

MINNESOTA SEA GRANT

THE
Lake
GAME

FOR PEOPLE WHO CARE
ABOUT LAKES



by Barbara Liukkonen



Minnesota is well-known as the Land of 10,000 Lakes. Our lakes are found in environments ranging from developed urban settings to remote wilderness areas. Lakes face a variety of threats such as overuse, pollution, and the introduction of exotic species. Minnesota's lakes serve many purposes so there are probably as many viewpoints on

how lakes should be used or managed as there are people and agencies in the state.

Minnesota's lakes are "public waters." That means we are all responsible for working together to better protect and preserve our water resources as they face increasing pressure from development and overuse.

PURPOSE

Throughout Minnesota, counties are developing water management plans and citizens are forming lake associations. Individuals and groups involved in these processes may have very specific ideas about how our water resources should be used or managed. In this activity, players assume roles that represent a variety of individuals who use a lake or lake water. The game has been designed to help introduce people to differing environmental values and to help them learn how to protect and improve our water resources.

The activity has been designed to fit the criteria for environmental education in Minnesota. It focuses on natural science within a social context, it addresses the issue of environmental valuing, and it identifies actions that students and others can take to protect and enjoy our environment.

GOALS

The goals of this game are:

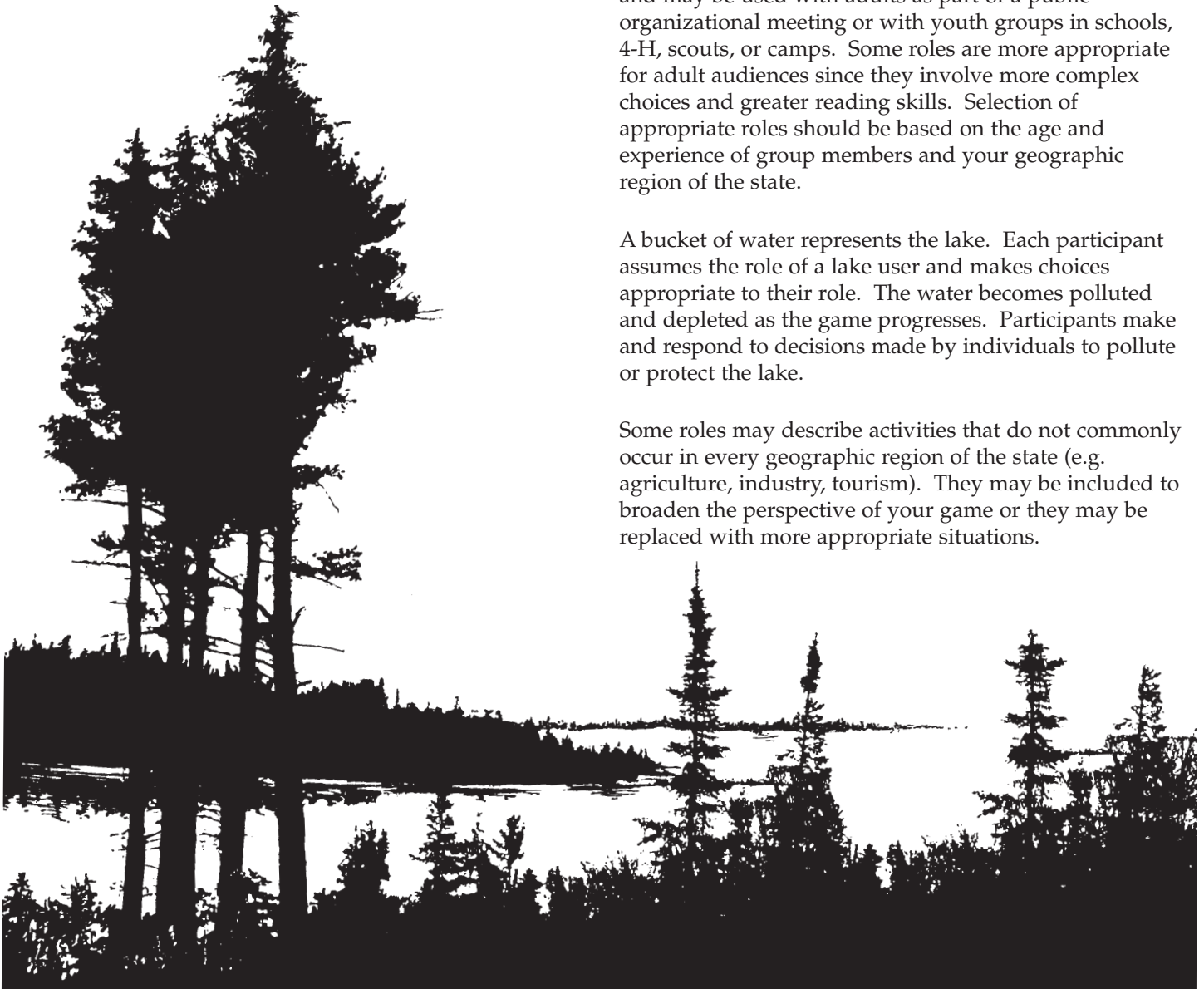
- to have participants realize how many people in the community depend on lakes for drinking water, recreation, and employment;
- to help participants better understand the economic complexity of decisions facing individuals and industries that use lakes; and
- to help participants understand how they as individuals can change their own actions to minimize harm to lakes.

