WATERSHED GAME
LESSON PLAN

Sea Grant
Minnesota

WOLF RIDGE℠
ENVIRONMENTAL LEARNING CENTER

WATERSHED GAME

CLASS DESCRIPTION: An Aquatic Ecology Class

The Watershed Game is a large-format board game to help students understand the relationship between land uses within a watershed, water quality, and their community. Working in teams, student apply tools (prevention, practices, plan, and policies) to decrease water pollution while balancing financial resources. The goal of the activity is to reduce non-point source water pollution from various land uses to the stream without going broke.

This curriculum was created by the University of Minnesota Extension and Minnesota Sea Great. There are more resources at watershedgame.umn.edu.

Total time: 1 hours 30 minutes (indoors)
Audience: 6-20 students, 8th grade through adult
Activity level: minimum
Travel: none
Total uphill travel: none

PURPOSE

To show how human actions impact watersheds.

CONCEPTS

1. A watershed is the area of land that drains to a particular lake, river, or stream.
2. Phosphorus and sediment levels can impact the health of a watershed if they are too high and unbalanced.
3. Citizens, organizations, and governments cooperate to make decisions about land use while factoring in economics and water quality.

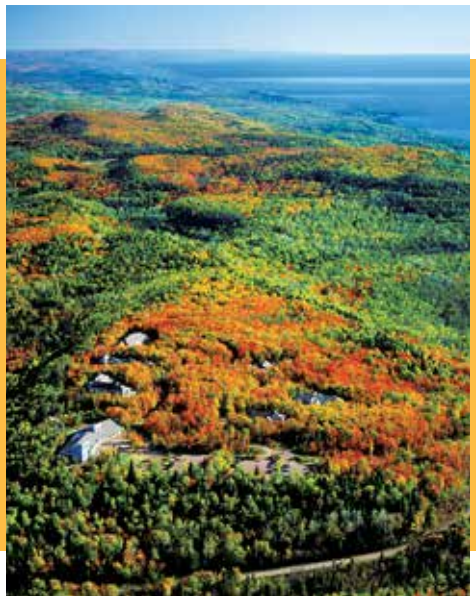
OUTCOMES

Upon completion of the Watershed Game class students will be able to:

- Understand that sediment and phosphorus are natural parts of healthy ecosystems.
- Describe how human activities associated with various land uses within a watershed may pollute a stream with excess sediment or phosphorus.
- Practice working cooperatively in Land Use Teams to evaluate the costs and benefits of tools that can decrease pollution.

Sea Grant Minnesota

This Curriculum was created by Minnesota Sea Grant.



WATERSHED GAME

Revised May 2024

Equipment

- full lesson plan
- 4 large laminated land use maps: farmland, city, residential, and forest
- watershed score box map (8.5x11 laminated)
- payment box map (8.5x11 laminated)
- full watershed map (11x17 laminated)
- pollution key map (11x17 laminated)
- water shed game money
- role cards (4 sets of 6 unique roles)
- tool cards (in brown folder pockets; labeled city, farmland, forest, and residential)
- student worksheets
- pencils
- white board/chalk board for score keeping

Appendices

- Glossary
- References
- Sources
- Student Information Sheets

Set-up (10 min.)

- Classroom/class prep description
- Safety Management

I. Introduction (10 min.)

A. Greeting
B. Assess Learner Level

II. Team Play (20 min.)

A. How to Play
B. Play

III. Full Class Play (30 min.)

A. Share Reports
B. Calculate Remaining PUs
C. Cooperate with other Land Use Maps to Further Reduce
D. Campaign

IV. Conclusion (20 min.)

A. Review
B. Stewardship Action

Clean-up (10 min.)

Set-up (10 min.)

Classroom/class prep description

Set up 4 tables with 6 chairs at each table. Put out one large laminated land use maps on each table (farmland, city, residential, and forest), one pencil, and one student worksheet. Draw scoreboard on whiteboard or blackboard. Lay out other materials in piles at front of room or on a separate counter: role cards, tool cards, full watershed map, pollution key map, payment box, and watershed score box map.

Safety Management

Adhere to and be familiar with all general safety practices designated by Wolf Ridge. Be aware of any student's special needs (medical, etc.) and adjust the activities as needed to maintain safety.

