around it in the form of litter, sediment (from erosion that happens during building development or from invasive species on the hillsides), nutrients, oil and grease, and pathogens. When it rains, or as snow melts, water flows down streets and across parking lots, picking up dirt, road sand, fine particles, and oil, all of which flow directly into storm drains that lead to Lake Tahoe. Research has shown that there has also been an increasing rate of eutrophication. Lake Tahoe is also threatened by climate change – since the climate is warming, more precipitation falls as rain rather than snow, because it isn't cold enough to freeze. More rain means more floods and stormwater runoff that carries sediment into Lake Tahoe. Climate change is also increasing the lake's water temperature and affecting regional weather patterns in ways that could change the lake's ecosystem and cause more of a decline in the lake's clarity.

Water is not only a precious natural resources for humans, but it is necessary for the existence of all life on Earth.

What can we do to help this ongoing water quality and pollution crisis?!

- Reduce your plastic consumption and reuse and recycle whenever possible
- Properly dispose of chemical cleaners, oils, and non-biodegradable items to keep them from ending up down the drain.
- Maintain your car so it doesn't leak oil, antifreeze, or coolant.
- If you have a yard, consider landscaping that reduces runoff and avoid applying pesticides and herbicides.
- If you have a pup, be sure to pick up its poop!
- Tell the federal government, the U.S. Army Corps of Engineers, and your local elected officials that you support the Clean Water Rule.



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Lesson - Kids

Pollution is gases, smoke, trash, and chemicals that are brought into the environment in large amounts. Pollution makes the environment harmful for humans, animals and plants. There is a ton of pollution all over the world, and it is a big problem. One of the things that is polluted the most is water. Water is very easily polluted because it is able to dissolve things better than any other liquid on Earth! Even in our country, many people get very sick from dirty water every year. There are two different types of water on earth: the first is water from the ground (which we call – you guessed it – groundwater), which seeps deep into the Earth and gets stored underground. The next one is surface water, which is the water that fills our oceans, lakes, rivers, and streams. Both types are being very polluted by us humans. We have two different categories for where this pollution comes from. A *point source* pollutant is something that comes from a single source, such as an oil refinery or a facility of sewer water (gross!!). *Nonpoint source* pollution is something that comes from many different sources, such as a combination of chemicals from farms and stuff blown into water from land. Nonpoint source pollution is the #1 cause of pollution in U.S. waters, but it's hard to stop because there is not one specific culprit to go after.

Water pollution is very harmful to the environment. Since ecosystems on earth have many different plants and animals that are all connected to each other, harm to one organism can create a chain reaction that can harm everyone. When fertilizers from farms get into the water, they deposit their nutrients. This might sound like a good thing, but too many nutrients are bad! Too many nutrients can actually make algae bloom so much that there is less oxygen in the ecosystem. Without oxygen, of course, it is hard for life to exist. Once life can't exist in a place, we call it a "dead zone". Other toxic chemicals from wastewater can often hurt and kill organisms. Trash, especially plastic, can strangle, suffocate, and starve animals. There is so much trash in the oceans that there are huge floating garbage patches, one that is the size of Texas!

Lake Tahoe, our local gem, is currently being affected by water pollution. The lake is SO clear, but used to be even clearer before! Sadly, it has lost 1/3 of its clarity during the last 40 years.

Pollution of the lake comes from litter, dirt from the land, nutrients, oil and grease, and bacteria. When it rains, or as snow melts, water flows down streets and across parking lots, picking up dirt, road sand, fine particles, and oil, and takes it all into the lake. Lake Tahoe is also threatened by climate change – since everywhere on Earth is warming, there is more rain than snow, because it isn't cold enough to freeze as often. More rain means more floods that carry pollution into Lake Tahoe.

Water is so important not only for humans, but it is necessary for the existence of all life on Earth.

What can we do to help this ongoing water quality and pollution crisis?!

- Use as little plastic as possible, and reuse and recycle your plastic whenever possible
- If you have a pup, be sure to pick up its poop!



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Runaway Pollution Experiment

Directions

1. Place a few folded up paper towels on the tray and set the cardboard egg carton on top of that.
2. Slowly pour water into one cup and observe how the water flows from cup to cup until they are all full.
3. Pour 1-2 teaspoons of flax meal into a cup on one end and observe how it too flows from cup to cup.
4. Repeat with the food coloring - stir a bit if needed to get it flowing.
5. Let it sit and after 1-2 hours come back and observe how the water and food coloring seeped through the bottom of the carton onto the paper towels.
6. Discuss what happened and how it relates to real life pollution dissemination!

Materials

Flat tray (to keep water from spilling all over)
Cardboard egg carton
Paper towels
Water
Food Coloring
Flax meal or other powder

The water and “pollution” flowing into each egg carton cup from a single starting source shows how easy it is for pollution to travel to different, connected streams, lakes, oceans, and other bodies of water. The water seeping through the egg carton represents how the pollution can also seep down under ground and contaminate our groundwater, on which nearly 40% of Americans rely!



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Oil Spill Experiment

Directions

Materials

1. Create the crude oil by mixing oil with cocoa powder.
2. Fill container with water and add blue food coloring. Add toys to create a “habitat” if available.
2. Have your kid slowly pour the oil into the toy boat (if available), to resemble a tanker carrying it in the ocean.
3. Tip the toy boat over to create an oil spill (or just pour oil directly onto the water if you do not have a boat).
4. Repeat with the food coloring - stir a bit if needed to get it flowing.
5. Have the kids hypothesize if spoons, cotton, or a sponge will be best for cleaning the oil. Then have them try each - it will be very hard to clean regardless.
6. Discuss what happened and how it relates to real life. There have been many major oil spills. They can take years to clean, all the while severely damaging marine and wildlife habitats, sometimes beyond repair. Animals can die at alarming rates or acquire deformities. Human casualties have also occurred. This is just one of the many risks of fossil fuel usage.

Large clear container
Blue food coloring
Toy sea creatures/pebbles (optional)
Toy boat
Oil
Cocoa powder (or dirt)
Test tubes or cup
Cotton
Sponge
Spoons



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Relevant Next Generation Science Standards

Kindergarten, 4th, and 5th Grade: Earth and Human Activity

Kindergarten

ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

ESS3.C: Human Impacts on Earth Systems

Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K-ESS3-3)

4th Grade

ESS3.A: Natural Resources

Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

5th Grade

ESS3.C: Human Impacts on Earth Systems

Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

Crosscutting Concepts

Cause and Effect

Systems and System Models