PROCESS

The game takes about 45 to 60 minutes, depending on the size of the group and the amount of discussion during play. It is ideally played with 10 to 30 players and may be used with adults as part of a public organizational meeting or with youth groups in schools, 4-H, scouts, or camps. Some roles are more appropriate for adult audiences since they involve more complex choices and greater reading skills. Selection of appropriate roles should be based on the age and experience of group members and your geographic region of the state.

A bucket of water represents the lake. Each participant assumes the role of a lake user and makes choices appropriate to their role. The water becomes polluted and depleted as the game progresses. Participants make and respond to decisions made by individuals to pollute or protect the lake.

Some roles may describe activities that do not commonly occur in every geographic region of the state (e.g. agriculture, industry, tourism). They may be included to broaden the perspective of your game or they may be replaced with more appropriate situations.



BACKGROUND INFORMATION

- Minnesota is rich in surface water resources with nearly 92,000 miles of streams and over 15,000 lakes larger than 10 acres in size. That's more than 3.4 million acres of water plus approximately five million acres of wetlands.
- Minnesota's lakes range in size from less than 10 acres to the 3,000,000-acre Lake-of-the-Woods.
- One-half of the lakes in Minnesota are less than 50 acres (an acre is about the size of a football field).
- Over 98 percent of Minnesota's lakes are found in the northern and central part of the state.
- The most common lake name in Minnesota is MUD, which is (over-) used 261 times! The next most common names are LONG (256), RICE (122), BASS (83), and TWIN (72).

Most of the state boundaries are actually water: the Pigeon River and Lake Superior in the northeast; the St. Croix and Mississippi Rivers in the east and southeast; the Red River of the North along the western boundary; and the Rainy River and border lakes within the Boundary Waters Canoe Area Wilderness in the north. Three of the major continental drainage basins have headwaters in Minnesota. Surface water leaving Minnesota may flow eastward through the Lake Superior Basin and the Great Lakes to the Atlantic Ocean, south through the Mississippi and Missouri Rivers to the Gulf of Mexico, or north through the Red and Rainy Rivers to Hudson Bay.

We are surface water exporters; no surface water enters Minnesota. Along with the surface water, we export pollution to downstream users in other states and in Canada.

In Minnesota all lakes and streams have a designated use. There are seven classes of water for the state, and each

has a specific set of water quality standards. The classifications are:

- Aquatic, Fish and Wildlife
- Recreation
- Industrial
- Limited Resource Value
- Domestic Water Supply
- Agricultural
- Navigational

All lakes and 99 percent of river miles in Minnesota are designated for fishable and swimmable use. All rivers are classified for agricultural, navigational, and industrial use. We often think of water quality in terms of human consumption, but there are many other uses that require protecting and preserving adequate supplies of high quality water.

The waters of Minnesota belong to all of us; they are said to be "public waters." Property adjacent to lakes or streams may be privately owned so that access to the water may be denied, but the water itself is in the public domain. Thus, we are all responsible for Minnesota's precious water resources.

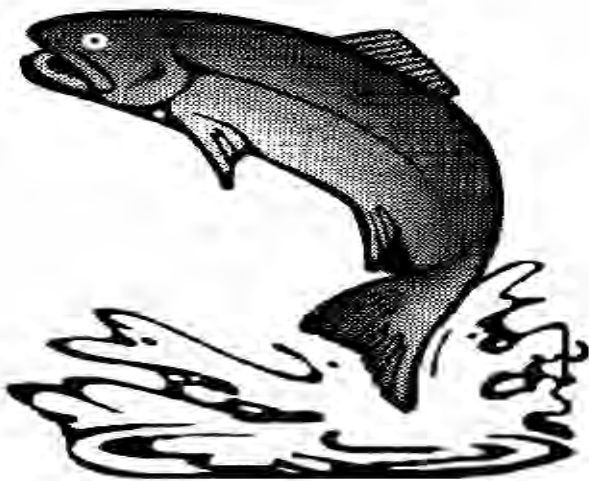
ADVANCE PREPARATION

Before beginning play, you should:

- contact resource people and leaders in your community;
- gather maps and factual information about your lake; and
- identify key issues relating to the lake and land use in your area.

Key resource people might include representatives of state agencies such as the Department of Natural Resources, the Board of Water and Soil Resources, the Pollution Control Agency, and the Department of Health. Other important contacts include: representatives of local government such as city, county or township board members; and local officials from the departments of zoning and planning, solid waste, highways and bridges, and public health. Other local resources include the University of Minnesota Extension Service, state Soil and Water Conservation districts, and college and university departments. Ask these people to attend to provide information and to participate in the game.

