

Roller Coaster

- Foam pipe insulation, ¾" inch
- Foam insulation, 2" planks
- Bamboo Skewers
- Standard size marbles (or larger and smaller for challenges)

Needle Felting

- Felting Needles
- Foam (at least 1 ½ inch thick)
- Wool Roving

Augmented Reality - T-shirt

- Curioscope Virtual-Tee, \$29.95
- Apple device

Merge Cube

- Merge Cube (Walmart, Amazon)
- Apple or Android device

STEM Explorer buttons

- Button Maker & Supplies
- Image of Choice

Silk Paper

- Gummy Silk, OliverTwistsFibres on Etsy (Shipping is so inexpensive!):
https://www.etsy.com/listing/204337043/silk-cocoon-strippings-gummy-silk-silk?ga_search_query=gummy&ref=shop_items_search_1&crt=1
- Iron
- Parchment Paper
- Water in Spray bottle
- Colored fiber or plant matter

Art and Ozobots

- Ozobots
- Blue, Green, Black, and Red markers

Design a Solution

- A book such as *Green Rover*, by WonKyeong Lee
- Idea Planning Sheet (attached)
- Research Sheets (attached)
- Craft bits and Junk
- Construction paper
- Glue, Tape, rubber bands, boxes, etc.

Whisper Tubes

- Printed history of speaking tubes
- YouTube Plastics manufacturing videos
- Blank Paper & Clipboards
- Straws, scissors, tape
- Measuring Tape
- PVC pipe/elbows
- Safety Glasses, vise or C-Clamp, Hand Hacksaw

Infinite Scope

- Infinite Scope, \$70-\$90: <https://www.infinitescope.io/>
- Smart phone
- Bits of stuff to look at

Wet Felting

- Wool Roving
- Bamboo mat or bubble wrap
- Silk that you can blow through (optional)
- Dawn Dish soap or natural bar soap like olive oil
- Warm water

Tallest Tower Challenge

- A book such as *Iggly Peck, Architect*, by Andrea Beaty
- Jelly beans
- Toothpicks
- Plastic tumbler cup
- Straws
- Tape
- 8.5x11 paper
- Paper clips
- Paper snack cups
- Rubber bands
- Paper plates

Idea #1:

Idea #2:

Idea #3:

Idea #4:

Garbage (Land Pollution) ~ Environmental Issue

Have you ever thought about what happens to the trash you throw away once it is taken away by the garbage truck? It goes to the dump or a landfill. The improper disposal of waste is a huge problem on Earth.

Sometimes, hazardous waste is left in the dump, and it has the potential to **contaminate**, or pollute, the soil. The toxins from the hazardous waste infect the soil, and it can take millions of years for the soil to become healthy again. With the population growing, there is becoming less and less space for the extra garbage.



What is land pollution?

When we first think of pollution we often think of trash by the side of the road. This type of pollution is called land pollution. Land pollution is anything that damages or contaminates the land.

Causes of Land Pollution

There are many causes of land pollution from the trash we throw away in our homes to waste produced at giant factories. Sometimes chemicals from the trash can contaminate the soil and eventually the groundwater we need for drinking.

- **Garbage** - The average person in the United States produces around 4 1/2 pounds of trash every day! That's a lot of trash. Some of this trash gets recycled, but much of it ends up in a landfill or on the ground.
- **Mining** - Mining can directly destroy the land, producing large holes in the ground and causing erosion. It can also release toxic chemicals into the air and soil.
- **Farming** - We all need farms to eat, but agriculture has destroyed many ecosystems and animal habitats. Farming also produces a lot of pollution in the form of chemicals such as pesticides and herbicides. Animal waste from livestock can also pollute the soil and, eventually, the water supply.
- **Factories** - Many factories produce a significant amount of garbage and waste. Some of this waste is in the form of damaging chemicals. There are regulations in some countries to prevent harmful chemicals from getting dumped directly onto the land, but this is not the case in many countries.

What can you do to help?

Here are four things people can do to reduce land pollution:

1. Recycle - Around 33 percent of trash in the United States is recycled. When you recycle you add less land pollution.
2. Produce less trash - Some ways to reduce trash include not using a napkin or paper towel unless you absolutely need one, drinking water from a cup rather than a plastic bottle, and being sure to properly dispose of harmful trash like batteries and computer equipment.
3. Pick up trash - Don't be a litter bug! Also, you can help out by picking up trash when you see it lying around. Kids make sure to ask your parents for help before you pick up strange trash.
4. Composting - Get with your parents or school and start a compost heap. Composting is when you collect organic waste and store it so it breaks down to where it can be used for fertilizer.

