Explore Your Watershed

Rangers in the Classroom—Presentation
Lesson Plan

Grade Level(s): 3rd, 4th, 5th

Setting: Classroom

Duration: 1 hour

Standards Addressed:

3rd Grade
˚ Science—Physical Sciences
1.f,
˚ Science—Investigation & Experimentation
5.a, 5.e
˚ History & Social Science—Community and Change
3.1.1, 3.1.2

4th Grade
˚ Science—Earth Sciences
5.c
˚ Science—Investigation & Experimentation
6.c, 6.f
˚ History & Social Science—Community and Change
4.1.4, 4.1.5

5th Grade
˚ Science—Earth Sciences:
3.a, 3.b, 3.c, 3.d, 3.e
˚ Science—Investigation & Experimentation
6.c, 6.f

Vocabulary:
accumulation, aquifer condensation, conservation, drought, evaporation, filter, ground water, model, non-point pollution, percolate, point pollution, pollutant, precipitation, reservoir, sediments, solution, watershed, water cycle, well

Introduction:

Welcome to the Rangers in the Classroom—Explore Your Watershed presentation. This program introduces students to the concept of a watershed. It provides a framework for understanding the local watershed and how human activity can impact the watershed.

Objective:

After completing this program, 3rd, 4th and 5th grade students will be able to:

1. Explain what a watershed is and how the landscape dictates the watershed boundary.
2. Explore how watersheds work and their value.
3. Describe point and non-point pollution sources and how each impacts a watershed.

Materials:

˚ Laptop (if the classroom is not equipped)
˚ Projector
˚ Extension cord
˚ Power point presentation
˚ Enviroscape watershed model
˚ Cardstock paper (one sheet per student)
˚ Non-permanent markers
˚ Spray bottles (two or three)
˚ Park maps and student fee waivers

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Presentation:

Introduction
Water is life. Every living thing depends on water: people, plants, animals and trees. Water is easy for most of us in this country to get. We turn on the faucet and out comes water. Water covers three quarters of the earth's surface. While it sounds like we have a lot of water, most of our water is in the oceans and ocean water is too salty for us to use. All living things need fresh water. Only about three percent of the water on Earth is fresh water. Since some of that fresh water is frozen in the ice caps and some is too far underground to use, only about one percent of the fresh water on earth is available to us. Therefore, water is limited and precious.

We use water in many ways. Farmers use water to irrigate crops. Ranchers use water for their animals. In our daily lives, we use water for a variety of things including drinking, washing hands, brushing our teeth, cooking, and bathing. We also use water for recreation.

A. The water cycle

1. The earth has a limited amount of water, which keeps going around and around in the water cycle.
2. The cycle is made of a few main parts:
    a. Evaporation
        1. Occurs when the sun heats up water in rivers, lakes or the ocean and turns it into vapor or steam, which rises into the atmosphere.
    b. Condensation
        1. Occurs when water vapor in the air gets cold and changes back into liquid, thus forming clouds.
    c. Precipitation
        1. Occurs when so much water has condensed that the clouds cannot hold any more and the water falls back to earth in the form of rain, hail, sleet or snow.
    d. Accumulation/Collection
        1. When the water falls as precipitation, it may fall on land and soak into the earth becoming ground water or it may fall back into the rivers, lakes or ocean where the cycle starts all over again.

B. What is a watershed?

1. A geographic area of land where all the water drains towards the same destination.
    a. All the water from rain, melting snow or ice drains downhill into a body of water (river, lake reservoir, wetland or ocean) like a funnel.
    b. As the water drains downhill, it carries sediments and other materials to the final destination.
    c. It includes the rivers that convey the water as well as the land surfaces from which water drains.
    d. Each watershed is separated from adjacent watersheds by a geographic barrier, such as a ridge, hill or mountain.
    e. Watersheds come in all shapes and sizes; they cross county, state and national boundaries.

2. John Wesley Powell said that a watershed is "that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."

Watershed Activity

Directions:

1. Pass out one piece of cardstock to each student.
2. Have the students crumble up their sheet of paper into a ball.
3. Have the students partially unfold their paper until it resembles mountains and valleys.
4. Have the students mark the high points with a pencil or crayon. These are the "mountain peaks."
5. Pass out one water-soluable marker to each student.
6. Have the students mark the low points with the water-soluable marker. These are the "valleys."
7. Explain to students how these mountain peaks separate one watershed from another. If water falls on the mountain peak, some water will flow down one side into a watershed and some water will flow down another side and into a different watershed.
8. Ask the students to look at the "mountains" and "valleys" in their watershed and to hypothesize what would happen if it rained in their watershed. Have them think about where the water will flow.
9. Using the spray bottles, gently spray each of the watersheds.
10. Ask the students to observe the direction of water flow and any patterns they observe.