You also need to identify key people involved in managing and protecting the lake. Is there a lake



association already in existence or a core group interested in forming one? Has friction developed between user groups such as swimmers and boaters, urban and rural users, or new and long time residents? If so, be sure to involve key players from each of the groups in advance.

Get a topographic map of the area; USGS maps at a scale of 1:24,000 are available for most of the state from bookstores, outdoor outfitters, libraries, surveying companies, or the U.S. government. It is also helpful for players to see the drainage area or watershed of the lake since it shows how land use affects the lake. Try to get copies of maps to hand out or make a large version to display. A bathymetric (bottom contour) map of the lake is also helpful.

Before playing the lake game, find out as much as you can about your lake and surrounding land use. Possible questions include:

- How is land in the watershed area used (agriculture, residential, industrial, forestry)?
- How many streams flow into the lake?
- Does the lake have an outlet?
- How much of the lakefront is developed?
- Are lake levels or fishery resources managed? By whom and for what purposes?
- Do individuals or communities use the water for drinking?
- Are roadways near the lake salted in the winter?

Finally, identify the areas of concern related to your lake and surrounding area. Are people concerned about individual point source polluters or non-point sources in general? Are they worried about use of the lake for specific purposes such as swimming, fishing, or boating? Does the lake have problems with exotic plants or animals? What are the main issues you need to address during the role-playing game? You may need to create some additional roles to fit the issues relevant to your situation.

GAME MATERIALS

Before playing the game...

1. You will need:

- a large container nearly filled with clean water to represent your lake; aquariums, large buckets, wading pools, and clear plastic garbage bags suspended from a frame have all been used successfully;
- an extra bucket or sink for dumping water removed from the lake;

- an extra bucket of clean water for rain;
- a small container of water colored bright red with food color to represent pollution;
- a similar solution of yellow food color;
- an eye dropper to dispense the pollution; one eye dropper full equals one unit of color;
- a plastic container with a perforated lid, filled with muddy water for the participants to add "shakes" of turbidity to the lake;
- a roll of toilet paper;
- a clear container for withdrawing water; a plastic cup works well;
- play money or a substitute, for the roles that involve paying instead of polluting. (Note that not all roles have this option. The leader can add requirements to pay as needed.);
- at least three fish made from plastic or plexiglass weighted to stand on the bottom of the lake (see Figure 1);

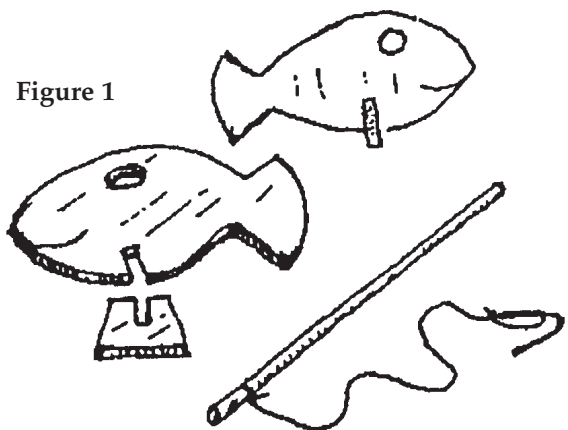


Figure 1

- a fishing pole to catch the fish;
- a picture of a loon or other wildlife;
- small beads to represent zebra mussels;
- curly red ribbon to represent fish guts;
- a tangle of yarn to represent Eurasian water milfoil;
- a die for Mother Nature to roll.

2. Silhouettes of fish may be cut from plexiglass or a plastic coffee can lid and inserted into a slit in another piece of plastic serving as a base (Figure 1). The base may have to be weighted to allow the fish to "stand" on the bottom of the lake. Red plastic or clear plastic edged with indelible red magic marker makes it more difficult to see the fish once the water becomes polluted. Each fish should have a hole in their back so they can be easily hooked with the fishing pole. The pole can be constructed from a short length of cord tied to a dowel, with a bent paper clip as a hook.

3. For each role-playing option photocopy, cutout and paste the role on one side and the leader discussion text on the back of a tagboard card. Cards should be flexible and durable. Cover the cards with clear contact paper to make them waterproof.

4. The cards are numbered in the order in which they should be played. This ensures some pollution of the lake before participants remove drinking water and go fishing.

5. If you are using play money, clip it to the appropriate cards before handing them out. Or participants can “borrow” money from the leader, as they would from a bank, to pay for cleanup costs. You can also make the handout card itself look like a check for the correct amount. Use a Clean-up Fund box, and after the game, check to see how much would be available for clean-up.