Facts About Land Pollution

- In 2010, the United States generated about 250 million tons of trash. Around 85 million tons of trash was recycled.
- The amount of trash per person in the United States has dropped over the last 10 years. In the last five years, the total amount of trash has dropped. At the same time, recycling rates have risen. This is good news!
- One way to reduce the amount of trash is for companies to use less packaging on products. Things like smaller bottle caps, thinner plastic, and more compact packaging has played a major role in reducing the amount of trash.
- Certain types of litter can kill animals when they get tangled or caught in it.
- Around 40 percent of the lead in landfills is due to improper disposal of computers and other electronic equipment.

Ocean Pollution ~ Environmental Issues



Oceans and seas are one of the world's greatest natural resources, and they're being polluted at an alarming rate. Water pollution is leading environmental issue that the world is facing today. Chemicals that are poured into the ocean can lead the creation of "dead zones." Dead zones are places in the ocean where nothing can survive because of the lack of oxygen. Similar to deforestation, this causes a loss in **biodiversity**, or variety of living things.

What Is Ocean Pollution

Ocean pollution is anything that hurts the world's seas and marine life. Ocean pollution, which is most often caused by humans, can lead to the death of plants, animals, and fish. It can also soil beaches and shores and even cause illness. Fortunately, the oceans are very large, but the disappearance of once common fish and the dying of coral reefs prove that oceans need our help.

What Causes Ocean Pollution / Causes of Ocean Pollution

The top causes of ocean pollution include:

- chemicals that are dumped into the ocean from the world's wastewater networks (from factories, homes, hospitals, farmlands, sewers, sinks and toilets, etc.)
- pesticides that come from farmland runoff
- pollution from ships
- pollution from drilling and other types of deep sea mining
- garbage that's been dumped into the ocean
- [acid rain](#)
- invasive organisms

Facts about Ocean Pollution

Here are facts about ocean pollution:

- Most ocean pollution (approximately 80%) starts on land and then washes into the ocean. This polluted runoff comes from cars, boats, septic tanks, farms, and ranches.
- Cruise liners are one of the major polluters of oceans. In a week, the average cruise ship dumps a million gallons of waste water into the ocean.
- Ocean pollution causes fish, marine plants, and birds to die.

River and Lake Pollution ~ Environmental Issues



River and lake pollution is one of the [top environmental issues](#) affecting quality of life today. Chemicals that infect freshwater sources is a huge problem. Living things need water to survive, and the water is not good if it is polluted with lead or garbage. As of today, there are over one billion people who do not have access to clean drinking water.

What Is River and Lake Pollution

River and lake pollution is the pollution of rivers, lakes, streams, creeks, and estuaries.

What Causes River and Lake Pollution / Causes of River and Lake Pollution

The top causes of river and lake pollution include:

- discharge from boats
- stormwater drainage
- sewage / failing septic systems
- wildlife
- pesticides
- herbicides
- fertilizers
- oil spills
- industrial waste (often from [mining operations](#))

Facts About River and Lake Pollution

Here are facts about river and lake pollution:

- Only 3% of the water on the planet is fresh water, with the other 97% categorized as salt water.
- Of the 3% of the Earth's water supply that is freshwater, almost 99% is frozen in the polar ice caps.
- Water from storm drains and ditches rarely gets treated; instead it flows directly into streams or bays.
- Almost half of the streams and lakes in the United States are polluted.
- Most of the 2.2 billion pounds of pesticides used in the United States each year will eventually find their way into lakes and rivers.

Air Pollution ~ Environmental Issues



Air pollution is one of the top environmental issues affecting quality of life today.

What Is Air Pollution

Any particles or gases that are not part of the normal composition of air (which is normally 99.9% nitrogen, oxygen, water vapor, and inert gases) qualify as air pollution.

What Causes Air Pollution / Causes of Air Pollution

The top causes of air pollution include:

- emissions and exhaust from engines (primarily vehicles)
- emissions from factories and power stations (burning fossil fuels such as oil and coal)
- emissions from refineries
- pesticides and herbicides
- particles released from mining operations
- burning of garbage
- charcoal grills / bbqs

Facts About Air Pollution

Here are facts about air pollution:

- In addition to outdoor air pollution, there is also indoor air pollution, such as pollution caused by cigarette smoke.
- Air pollution has led to smog, ozone layer depletion, and climate warming.
- Air pollution can be caused by gases, dusts, fumes, odors, chemicals, particulates, or biological materials.

Plastic Bags ~ Environmental Issues

The use of plastic bags is one of the top environmental issues affecting quality of life today.

What Is Air Pollution

Any particles or gases that are not part of the normal composition of air (which is normally 99.9% nitrogen, oxygen, water vapor, and inert gases) qualify as air pollution.

