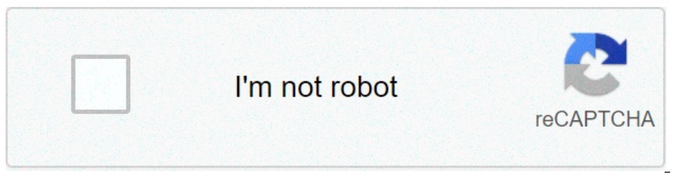

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Point and nonpoint source pollution worksheet answer key

State and local governments, volunteer groups, water quality professionals, and ordinary people are working together to clean up our lakes, rivers, streams, and wetlands. You can help! Whether you live in a big city or in the country, you can prevent nonpoint source pollution by taking simple actions on your property or in your community. The following are some simple solutions to a big problem. Together, we can all make a difference!Dispose of Oil and Household Chemicals ProperlyThe public can keep oils and chemicals out of local streams by utilizing and supporting local toxic drop-off sites, maintaining vehicles to reduce leaks and never pouring any materials down a storm drain.Maintain Septic TanksJust like any other tool or appliance, a septic tank needs to be maintained to function properly. A septic tank allows solids, greases, and liquids to separate in the tank. Bacteria break down the solids and the liquid is treated as it moves into the absorption field. A properly working septic system shouldn't release anything that's harmful to you or the environment.Find Other Ways to Water LivestockThere are many options for reducing the impact of livestock on water quality. The most efficient way to improve water quality is to block animals from directly accessing streams, rivers, and other water bodies. Livestock trample the stream bank and deposit feces, allowing higher E. coli levels. Limit access with fences and provide alternative drinking water sources. If you pasture livestock, consider creating a rotational grazing system that reduces pasture erosion and allows the vegetation time to grow. For other ideas more specific to your facility, contact your local Soil and Water Conservation District [PDF].Reduce Sediment Run-off from FieldsFertile soil is an important ingredient in a successful agriculture operation. As a result, it is vital to keep your fields' fertile soil in place. Soil loss often occurs in fields that border meandering streams. While you can't completely stop soil from entering the stream, you can limit movement by planting buffer strips and encouraging the growth of a healthy riparian corridor. Together, those practices will help keep fertile soil on your field.There's also plenty you can do to maintain your field and soil. Reduced tillage techniques improve the structure of your soil, leaving a vegetative cover that protects the soil from erosion. Using cover crops is gaining popularity with farmers wishing to strengthen and protect their soil resources.Reduce Nutrient Run-off from FieldsRegardless of whether agriculture fertilizers are man-made or animal manure, nutrients used on fields should be properly applied and stored to protect water quality. Best management practices for fertilizer should be used. Manure should never be stored for long periods in the open. Fertilizer applications should be modified to meet the soil's nutrient needs, not exceed them. For more information contact your local Soil and Water Conservation District.Create and Enhance Riparian CorridorsRiparian corridors are the buffer zones between used land and a stream, most often planted with vegetation. A well-established riparian corridor can help regulate water temperature, protect the bank from erosion, and filter pollutants from storm water. The recommended width of a riparian corridor varies depending on its intended use and surrounding land use. You can start improving your riparian corridor by allowing natural growth, rather than mowing along the stream bank. Allowing native plants to take over the area, as well as adding trees and bushes will help increase the function of your corridor.Pick Up Pet WasteIt's simple to reduce nonpoint source pollution from pet waste - just pick up after your pet. Pet waste contributes to nutrient and E. coli nonpoint source pollution. Pet stores and large retail stores carry small plastic bags for picking up pet waste. Biodegradable bags are even available for purchase.Take Care of Big Issues on Small FarmsDepending on the type and number of animals you have, there are many options for reducing the impact of your hobby farm. First, consider isolating animals from water bodies and providing alternative drinking water sources. Animals trample vegetation on stream banks and deposit feces in the water. If you pasture animals, create a rotational grazing system that reduces pasture erosion and allows the vegetation time to grow. A rotational grazing system will also allow for the ease of composting, if you are interested in reducing nutrient impacts even further. For other ideas more specific to your operation, contact your local Soil and Water Conservation District.Read the Label - Use Lawn and Garden Fertilizer WiselyFertilizer is composed of nitrogen, phosphorus, and potassium. The content