C. Your local watershed

1. Kaweah River drainage—See the outline in blue on an old Tulare county map.
2. It is partially within boundary of Sequoia National Park.
3. Note the North, Marble, Middle, East and South forks of the Kaweah River.
4. Where does your watershed start?
    a. It starts at 12,643 feet in elevation at Triple Divide Peak (divides three separate watersheds: Kaweah, Kern and King).
    b. During the winter, precipitation in the mountains is mostly snow.
        1. Equates to about forty-five inches of rain per year. (One inch of rain = ten inches of snow.)
        2. Compare with the rainfall in Central Valley ~ ten inches per year.
5. All of this water is stored during the winter months and melts in the spring and summer.
6. The volume of water flowing down the Kaweah increases dramatically during the spring run off.
7. Many plants and animals depend on this annual snowpack and spring run-off.
    a. Giant Sequoias
        1. The availability of sufficient soil moisture during the summer growing season is essential for the giant sequoia.
        2. Soil moisture comes from the melting snowpack as there is little rain at this elevation during the summer.
    b. Meadows
        1. An underground layer of bedrock helps keep meadows damp all summer long.
        2. Sequoias will grow near meadows, but not in them because they are

too wet.
c. Animals
1. Animals will migrate to follow the food and water.
2. The tiny salamander absorbs water through its skin; the health of the salamander population is a good indication of the health of the watershed.
d. Plants
1. A variety of wildflowers grow in the watershed.
e. Caves and cave critters
1. Sequoia and Kings Canyon have over two hundred and fifty identified caves.
2. Water formed these caves.
3. These caves are home to unique creatures, some only found in one of these caves.
8. The water flow ends at Lake Kaweah—a reservoir created by Terminus Dam.
a. A reservoir is a human-made place where water is collected and stored.
1. Water from Lake Kaweah is released for crop irrigation during the hot summer months.

D. Water Usage in California
1. Forty-three percent agriculture (crops and animals).
2. Forty-six percent environmental (streams, wetlands, vegetation etc.).
3. Eleven percent urban (home, business, industry etc.).
4. How much water do you use in one day?
a. Bath: Approximately fifty gallons
b. Shower: Approximately two gallons per minute
c. Dishwasher: Approximately seven or more gallons per load
d. Toilet: One and a half to three gallons per flush
e. Teeth brushing with water running: Approximately one gallon per minute
f. Car wash: Approximately fifty gallons per minute
g. Water landscape: Approximately ten gallons per minute
h. Washing clothes: Approximately ten gallons per load

E. Enviroscape Model
1. What is a model?
a. A model is a smaller or simplified version of a system that makes it easier to see how the system operates in the real world.
b. This is a model of a watershed.
1. Point out the various features: residential neighborhood, golf course, farm, lake, rivers, deforested area, etc.
a. Does the model resemble where the students live?
2. Get the students to help set up the “town” on the model.
3. Get the students thinking about their own home, neighborhood and community. Ask them to consider how the actions demonstrated on the model might impact their environment in the “real world.”
4. What can we learn from this model?
a. What kinds of pollution spoil our environment for plants, animals, and

people?
b. How does drought affect people and pollution?
c. What can you do to help decrease water use?
d. What can you do to decrease pollution?

2. What is pollution?
   a. A substance that is dissolved or placed in the environment, such as pesticides, paints, oil, harmful bacteria etc. that is harmful to the air, soil, water, or other natural resources.
   b. Some types of pollution can be seen, smelled or felt; others may be colorless and odorless but still dangerous.
   c. Noise and light are also types of pollution.
3. Two sources of Pollution
   a. Non-Point Source Pollution (NPSP)
      1. A source of water pollution that comes from many diffuse sources, such as excess fertilizers or herbicides from agricultural or residential areas; and oil, grease and other chemicals from urban run-off and energy production.
      2. One cannot determine exactly where the pollution is coming from.
   b. Point Source Pollution (PSP)
      1. Any specific point (factory, pipe, ditch, channel, tunnel, well, etc.) from which pollution is discharged.
      2. One can determine exactly where the pollution is coming from.

ENVIROSCAPE: demonstrate different types of non-point source pollution.

1. Litter
   a. Ask students if they have ever thrown anything out the window of their car or if they have seen other drivers do it.
   b. Pour colored sprinkles around the road to represent litter along a highway.
   c. Pour colored sprinkles anywhere on the model that the students suggest we might find litter.
2. Pet Waste
   a. Ask students if they walk their family dog and if they carry a plastic bag to pick up the doggie waste.
   b. Pour chocolate sprinkles around the neighborhood to represent doggie waste that was not picked up.
3. Loose soil and dust
   a. Ask students if they have ever seen dust blowing outside.
   b. Pour chocolate sprinkles over the farmer's field to represent a field plowed for strawberries, but it is not warm enough to plant yet.
   c. Pour chocolate sprinkles over the bare hilltop to represent an area that was clear cut by a lumber company and was not replanted. The hillside is eroding.
   d. Pour chocolate sprinkles over the bare ground to represent an area that was cleared of most trees to build a shopping center and a parking lot. Unfortunately, the economy isn't looking very good right now. The shopping center is on hold, so the land will just stay bare.
4. Herbicides/Pesticides/Fertilizer