What are Plastic Bags doing to our Environment?

Here is what plastic bags do to our environment:



- get into soil and slowly release toxic chemicals
- break down into the soil, where animals eat them and often choke and die
- Farm animals die each year after eating plastic bags that end up in their grazing grounds
- Animals in the wild are poisoned by the chemicals in plastic bags
- Animals die slow deaths when they eat plastic bags
- sea turtles are at particular risk from plastic bags, because they often [mistake them for jellyfish](#) (their favorite food)
- 52% of sea turtles have eaten plastic
- Plastic bags clog sewers and block the flow of water, causing flooding, property damage, and prevents water flowing to creeks, wetlands, and streams

Facts about Plastic Bags

Here are facts about plastic bags:

- About 500 billion plastic bags are used every year
- Very few plastic bags are recycled and most go into the trash
- A plastic bag takes 10 to 1,000 years to decompose
- plastic bags that make their way into rivers, lakes or oceans [never completely decompose](#). Instead, they break down into smaller and smaller pieces, [eventually becoming “microplastics,”](#) which are less than 5 millimeters long.

Alien Profile: Zebra Mussel

Alias (scientific name in Latin): *Dreissena polymorpha*

Home Land (Origination): Ponto-Caspian region of western Russia

Arrival Date: They were first found in the Great Lakes on June 1, 1988. They were accidentally introduced to North America in ballast water from a boat that traveled across the ocean.

How to Identify:

Polymorpha (part of this alien's scientific name), means "many forms." Zebra mussels come in many colors. Most are white or cream-colored with jagged brown or black stripes. However, some individual mussels have been found that are all-white, all-black, or have stripes going the other direction. Zebra mussels are members of the phylum Mollusca (mol-US-ka), or mollusks. Mollusca comes from the Latin word, mollis, meaning soft. Slugs, snails, octopuses, clams, and oysters are all mollusks. Mussels are bivalve mollusks. Bivalves have two shells that are held together by a strong ligament.

How They Multiply:

Male zebras release a cloud of sperm into the water. Female zebras release a cloud of eggs. A female zebra mussel can produce 30,000 to 1,000,000 eggs in one year!

The fertilized eggs quickly develop into free-swimming larvae called veligers (VEL-i-jers). Veligers are smaller than periods! They feed on tiny phytoplankton and begin to grow shells. The water currents can cause veligers to travel great distances.

At 3 - 4 weeks, the veligers' shells weigh enough to cause them to sink. They must find something to attach to or they will die.

Some of the veligers attach to hard surfaces called substrates. Hard surfaces include rocks, wood, glass, metal, native mussels, and each other. They now change from free-swimming larvae to anchored mussels. Very few of the veligers survive to this stage.

The young zebra mussels reach sexual maturity during their first year and are ready to continue the cycle.

Invaded Territory: Great Lakes and several inland lakes and rivers like the Mississippi River.

Evidence of Invasion:

They're clogging things up! These tiny little mussels can get into the water intake systems of power plants and water treatment facilities and significantly reduce the flow of water. They also can clog up the cooling systems of boat engines. This clogging costs millions of dollars to unclog!



Zebra mussels also pile up on beaches. When they die they wash up on the shore and begin to decay. Their shells are razor sharp. Watch your step!

When zebra mussels feed on plankton, they remove incredible amounts of food from the water. They can filter about 1 quart of water each day. They leave the water clear, sometimes too clear. The zebras grow on top of the native mussels and smother them. With plankton removed from the water, more sunshine reaches the bottom. Plants living here grow rapidly. They also use zebra mussel droppings as fertilizer. Bottom-feeding fish feast on the waste produced by the zebra mussels. Their numbers increase. Zooplankton and small fish which feed on plankton have less to eat. Their numbers decrease. Larger fish which feed on the small fish decrease in number. The zebra mussels take food, space, and oxygen, causing the death of native mussels.



The zebra mussel can quickly encrust things, like this crayfish.

Zebra mussels are also just plain tough. Veligers can survive for a month in water with little or no food. Adults can survive a week or more out of water. They reproduce so rapidly that they outcompete other animals. With few natural predators, scientists are concerned about when and where the invasion will end.

Help Stop the Alien Invasion!

Extermination Techniques:

1. Are you providing free rides to aliens? Don't be an alien helper, watch out for hitchhikers. Zebra mussels have already invaded the Great Lakes and the Mississippi River. Check the ways you think zebra mussels can get from one body of water to another.