6. If possible, prepare a large-scale map of your lake, traced on plastic or chalked on the ground. Indicate cities with dots and township or county borders with lines, but don’t necessarily identify them by name. If roles have been assigned to specific locations, finding their “home” becomes part of the experience for participants unfamiliar with the entire lake. The map should be large enough for participants to sit around while they play.

PLAYING THE GAME

1. Place the container representing your lake in the center of the map. Stand the fish on the bottom. If they tip over when water is added, leave them lying down.

2. Arrange the pollution solutions, eye dropper, turbidity shaker, and the container for withdrawing water near the bucket. Set up the picture of wildlife near the lake. Retain the fishing pole, die, toilet paper, yarn, etc., until that particular role is read.

3. Distribute the role cards and explain playing order. Encourage participants to role play and act as they think the person described on their card would act. Have participants sit around the map of the lake, read over their cards, and consider their decisions.

4. As each participant’s turn comes, have her/him read the role aloud and what choice s/he has made, if a choice is indicated. Each role should involve an action of some sort. You may or may not want to allow participants to influence others’ decisions.

5. Have participants perform the appropriate actions—polluting the lake, paying money, withdrawing water, catching fish.

6. After the participant has made her/his decision, the leader should read the text on the back of the card. This gives some background information and can stimulate discussion.

7. Discuss decisions as you play—balance economic considerations against idealism. If no one opts to pollute, ask how realistic that situation is. Compare the multi-million dollar decisions that they may not feel they can influence, with what they can do as individuals to reduce or prevent pollution. Discuss how they really can have an impact on corporate decisions through letterwriting campaigns, boycotts, etc.

8. Review that the container is a simple model of your lake. In reality, water is constantly being added through precipitation and runoff, and pollution is diluted or flushed out at the outflow. Stress, however, that water in your lake is a limited resource—it isn’t infinite.

9. Finish up with a review of which activities and choices polluted or depleted the lake water. Have participants discuss which were acceptable and how they could alter their own or others’ behavior patterns to better protect their lake.



LAKE USER ROLES

1.

I am smoking a cigarette as I drive along the lake. My car's ashtray is full. I can stop at the next roadside trash barrel to empty it, or I can toss my burning cigarette butt out the window and keep driving. **[If you toss the butt out the window, it starts a forest fire, destroying trees and causing erosion. Add mud and stir.]**

Discussion

Though part of the natural cycle in many forest ecosystems, severe fires destroy wildlife habitat, and can destroy trees and shrubs whose roots prevent erosion. Without roots to hold it, soil is carried by runoff down slopes and into lakes and rivers. Besides the loss of valuable topsoil, erosion carries nutrients into our lakes. This can cause algae blooms or excessive aquatic plant growth that can make our lakes unattractive and unhealthy.

2.

I am a homeowner living on a dirt road. I like to dump oil along my road to keep down the dust. This can pollute the lake. When I change oil in my truck, I have to choose whether to dump it along the road or take time to bring it to a used oil recycling center. **[If you choose to dump it along the road, add two units of red color.]**

Discussion

In Minnesota it is illegal to dump used motor oil. Used oil runs off into ditches and can get into groundwater or lakes and streams where it is harmful to plants and animals (including humans). Used oil also contains heavy metals (from engine wear) that pose a health risk. By law, the place where you bought the new oil must accept used oil or post a notice of where you can recycle it.

3.

I live near the lake and I know I should take my solid waste to the landfill, but it is cheaper and easier to dump the garbage in my backyard. I have to choose whether to continue to use the creek in my backyard as a dumping ground for my household waste or to pay \$18 a month and haul my waste to the landfill. **[Pay or add one unit of red color.]**

Discussion

Is it okay to use your backyard in whatever way you want? Why or why not? If you lived next to somebody who dumped garbage in his/her yard, how could you convince him/her not to dump there?

4.

I go fishing with my friend. When we clean our fish we could either dump the guts in the lake or wrap them up and throw them away. We think dumping the guts might be okay because they are biodegradable or birds will eat them. **[If you choose to dump the guts into the lake, add red curly ribbon.]**

Discussion

In Minnesota it is illegal to dump fish guts into the water. Although they are degradable, they stink and attract insects, birds and other wildlife. Dumping the guts makes using the area unpleasant for others and can pass along disease to other fish. You should take the guts home to either compost or dispose of with your garbage. If you're out camping, bury them in a hole at least one foot deep and 100 feet away from the water's edge.

5.

I am a logger who is cutting timber in the area. If I clearcut an area too close to a stream, it will cause erosion and streambank collapse, but I will earn \$1,000. The erosion would cause turbidity in the stream, damaging fish spawning grounds and polluting the lake. **[If you cut, add five big shakes of turbidity.]**

Discussion

Many fish lay their eggs on clean gravel beds in streams and lakes. Fish eggs that are covered with silt may never hatch. We have to be able to harvest our forest products, but there are ways to do so without damaging our lakes and streams. Loggers should use “Best Management Practices” (BMPs) when they cut and haul trees. These BMPs include not driving equipment through streams and leaving a buffer strip of uncut vegetation near water bodies.