of each is usually listed as a string of three numbers on the fertilizer bag. Although garden plants need varying levels of each chemical to grow properly, Indiana's soil provides plenty of phosphorus for established lawns. Using fertilizer with low or no phosphorous for established lawns will keep it green and minimize the impact on water quality. Starter fertilizer should only be used when growing grass from seeds. When you apply fertilizers, make sure you follow the directions. Over-application and sloppy application leads to fertilizer washing from lawns, sidewalks, and streets into storm drains.Think Before You DigConstruction sites that disturb one acre or more of land are required to use best management practices (BMPs) to keep sediment out of water bodies. Although it's likely your backyard project won't come close to the one acre size limit, it's still a good idea to avoid leaving bare soil on your property. If you need to disturb the soil for any reason, reseed and replant bare ground as soon as possible to keep soil on your yard and out of streams, rivers, and lakes.Give Water More Places to GoIn urban areas, land development and impermeable pavement increases storm water run-off, and subsequently the volume of flow when storm water enters waterbodies. This increase can impact the environment through downstream flooding, stream bank erosion, and increased nonpoint source pollution. You can do things on your property that can hold onto storm water like a sponge, giving it time to infiltrate into ground water:Plant a rain garden to catch and infiltrate excess storm water as it flows across your yard.Connect your downspouts to rain barrels and then use that water to irrigate landscape during dry periods. Make sure the barrel's overflow goes to a pervious surface like a garden or yard instead of your impervious driveway.When it's time to replace your driveway, use some type of porous pavement. These materials allow storm water to soak through and infiltrate into the ground. If you can't afford a whole driveway of porous pavement, consider using it at the driveway's apron where it meets the street. Point sources release pollutants from discrete conveyances, such as a discharge pipe, and are regulated by federal and state agencies. The main point source dischargers are factories and sewage treatment plants, which release treated wastewater. Nonpoint Source Pollution Nonpoint source pollution is a combination of pollutants from a large area rather than from specific identifiable sources such as discharge pipes. Runoff is generally associated with nonpoint source pollution, as water is emptied into streams or rivers after accumulating contaminants from sources like gardens, parking lots or construction sites. The federal Clean Water Act requires states to identify a total maximum daily load (TMDL) for each pollutant — the combined amount of pollution from point and nonpoint sources that the state believes a water body can accept without exceeding water quality standards. The list of TMDLs is sent to the U.S. Environmental Protection Agency for approval. Refer to the Lake Pontchartrain Basin Water Pollution Map in Appendix A. Let's look at some similarities and differences between the two types. Point source pollution because it enters the water directly, can be easily traced from sources such as factories and chemical plants. But nonpoint source pollution, harder to trace and to treat, can cause long-term damage before the problem is handled. It can come from many different sources and travel long distances through a watershed before it is noticed. Nonpoint source pollution provides a greater chance for chemicals to mix and react together. This is known as the synergistic effect. A combination of two or more contaminants can be even more harmful than the original pollutants—-and harder to treat. In fact, nonpoint source pollution is the major cause of water pollution in the Lake Pontchartrain Basin. Do you realize that most nonpoint source pollution comes from runoff? Rainwater or wastewater carries various pollutants along as it flows into our lakes, streams, and rivers. Urban runoff from the southshore of Lake Pontchartrain and agricultural/ sewage runoff from the northshore are causing serious water pollution problems in the waterways of the Basin. Here is a chart to help you understand some of the key nonpoint sources: Some of the same pollutants in urban runoff can also be found in agricultural runoff. Which ones are they? How do they differ? Are there any pollutants unique to agricultural runoff? COMPLETE THE FOLLOWING CHART: (link to pdf) Page 2 Hello! My name is Cassie, and I am a Goldfish(Carassius auratus)! Did you know a group of goldfish is known as a troubling? How troubling! Learn more interesting facts about goldfish by rolling your mouse over my picture to the left! Welcome to the fifth chapter of Lessons on the Lake, Our Water Resources. We'll learn about