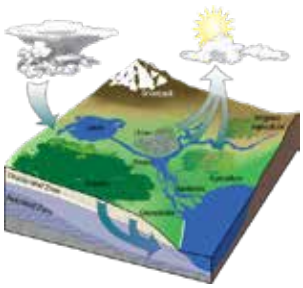
- First aid kit is located in the kit room.

I. Introduction (10 min.)

A. Greeting

Greet the students as they enter the classroom.

B. Assess Learner Level



Assess Learner Level

Ask the students to brainstorm all the lakes and rivers they can think of near their home. This is a great opportunity for student to take note of the parts of their watersheds.

This is a great opportunity for student to take note of the parts of their watersheds. Point out the land use maps on their tables and ask them if they can recognize these watershed components in their hometown.

Have the class split into 4 equal groups around the tables, if they aren't already. Each group will have a different Land Use Map on their table that when all put together, make one watershed. Show the 11x17 Full Watershed Map. Explain the goal of the game. The goal of this game is to create and interact with a model watershed and reduce the pollution created by it without exceeding their money limit.

II. Team Play (20 min.)

Before getting to game play, review the fundamental terms with students. Have them help you define them.

watershed - The area of land that drains into a particular lake, wetland, or stream.

sediment - Materials broken down by weathering, carried by water and wind; i.e. Soil, sand. Excess sediment can come from erosion within the stream channel or from erosion upstream in the watershed.

phosphorus - An essential element of all living things. It cycles naturally through watersheds but as an excess can become a pollutant. Excess phosphorus can come from fertilizer and animal or human waste.

nonpoint source water pollution - Pollution resulting from many diffuse sources. Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrological modification (rainfall and snowmelt) where tracing pollution back to a single source is difficult. Sediment and phosphorus are examples of nonpoint source water pollution.

pollution units (PUs) - Scientists and environmental managers measure pollution in many ways and in different units. To simplify the game, we use the generic term, pollution units.

pollutant load - The mass of a pollutant that is measured or calculated to pass a particular point in a stream, river or lake outlet in a specified amount of time.

Assessment Concept 1 - *A watershed is the area of land that drains to a particular lake, river, or stream.*

Tell the students which pollutant the class will work to reduce: sediment or phosphorus. The facilitator chooses sediment or phosphorus based on the amount of challenge you wish to set. Phosphorus is an easier goal to achieve and sediment is more challenging.

Point out some important features on the Watershed Game Board such as the undeveloped land at the bottom of the corner. Remind student that sediment and phosphorus are natural components of a watershed and only become pollutants when they are excess. Introduce students to one or two example of visible pollution (ex. Excess soil eroding into steam) so they know what to look for when working in teams.

A. How to Play

Explain the basic rules while showing the game pieces. The student worksheet will guide each team through prompts and help collect you thoughts. Each person within a team will have a different role and will receive a role card describing their role. Options include: The reader, pollution specialist, reporter, mapper, banker, scribe. Facilitator can choose who gets what role. If you have less than 6 students at each table, you can give a couple students two roles. Each team will receive $60,000 to buy tool cards. Each team must keep at least $10,000 in the bank for future use. Team members will be responsible for one or more tool cards. Each tool cards has various ways to reduce pollution for a specific cost. Each team will use up to 3 of their tool cards and select one extra tool card to keep in reserve.

INSTRUCTOR NOTE:
While students are playing in their land use teams use the time to prepare for full class play.

Prepare a table, floor or wall space to piece together team land use maps into the watershed game board.

B. Play

Distribute role cards and allow students to review their roles. Instruct students to begin working together by following the prompts on their worksheet step-by-step. When a group completes steps A-C on their worksheet, provide $60,000 and the respective tool cards for them to continue.

While students work through their worksheets, circulate the room helping them with prompts or questions if they need. Feel free to reference the Pollution Key Map for example of pollutions on each Land Use Map.

III. Full Class Play (30 minutes)

Once each group has completed their worksheet, gather teams for reporting. Assemble all the Land Use Map along with the Score Box and Payment Box Map (reference Full Water Shed Map to see how pieces fit) in an area where the class can gather around the map. Remind students to bring their worksheets, money, and chosen tool cards. Help the class calculate the total starting Pollution Units reaching the stream from the entire watershed:

- 4 land uses X 50 Pollution Units (PUs) per Land Use= 200 PUs
- Undeveloped Land= 5PUs
- Total starting PUs for the whole Watershed= 205 PUs

A. Share reports

Ask the teams to report. Each student shares certain information based on their role card.