6.

I run an industry on the lake, but none of the company officers live in the region. They are more concerned about making money than they are about protecting the lake. **[Add three units of red color.]**

Discussion

How could we convince the company that a clean lake has tremendous value too? Your voice counts! By boycotting products, writing letters to elected officials, and focusing media attention on unresponsive industries, you can make a difference.

7.

We have a fishing boat and often spill gasoline into the lake when we are filling the tank. I don't think it matters because the lake is so big that a little gasoline won't hurt it. **[Add two units of red color.]**

Discussion

That little bit spilled into the lake shouldn't hurt, right? What if everybody spilled “just a little bit?” Gasoline is easily dispersed through the lake and affects many plants and animals. One gallon of gasoline can contaminate one million gallons of water. Some components of gasoline (benzene, for example) cause cancer in humans and other animals. Another source of gasoline contamination in the environment is the “last few drops” that fall out of the pump handle when people fill their car's tank.

8.

I own property away from the lake. I figure what I do with my own land is my business. I would like to drain a wetland to give me a better area for hiking and ski trails, so I can enjoy nature without having to travel far. This area now serves as a holding area for spring meltwater. If I drain it, the water would pour down a nearby creek, causing erosion and carrying sediment into the lake. **[If you drain the wetland, add five big shakes of turbidity.]**

Discussion

Wetlands are valuable. They provide for flood protection by soaking up and retaining extra water during peak flow periods. They also serve as recharge areas by releasing that water slowly over time. They offer unique plant and wildlife habitat. In fact, there are many species you'll never see anywhere else. Wetlands also improve water quality by trapping or filtering out nutrients and other pollutants. We lose about 500,000 acres of wetlands every year in the United States to development.

9.

I own an industry near the lake. It would cost us \$10 million to change our production process to reduce pollution. If we have to pay that much we will go out of business and 300 people will lose their jobs. I have to choose whether to clean up or continue to pollute the lake. [Pay or add four units of red color.]

Discussion

This game is like real life. Often the choices aren't this dramatic, but hard economic choices have to be made when we want to reduce pollution. What kind of compromise could be worked out to avoid losing 300 jobs, but reduce or stop polluting the lake?

10.

I own a home with a well. My septic system is old and needs repair, but the upgrade will cost me \$500. I'd rather use the money for a vacation. I have to choose whether to pay to have the tank replaced, or continue to let my system pollute the lake. [Pay or add one unit of yellow color and one torn up sheet of toilet paper.]

Discussion

Most cities have sewage treatment plants that take your household water and clean it before returning it to the environment. Country homes rely on septic systems and drainfields filled with soil bacteria that eat up wastes before they get into lakes or wells. These work if they are constructed properly and maintained, and if people are careful about how much water they use at home. How many of you have septic systems at home?

11.

I represent the county highway department. We salt the highway during the winter. This makes the road safer, but when the salt runs off in the spring it pollutes the lake. Using alternatives to salt would cost taxpayers an additional \$25,000 per year. [Pay or add two units of red color.]

Discussion

Although salting our highways does make them safer for winter travel, the salt can run off and enter our lakes and rivers where it can be harmful to plants and animals. We don't want to have more accidents, but we need to consider our environment. There are alternatives to salt. What are some of them? Minnesota is experimenting with an environmentally-safer road de-icer called urea. It is expensive but pollutes less than salt.

12.

I am in charge of a paper plant that uses water to make paper. Most of the water is supposed to be returned to the lake clean, but I know there is a problem with the equipment, causing polluted water to return to the lake. Nobody else knows about this problem. Fixing it will cost \$100,000, will reduce profits to company investors, and will likely eliminate the \$10,000 raise I was expecting this year. [Pay or add two units of red color.]

Discussion

The profits that businesses make are important to individual employees, stock holders, investors, and our economic system. How can you determine the cost of pollution? How can you determine the value of a clean lake? Who benefits from a clean lake and how?

13.

I want to build a sauna near the lake so we can jump in the water to cool off. Installing a drainage system to carry our soapy wastewater back up into our septic system will cost me an additional \$500. Nobody will ever know if I just bury the pipe and let the wastewater run into the lake. **[Pay or add one unit of red color.]**

Discussion

Even though no one may know you're draining your sauna into the lake, you'll be hurting yourself by lowering water quality. The amount of wastewater may be small but the added nutrients can increase algal growth, and the soaps and oils from the sauna aren't good for the lake. Besides, you'll affect the water quality in front of your property—just where you want to enjoy the lake!

14.

My friend and I go out for treats. On the way home my friend throws his garbage out the window. I tell him he shouldn't litter, but he doesn't care. I can choose to stop the car and pick up his garbage or leave it. **[If you leave the litter, add one unit of red color.]**

Discussion

Each American throws away four pounds of solid waste a day. That equals 1460 pounds a year. Minnesota's garbage would fill the Metrodome to the roof, twice a week! How many of you avoid littering? How many would tell a friend not to litter? How many would actually stop the car and pick up the litter?