our water, do the water cycle walk, measure water quality, develop a mini action plan, and write in our journal. All right! Let's get started! Page 3 While remarkable strides have been made to reduce water pollution in the Lake Pontchartrain Basin, there is still much work to be done — and it will take the efforts of all of us. Solving the Basin's pollution problems will not be easy, but you'll find that there is something you can do. In this next activity, you will design a project of your own. Here are some proposed solutions to current problems. Research one and develop a mini action plan to get you started using the chart below and the student handouts. (link to pdfs) Page 4 How do the choices I make, good and bad, affect our water quality? How can I improve the choices I make concerning my use of our precious water resources? How does my personal use of water affect water quality in the Lake Pontchartrain Basin? If I could swim or boat along the shores of waterways in the Lake Pontchartrain Basin, what kinds of pollution would I find? How do those pollutants affect living organisms in the Basin? You are a dairy cow in a herd of 300. The amount of waste generated by the herd and entering a nearby stream distresses you. As a representative of the herd, what would YOU say to the dairy farmer? ---------- You work at Bun 'n' Burger, a local fast food restaurant. You found out that the grease trap is being emptied by a company that dumps the grease into the LaBranche Wetlands bordering Lake Pontchartrain. What would you do? ---------- You are a tomato plant on a large farm in a rural parish. You're worried that the pesticides and fertilizers running off the land will cause fish kills in a nearby waterway. Here comes the farmer again, ready to spray. You tell him, "STOP! _____."(Finish the story.) Page 5 HOME | SITE MAP | ABOUT | CHAPTER LIST | FOR TEACHERS | FOR STUDENTS | FIELD TRIPS | TURTLE COVE | GLOSSARY | SEARCH | LINKS | CONTACT This is a project of the Lake Pontchartrain Basin Restoration Act in cooperation with The Lake Pontchartrain Basin Foundation and the National Oceanic and Atmospheric Administration with Southeastern Louisiana University Page 6 Hello! My name is Odie, and I am a White-Tailed Deer (Odocoileus virginianus)! Did you know that there may be as many as 40 subspecies of white-tailed deer? Learn more about deer by rolling your mouse over my picture to the left! Welcome to the sixth chapter of Lessons on the Lake, Natural Resources of the Lake Pontchartrain Basin. We'll learn about the most earth-friendly ways to manage our resources, learn about the effects of runoff on our ecosystems, discover the effect of salt on cypress and other wetland plants, and write some poetry about the Basin. Are you ready? All right! Let's get started! Page 7 The watershed of the Lake Pontchartrain Basin is fed by streams and ditches which drain the crop and pasture lands north of the Lake. Many of these streams contain extremely high levels of organic nutrients, chemical fertilizers, and pesticides. Most of this pollution is directly attributable to runoff from dairy and crop farms which have not installed holding ponds. Holding ponds allow much of the pollution to become incorporated into plant tissues or to be biodegraded into less harmful components while at the same time allowing associated bacteria to be rendered harmless. This experiment allows students to determine for themselves exactly what effect these compounds can have upon aquatic and wetland ecosystems. A dramatic comparison between polluted and unpolluted sites can be made using aquaria in which stable "ecosystems" have already been established. Teaching Materials: An even number of "aquariums". These can be actual aquaria, or large, clean glass jars. The size of the jar will necessarily limit the number of plants and animals as well as the types of animals which can be incorporated into the "ecosystem". Cleaned sand, gravel, oyster shells or other substrate for the aquaria. A supply of pond water, enough to make up at least 1/4 of the total in each aquarium. An assortment of pond animals and plants which can be evenly distributed among all aquaria. Examples can include snails, small fish, crawfish, duckweed, common aquarium plants like Elodea, etc. NOTE: While using animals better approximates a real ecosystem, this experiment can be successfully conducted by using only pond water in an aquarium or jar. A moderately sunny windowsill or some artificial light source such as bright aquarium lights. Assorted pollutants. One of the best is a well-balanced, basic garden fertilizer, something like 13-13-13. A small chart with numbers or text in decreasing font sizes, much like an optometrist's eye chart, which can be placed behind the aquarium to measure turbidity or water cloudiness (Refer to "Data Analysis and Collection", Page 154). Getting Ready: Place aquaria in their permanent locations (make sure they