- The reader should guild team members to report in the follow sequence.
- Pollution specialist - describe and point to the two sources of pollution the team detected on their Land Use Map (Part C).
- Reporter - Describe the Tool Cards that the team picked, including the title, how they reduce pollution, number of PUs reduced, and cost (Part F).
- Mapper - Place the Tool Cards in their correct locations on the Land Use Map.
- Banker - Pay for the Tool Cards (place the correct amount of money in the Payment Box) and keep track of teams remaining money.
- Scribe - report the team's remaining PUs and money (Part G). Add to the group score card on whiteboard or chalkboard.

B. Calculate remaining PUs

Calculate and record the remaining PUs still reaching the stream and remaining money from all Land Use teams combined. Introduce the Watershed Clean Water Goal and write it on the score card

- Phosphorus = 75 PUs
- Sediment = 30 PUs

Determine and discuss whether the class has met the Watershed Clean Water Goal. If not, calculate how many PUs still need to be removed. Students will most likely NOT have met the clean water goal and no one land use team will have enough money to reach the goal. At this point they need to work together as a unified watershed team. If time allows, see if they can come up with the team work solution on their own.

C. Cooperate with other Land Use Maps to Further Reduce

Ask the class how they could achieve the Watershed Clean Water Goal and still keep some money for maintenance and/or future projects. Groups will have to work together- pooling their remaining money and choosing from the extra Tool Cards that each team pre-selected in part H of the worksheet.

D. Campaign

Have each teams Pollution Specialist present and campaign for their extra Tool Card to the rest of the class. Guide the class through a discussion and debate around the presented Tool Cards. What are the pros and cons of each? Which might have the most overall benefits? Least cost? Have the class pick one of the presented Tool Cards to apply to their watershed. Recalculate PU totals and see if the Clean Water Goal has been reached.

IV. Conclusion (20 minutes)

A Review

Have the students take a close look at the fully assembled Watershed Game Board with all the Tool Cards they used in their proper places.

Assessment Concept 2 - *Phosphorus and sediment levels can impact the health of a watershed if they are too high and unbalanced.*
Concept 3. *Citizens, organizations, and governments cooperate to make decisions about land use while factoring in economics and water quality.*

Lead a closing discussion with the group with some of the below prompts/questions on the Watershed Game.

- What do they notice that is different from the beginning of the game? (i.e. more aesthetically pleasing, less polluted)
- Why are sediment and phosphorus important for a healthy ecosystem? How can they become pollutants?
- What are the types of activities on the land that can cause too much sediment of phosphorus to enter the water?
- What are the impacts of these pollutions on fish, other wildlife, humans?
- Why might different Tool Cards have different costs and PUs?
- Could one Land Use Team have met the Clean Water Goal alone? Why or why not?

B Stewardship Action

Ask the following questions of students to help them connect the Watershed Game to their lives.

- Students realized during the full class play they all had to come together as a team forming a watershed community. Do any of the Tool Cards used describe thing that could be done in their owl local watersheds?
- What advice would you give to people in your watershed to help determine the water quality?
- What tools or behaviors would you suggest they use to reduce pollution?
- What are ways watershed leaders could raise money to pay for new tools?

Clean Up (10 minutes)

- Erase student worksheet laminates.
- Put all materials back in Watershed Game Box.
- Stack chairs.
- Fold table and put along wall.
- Erase board.
- Put the Watershed Game Box back in the Kit Room.

Appendices

Glossary

non-point source water pollution - is pollution resulting from many diffuse sources. Non-point source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrological modification (rainfall and snowmelt) where tracing pollution back to a single source is difficult. Sediment and phosphorus are examples of nonpoint source water pollution.

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References

- Minnesota Sea Grant, www.northlandnemo.org/watershedgame.html

Sources

- Minnesota Sea Grant, www.northlandnemo.org/watershedgame.html
- Lake Superior Graphic National Oceanic Atmospheric Association, http://www.glerl.noaa.gov/pr/ourlakes/lakes.html
- Great Lakes Watershed Graphic, "The Geography of North America" http://48ounces.com/?page_id=271