15.

I am going to build a new dock. I know that treated lumber will last longer and save me money and time in the future, but the chemicals used to treat the wood may be bad for the lake. I have to choose whether to build a long-lasting, treated dock, or to protect the lake. **[If you choose the treated lumber, add one unit of red color.]**

Discussion

The chemicals used to make lumber resist rotting can be harmful for plants and animals in our lakes. What would be some options instead of using treated wood? Using non-treated wood like cedar or redwood, metal, or plastic materials are more expensive, but better for the lake.

16.

I am Mother Nature. I supply water to the lake by rain. **[Roll the die. Add water to the lake according to the following:**

- 1 = "slightly dry year," add one cup
- 2 = "normal year," add two cups
- 3 = "slightly wet year," add three cups
- 4 = "drought year," add no water
- 5 = "second drought year in a row," remove one cup
- 6 = "very wet year - FLOOD," add six cups.]

Discussion

We can't expect the water input to our lake to be the same every year. Recharge occurs through precipitation directly onto the lake surface and through runoff from precipitation over the land around the lake. That runoff can come from rivers or streams or right over the land surface. The land area that drains into a lake is called its "watershed" or drainage basin. Recharge also can occur from groundwater seeping into the bottom of the lake. Water leaves the lake through evaporation, rivers draining out, groundwater seepage, and diversions by humans. Much of the water that we divert is returned to the lakes after our use—that's called non-consumptive use. If the water doesn't get back to the lake, it is called consumptive use.

17.

I am head of the city parks and recreation department. We have been losing sand from our public beach due to erosion. I have to find a source to replace it. I have found a cheap source of sand that is slightly contaminated with salt. Clean sand would cost so much that we would not be able to replenish our public beach this year and would have to close it down for the summer. I have to choose whether to purchase the cheaper, contaminated sand. **[If you use the sand, add one unit of red color.]**

Discussion

What do you think the public would say if you closed the beach? What about the local tourism industry? Many people think environmental concerns are fine until they themselves are put out. How would you respond when they asked, "Just how much damage can a little salt cause, anyway?"

18.

I own lakeshore property and want to have a nice, green, dandelion-free lawn running down to the lake. I can choose to use chemicals on my lawn or pull the dandelions by hand. Chemicals could pollute the lake, but would save me work. **[If you choose to use chemicals, add one unit of red color.]**

Discussion

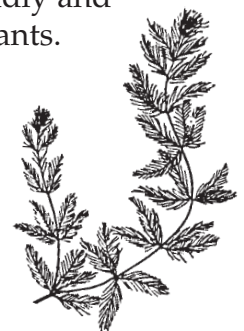
The best kind of lakeshore environment—for water quality, for animals, and also for people—is one that includes vegetation other than mowed grass. Buffer strips of weeds, aquatic plants, shrubs, or trees help protect the lake by preventing runoff of soil and nutrients or chemicals, and by providing habitat for animals. One of the worst things lakeshore owners can do to their lake is use fertilizer or herbicides (chemicals to kill weeds) on mowed lawns next to the lake.

19.

I have a rare three-day weekend, and I want to take my motor boat to as many different lakes around the state as I can during this time. I start at Lake Minnetonka, near Minneapolis. As I'm leaving this lake, another boater tells me to wash off my boat, because I might be carrying Eurasian water milfoil to another lake. I'm in a hurry, though, and I don't remember seeing any of the plant attached to my boat propeller or trailer. **[If you don't stop to wash boat and trailer, add a tangle of yarn to the lake.]**

Discussion

Eurasian water milfoil was first discovered in Minnesota (in Lake Minnetonka) in 1987. By 1998, it had spread to 82 lakes and 4 rivers in the state. It is a nuisance weed that is spread by people carrying it from one lake to another on their boats or trailers or in their live wells or minnow buckets. It grows rapidly and crowds out beneficial native plants. It doesn't provide good habitat and is a nuisance for boating, swimming, water-skiing, or fishing. Its spread can be slowed if people take a few extra minutes to make sure they are not transporting it to another lake.



20.

I am a newspaper reporter. I have information about illegal dumping of toxic waste that is polluting the lake. The dumper has offered me \$10,000 not to tell. I have to choose whether to take the bribe or write the story. **[If you take the money, add two units of red color.]**

Discussion

Is the pollution of the lake worth only \$10,000? How much money would get you to clam up about the story? \$20,000? Only \$500? Is your personal gain worth damage to the lake that ruins everyone else's use, including the fish and wildlife that rely on the lake?

21.

I am a very good lawyer who wins all my cases. I have been asked to help a company avoid installing expensive new pollution-control equipment. If I take this case, I will make lots of money, but pollution of the lake will continue. **[If you take the case, add three units of red color.]**

Discussion

Would earning \$10,000 from the case be worth continued pollution? Would \$5,000 be worth it? Would \$500 be worth the pollution? Is earning this fee worth the damage to the lake?