are not too sunny; sunlight for half of the day should be about right). Allow students to select from available substrate materials to construct their ecosystems. Fill aquaria 1/2 to 3/4 full with tap water and arrange plants in the gravel, etc. Let the system stand overnight. Add fish, snails, etc. and finish filling with pond water or aged tap water. After aquaria have 'set-up' for a few days, you will be ready to apply fertilizer treatments. The number of different fertilizer levels (amounts of fertilizer) will depend upon how many aquaria you have available. This exercise can, of course, be done with as little as two aquaria...more allows for replication of many different levels of pollution. Fertilizer solutions can be tested against non-fertilizer solutions (controls) as well as each other (increasing levels of pollution). Add 100mg of fertilizer to each 10 gallon aquarium (you may have to adjust this amount depending upon the size of the aquarium), or vary the amounts in each tank (i.e., 100mg, 200mg, 300mg, etc.). Remember to keep one tank "clean" (no fertilizer) to use as a control. Have your students measure and record the turbidity levels in each tank every morning using the charts they have constructed. (Refer to "Data Collection Sheet", Page 155). Continue to monitor the pollution levels and help students formulate hypotheses concerning agricultural runoff. PLEASE!! remember to feed your "critters" if any live animals have been used in the tanks. By the end of this experiment, you should be able to answer these questions! Does runoff affect aquatic ecosystems? How? Are animals affected by runoff? Do you think that greater amounts of runoff would change this? Would mixing other runoff (pesticides, manure, motor oil, gasoline) affect the animals more? Why or why not? How can we help improve the health of Lake Pontchartrain? How can we reduce the amount of runoff entering Lake Pontchartrain? Page 8 Saltwater intrusion, or the advancement of salt water into formerly freshwater marshes and swamps, has been blamed for much of the wetland loss in the Lake Pontchartrain Basin. Quite often salt water is allowed to enter interior marshes by way of straight canals dug by oil companies to facilitate travel during oil exploration or deepwater navigation channels designed to improve shipping traffic in the Port of New Orleans. While saltwater intrusion is not necessarily to blame for wetland loss in all parts of the Basin, it is certain that almost all plants accustomed to fresh water cannot tolerate salt water for very long. Some plants can, over time, adapt to changing salinity conditions. Do different species react differently to changes in salinity? Can older plants tolerate greater levels of salt than young plants? How does salt affect the germination of new seedlings in fresh or intermediate marsh and swamp areas? These experiments will allow students to develop hypotheses like these concerning the effects of salt water on various wetland plants. Teaching Materials: Egg cartons for planting and growing seedlings Sterilized garden topsoil Spoons Wetland plant seeds (these can be obtained from almost any ditch, pond, or vacant lot). Try to get seeds from plants of different sizes (sedges, lilies, cypress trees, acorns, etc.). Be sure to keep the seeds separated and labeled if you know the plants. Ordinary plant seeds from your local hardware store will also demonstrate the effects of increasing salt levels. A plastic bottle for plant watering. Something with a sprinkler or spray top works best. Salt. You can use something like Instant Ocean which mimics sea water more closely, but ordinary table salt will work just fine. The only preparation involved is obtaining seeds, filling the egg carton sections with soil, and mixing a saltwater solution. Saline solutions can be tested against non-saline solutions (controls) as well as each other (increasing levels of saltwater intrusion). Salt water is measured in parts per thousand (ppt) and can easily be made up by mixing one gram of salt to 1000 ml of water for a concentration of 1 ppt. What?!? Okay, add about one teaspoon to a two-liter soft drink bottle for a concentration of about 1 ppt...two teaspoons for 2 ppt...three teaspoons for 3 ppt...you get the idea. By the way, ocean water is roughly 35 ppt, brackish water is from 0.5-15 ppt, and fresh is from 0-0.5 ppt. Mix 5 ppt and 10 ppt solutions, label them clearly and set aside with the control (tap water). Many students will respond favorably to background information by developing their own hypotheses to test. Others may require a bit of coaxing in the right direction. Seedlings grown in the "control" cartons can serve as nursery stock for further experimentation that requires larger, more mature plants. For example, larger versus smaller plants, etc. Place ONE seed in each of the egg carton dividers. (Use the same kind of seed in each divider.) Place in a nice, warm, sunny