- Boaters use their boats in several places without cleaning them with hot water.
- Kids, mucking in a lake, slosh over to a different lake and empty out their boots.
- Anglers take their bait buckets from lakes to rivers and empty them into the waters.
- Someone gets bored with a pet zebra mussel and releases it in a new home.
- Ducks, with muddy feet, fly off to new watery homes.
- Water plants get stuck on boats or other equipment and are carried to different bodies of water.

If you find a zebra mussel, take a close look at it. While we are not crazy about having them in New York, they are fascinating animals. Do not put the mussel back into the water. Try to determine if anyone has seen zebra mussels in this particular body of water before.

Note: If you checked all the boxes above, you know how to avoid giving free rides to zebras!

2. **Freshwater drums (fish) and diving ducks** eat zebra mussels, but they don't eat enough to control their population. Zebra mussels seem to be able to survive everywhere, but they are rarely found in still water or fast-moving water. They also don't do well in polluted water or at low oxygen levels. Summer water temperatures might also limit their spread.

3. **Chemicals** will also kill the other animals living in the lakes. Scientists are searching for ways to control their growth. Meanwhile, some diving ducks are changing their migration patterns to munch on zebra mussels.

Alien Profile: Round Goby

Alias: *Neogobius melanostomus*



Round Goby Fish, ©Dave Jude, Center for Great Lakes Aquatic Sciences

Homeland: The Black and Caspian Seas, the same home as the [zebra mussel](#).

Arrival Date: First discovered in Great Lakes at Lake St. Clair in 1990. Scientists think they traveled in ballast water from ocean going vessels. They were found in 1994 on the east shore of Lake Michigan and have now invaded all of the Great Lakes, the Mississippi, and most likely all tributaries that lead to Lake Michigan up to the first dam.

How to identify: This invader is a bottom dwelling fish with a large head, resembling a tadpole. It can grow to be 10 inches long but is usually five or six- inches-long.

Look for the unique bottom fins on the belly that are connected. They form a suction disk that helps this fish hold onto rocks in fast moving water. The goby also has dorsal fins without spines. Young are a solid slate gray in color and larger fish have black and brown patches with a greenish dorsal fin.

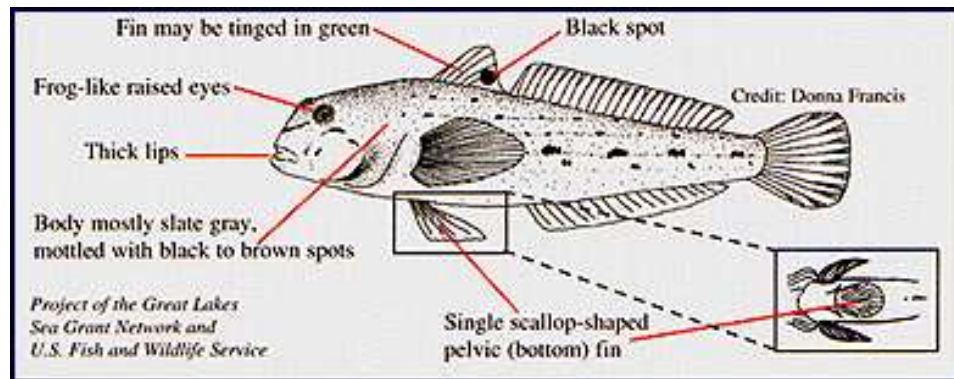
Round gobies are successful invaders because they:

1. Eat the eggs and young of native fish (sculpins, darters, [lake trout](#), smallmouth bass).
2. Protect vital spawning sites from native fish (sculpins).
3. Have sharp senses that allow them to find food in total darkness.
4. Can survive in poor water conditions.
5. Reproduce up to six times a summer.

The [zebra mussel](#) is an important part of the goby's diet and one goby can eat as many as 78 zebra mussels per day, which may reduce the numbers of this other invader but will not eliminate them. Predators of the goby include sport fish like the smallmouth and rock bass, [walleye](#), [yellow perch](#), and brown trout.

These invaders can be a nuisance near shorelines since they often steal worms or other invertebrates from your hook. They can also get on your line when you really want to catch perch, but don't let them go. They should be thrown in the trash!

Disguise: Be careful, round gobies look like the sculpin, a native bottom dwelling fish. They both have similar markings, are black during spawning, and have a black spot on the dorsal fins. Look for the separate bottom fins on the underbelly to know it is a sculpin and not a goby.



How to identify a Round Goby, ©Donna Francis

Prevent the Spread:

Getting rid of these invaders is nearly impossible once they multiply. What can you do?

1. Learn to identify the round goby and the differences between the goby and the sculpin.
2. Do not use gobies for bait.
3. Empty bait buckets in the trash before going to another location.
4. You can keep and freeze one round goby in order to report it to the DEC or Sea Grant office.