22.

I own a dairy operation along the lake. My cows are free to wander down to the lake to drink and escape from the heat and bugs. Some people across the lake want me to restrict my "feedlot" and not let my cows in the water. To run fencing along my two-acre frontage would cost me \$20,000 and I'd need to install pumps and line to get water for them to drink. If I paid that much for improvements, I'd have to close down my operation. **[Pay or add two units of red color.]**

Discussion

There are clearly no easy answers in this situation. Although the dairy herd is harming the lake, shutting down the operation is not an easy solution. The Minnesota Pollution Control Agency handles feedlot complaints and violations and will work with livestock operators to reduce or eliminate environmental damage. One question to ask about a lakeshore feedlot is, "How does pollution from the feedlot compare with pollution from other sources such as septic systems, runoff, and lawn chemicals?"

23.

I spend a day fishing at Guppy Lake. A fellow angler tells me the fish are biting better at another nearby lake. Quickly, I gather my gear, put my boat on the trailer, and prepare to head off to the other lake. I notice a sign at the boat landing saying zebra mussels have been found in Guppy Lake, and asking boaters to carefully wash their boats, trailers, bait buckets, and other items before boating in another lake or river. I'm in a hurry to land that big lunker! **[If you don't wash your boat and gear, add zebra mussel beads to lake.]**

Discussion

Zebra mussels are small mollusks native to Europe that made their way into U.S. waters in the late 1980s. Since then, they've spread quickly. They move from lake to lake by attaching themselves to hard surfaces, like boat hulls, bait buckets, and so on. They can live out of water for several days. Zebra mussels reproduce rapidly, and they eat by filtering tiny organisms from the water. This can make lake water clearer, but it also removes these tiny organisms that provide food for other aquatic animals in the ecosystem. Most researchers agree zebra mussels are here to stay, but it is up to people who use lakes and rivers to control their spread.

24.

I am a great water skier. I like to ski near shore so people can see how good I am. This stirs up bottom sediments along the shoreline. I have to choose whether to quit skiing near shore to protect the lake or to keep showing off. **[If you continue to ski near the shore, add three big shakes of turbidity.]**

Discussion

Sometimes little things make a big difference in a lake. The addition of turbidity not only makes the lake less pleasant for us, but it also damages plant and animal habitat. It decreases the amount of light that reaches deep into the lake, which can affect water temperature and the ability of predators to see prey. It can also cover fish spawning grounds.

25.

I am in charge of mosquito control for the city. Every year we spray near the lake. I have been asked to increase the area we spray to kill more mosquitoes. Some people don't want any spraying. I have to choose whether to spray more, less, or the same as in past years. **[If more, add two units of red color; if less, add no color; if the same, add one unit of red color.]**

Discussion

Chemicals approved for mosquito control are safe if applied correctly. But some may have long-term effects on birds and other animals. Do we really need to get rid of all mosquitoes? How is local tourism affected by lots of bugs? Is that important, too?

26.

I live by the lake and can choose to spend five minutes a day making sure that my family recycles our aluminum cans, newspapers, and glass. Do I choose to recycle? **[If you choose not to recycle, add one unit of red color.]**

Discussion

Each person in Minnesota throws away 600 pounds of paper, 60 pounds of aluminum cans, and 200 glass containers each year. Recycling would not only save space in our landfills, or prevent air pollution from incineration, but it would also reduce the amount of natural resources used to make new products. People in Minnesota are getting better about recycling. How many of you recycle?

27.

I am an angler who just spent \$700 on fishing equipment. I can catch a fish if there isn't too much pollution. **[Try to catch fish. Fifteen seconds will be allowed for fishing.]**

Discussion

Would you want to eat a fish that came out of water polluted like our lake? Pollutants in lakes can build up in sediments, in insects, and in small fish. When bigger fish eat contaminated prey, pollutants accumulate in fish's flesh (particularly fatty tissue). This is called bioaccumulation. The Minnesota Department of Health has issued guidelines for eating fish from 260 lakes in Minnesota. Young children and pregnant women who eat fish contaminated with mercury and PCBs face health risks.

28.

I am in charge of the sewage treatment plant for a city on the lake, but I don't think people who live in the city will agree to pay higher rates for wastewater treatment. Rates only \$3 a month higher would help prevent pollution of the lake. **[Take a vote. If the majority say they would pay more, add no color. If they vote no, add three units of yellow color and two sheets of torn up toilet paper.]**

Discussion

Most treatment systems do secondary treatment of sewage before it is returned to the lake. Tertiary treatment produces even cleaner water, with fewer nutrients to affect the lake. Tertiary treatment is more expensive and many small communities have a difficult time financing improvements. How much would you be willing to pay? \$5 per month? \$10 per month? \$20 per month?