place and water regularly, one tray with 0 ppt, one with 5 ppt and one with 10 ppt. Keep the soil moist, but not wet. Have the students keep a log containing their DAILY observations. When seedlings sprout, they should be measured also. Observations might include such descriptions as how many leaves the plants have, when they sprouted through the soil, when they died, etc. The average number of seeds germinating in each of the different salinity egg cartons can serve as data to be used for statistical analysis (t-test) to quantify the effect of salt on seedling germination. Page 9 Many of us feel so out of touch with the natural world that we often don't see what is there beyond the obvious. The focus of this activity is to have students feel that they are a part of the natural world. Plan a field experience for students in order to conduct observations of natural elements. (Refer to Chapter 11). If an actual field experience is not possible, conduct a "guided visit" in the class. Students should sit quietly by themselves and use their senses to observe as much as they can. Discuss elements of the I AM Poem with students. Brainstorm ideas with the class. Teaching Materials: Observation log sheets per student Copies of I AM Poem handout (next page) Procedure: Using the format and models of the I AM Poem provided, students should work alone or with a partner to compose an original poem about some element of the Lake Pontchartrain Basin. The following steps are suggested: Using your senses, collect as many observations about the place around you as you can. If possible, return to the same spot on other occasions, especially at another time of day or in other weather conditions. Complete an observation log sheet each time you go. These will help you complete the lines of the poem that begin with "I hear…"; "I see…"; "I touch....". Using your internal senses, try to feel a connection with the world around you and express what you are thinking or feeling about your observations. This will help you complete the lines of the poem that begin with "I pretend..."; "I worry..."; "I dream...."; "I hope....". Putting observations and feelings together will help you complete the poem. These are the lines that start with "I am..."; I wonder..."; "I understand..."; I try....". Use a computer and other resources such as clip art or photographs (downloaded from the Internet) to create your I AM Poetry. Type, proof, and edit if necessary. Share your poems with your classmates. End of Chapter 6.... Proceed to Chapter 7! Page 10 HOME | SITE MAP | ABOUT | CHAPTER LIST | FOR TEACHERS | FOR STUDENTS | FIELD TRIPS | TURTLE COVE | GLOSSARY | SEARCH | LINKS | CONTACT This is a project of the Lake Pontchartrain Basin Restoration Act in cooperation with The Lake Pontchartrain Basin Foundation and the National Oceanic and Atmospheric Administration with Southeastern Louisiana University Page 11 Setup and Procedures: Loose leaf or larger paper, some pens or markers and a few good ideas are all the materials necessary to begin. Good ideas can take the form of conflicting points of view regarding the use of our shared natural resources. It is important to stress the fact that we all use the same limited pool of resources and that understanding another's point of view is essential to the resolution of these types of problems. The educator should introduce some possible conflicts and serve as a facilitator throughout the resolution process, rather than one who supplies all the answers. The types of questions to ask are important in generating a knowledgeable understanding of opposing viewpoints and in reaching an agreeable conclusion. Examples: GOALS: Who are the two groups involved? Commercial Fishermen (CF) Major Oil Company (MOC) What are their current goals? CF = Protect fisheries stocks to maximize catch MOC = Maximize oil production to meet current demands INTERACTION: Do these two groups conflict or cooperate? What might happen in each scenario? OUTCOME: What might be some of the projected outcomes, given each group's attitudes and expectations? Page 12 Of course, all of these natural resources are important and essential aspects of the Lake Pontchartrain Basin, the many different facets of our 'natural treasure'. Even so, most of us have our own ideas as to which of these are the most important, and, therefore, the most precious. While the preceding exercise provided some insight into the motivations and goals of people who use a particular resource, we all must strive to maintain and improve the ecosystems surrounding Lake Pontchartrain. Page 13 Essential Questions: What are the natural resources of the Lake Pontchartrain Basin? What are the opportunity costs and benefits regarding the use of the Basin's natural resources? What do I think is the most precious natural resource of the Lake Pontchartrain Basin? How can I investigate the effects of pollution upon the Lake Pontchartrain Basin Ecosystem?