29.

I'm fond of fluorescent pink. My lakefront house needs painting, and I start painting it pink. Several boaters stop by and say the color makes boating past my property less enjoyable for other people. They ask if I would consider another, more subtle color. **[If you keep it pink, add one unit of yellow color.]**

Discussion

Although painting the house a bright color wouldn't actually pollute the lake, it does make the area less pleasant for people who don't happen to like pink. Should people be able to do whatever they want to with their own property? Why? Why not? In Minnesota, the DNR has shoreland regulations on how close buildings may be to the water, how large or tall they can be, and how wastewater is treated near the water.

30.

I want to get rid of the aquatic plants in the water near my beach to make a plant-free swimming area. I could cut the plants or use a chemical herbicide. Chemicals would be easier and would take a lot less time, but could cause problems in the lake. I have to choose whether to cut the plants or use chemicals. **[If you choose chemicals, add two units of red color.]**

Discussion

Using chemicals in the lake to kill aquatic plants is not as easy as it seems. You must have a permit from the DNR to use chemical herbicides. When chemicals are applied at the wrong rate or at the wrong time of day they can harm fish and other animals. Wind or currents can cause the chemicals to travel away from where you want them to work. If there are plants in the rest of the lake, they'll continue to come back to your beach area. Besides, aquatic plants help reduce bank erosion, help improve water quality, and provide habitat for fish.

31.

I have a 25-minute drive to work every day. My neighbor works in the same office building as me. She suggests we carpool, but she leaves 10 minutes earlier than I do in the morning, and returns home 10 minutes later each evening. My time is precious! **[If you decide not to carpool, add one unit of red color.]**

Discussion

Automobile exhaust contributes pollutants like sulfur dioxide, nitrous oxides, and mercury into the atmosphere. These compounds mix with moisture, then return to earth attached to rain or snow. When these pollutants fall or run into lakes and rivers, they cause damage to plants and animals in the aquatic ecosystem.

32.

I work for the Department of Natural Resources. I am in charge of controlling purple loosestrife, an aquatic plant that is taking over in our region's wetlands. I have to choose whether to use crews to remove the plant by hand (not as effective and very time-consuming) or use a herbicide to poison it. If I use a crew, the plant may spread farther, but using herbicides improperly could pollute the lake. **[If you choose to use herbicide, add one unit of red color.]**

Discussion

Purple loosestrife is a serious threat to our wetlands and lakeshore areas. A single plant can produce up to 10,000 seeds annually. Currently only one herbicide is approved for chemical control, and when used correctly, it is safe and effective. However, any chemical may cause problems if it is mishandled and some environmentalists want to ban all pesticides. Is allowing the spread of loosestrife an acceptable trade-off for eliminating any risk from pesticide use?

33.

I don't live by the lake, but I know that when I waste electricity it increases air pollution that affects the lake. I have to decide whether to conserve electricity at home by moderating the settings on my air conditioner and electric heaters, turning off unused lights and appliances, and so on. **[If you continue to waste electricity, add one unit of red color.]**

Discussion

Many electrical generating plants in Minnesota burn coal. Coal contains an impurity called sulfur. Sulfur dioxide and nitrous oxides (from automobile exhaust) combine with moisture in the atmosphere to form acid rain. Acid rain is a problem for our aquatic and forest resources as well as for man-made materials. "Scrubbers" can be installed on power plants to reduce sulfur emissions, but they are expensive. How much would you pay to reduce acid rain?

34.

I represent a city on the lake. We need 200,000 gallons of clean water from the lake each day for our city water supply. **[Remove four cups of water; show everyone how polluted the water is.]**

Discussion

How many of you would want to drink this water? Many communities in Minnesota use surface water for their municipal water supply. When the water was clean, the city could send it out to homes. Now what will they have to do to it? What will that mean in terms of the cost of using water?

35.

I got a new personal watercraft for my birthday. For my next vacation, I'm planning to take it to a northern lake where I know there's a lot of wildlife. It will be fun to explore all the little bays and inlets, and see wildlife like loons up close. **[If you take this craft to the lake, add one shake of turbidity and turn the wildlife picture face-down.]**

Discussion

Because personal watercraft do not have propellers, they can be taken into shallow water near shorelines. This can cause several problems. First, the wave action can stir up bottom sediments, making the water cloudy and damaging plant and animal habitat. Secondly, the noise made by personal watercraft can disrupt wildlife, and can even scare birds like loons off their eggs during nesting season. That has a direct impact on wildlife populations. How can we appreciate wildlife on lakes without causing these disruptions?

OTHER RESOURCES

DNR Waters Section. "Listing of Lake Names and Sizes by County, 1968." AN INVENTORY OF MINNESOTA LAKES, Bulletin No. 25, St. Paul, MN.

"Yes, Folks, There Really is a Lake Lake!" VOLUNTEER 44 (256):1-20. Minnesota Department of Natural Resources.

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