a. Ask students if anyone at home uses fertilizer on the yard or pesticides in the garden. If they live on a farm, ask them to talk about what they grow and what chemicals are used.
b. Pour colored sprinkles on the farm to represent the herbicides used to control weeds, pesticides used to control insects and fertilizer used to promote crop growth.
c. Pour colored sprinkles on the golf course to represent the herbicides used to control weeds, pesticides used to control insects and fertilizer used to promote grass growth.
d. Pour colored sprinkles on the yards in the residential neighborhood to represent the herbicides used to control weeds, pesticides used to control insects and fertilizer used to promote grass growth.
e. Ask the students about the quantities of herbicides, pesticides and fertilizer used in each of these places (i.e. the yard, golf course and farm).
f. Are they justified in their use of these chemicals? (i.e. is having a nice looking yard or golf course as important as growing food?)

5. Oil/Antifreeze/Lubricants/Grease from automobiles
   a. Ask students if they have ever noticed the black and sometimes sticky stains in a parking lot, on the streets or even in their driveway.
   b. Pour sludge (a mixture of cocoa and water) on the parking lot, roads and driveways to represent all the fluids that leak from automobiles in these places.
6. Waste Poured in Storm Drains
   a. Ask students if anyone at home washes their car in the driveway. Ask if they have ever watched where the water flows. It flows toward the open areas in the curb, which are called storm drains.
   b. Storm drains are meant to collect and divert rainwater to avoid flooding. The water from the storm drains flows directly into the local waterway. It does not go to a waste water treatment facility first.
   c. Pour colored sprinkles and/or sludge down a storm drain to represent paint, oil or household chemicals that were dumped there.

ENVIROSCAPE: demonstrate different types of point source pollution.

1. Factory Waste
   a. Ask students if they have ever seen smoke or other pollution being discharged from a business or industry.
   b. Pour sprinkles or sludge into the factory to represent the industrial waste that is sometimes discharged directly into waterways.
   c. Note: we have environmental protection laws that prohibit the direct release of waste into our waterways, but sometimes accidents happen. Some countries do not have environmental protection laws (e.g. China and India). So what?
   d. Encourage the students to consider global connections and how polluted rivers may lead to the oceans that we all share.
2. Accidents
   a. Ask students if they have ever seen or heard about a major oil spill or car accident where waste was scattered all over the road.
   b. Pour colored sprinkles and/or sludge on the road to represent an accident with an

oil tanker where hundreds of gallons of fuel were spilled on the road.

3. What happens when it rains?
    a. In a watershed, all the water flows toward a common destination.
    b. As the water drains, it carries sediments and pollution with it.

ENVIROSCAPE: demonstrate what happens to the pollution when it rains.

1. Rain
    a. Mist the entire model with a spray bottle until there is enough water to see how the rain and the pollutants flow.
    b. Ask the students what they think about what is happening in their watershed model.

F. Drought

a. A drought is a prolonged period of little or no rainfall.
b. It is a normal part of the climate and can happen anywhere. (e.g. Arizona and Maine both experience droughts, even though their climates are very different).
c. Extended periods of drought can have serious impacts on agriculture, city water supplies (health issues), recreation and tourism (economic issues), energy production and the environment.

1. Agriculture—Drought conditions may mean that there is not enough water for crops or for the grass for livestock. If a farmer relies on irrigation, a drought may result in a shortage of water in reservoirs, streams and ground water and irrigation may be restricted.
2. Municipal water—Drought conditions may mean that there is not enough water for watering grass, trees or other plants. Citizens are sometimes asked to conserve water used inside and outside the home during drought conditions.
3. Electricity—Drought conditions may reduce hydroelectric energy production, which could cause the price of energy to go up.
4. Environment—Drought conditions may result in a loss of wetlands, which are home to numerous plants and animals. There may not be enough water for plants to grow, which would affect the animals who eat those plants. A reduction in plant life sometimes causes erosion of the soil.

G. Ways to reduce water pollution and promote water conservation

1. Don't litter. Place all trash in bags and store in a trashcan with a secure lid. Don't throw loose trash into the bed of a pickup. Cover the load.
2. Wash your cars at a commercial carwash that handles waste water properly. Do not wash your car at home on the driveway or other paved surfaces. Waste water from washing your car may contain oil, grease, road grime, and detergents. If you have to wash your car at home, wash it less often and on the grass so the water can soak into the ground.
3. If your family's car is leaking, get if fixed promptly. Recycle waste oil.
4. Don't pour anything down a storm drain.
5. Pick up after your pets; bag it and throw it away in the trash.
6. When your family uses fertilizers and pesticides, use them according to the directions. Do

not over apply and do not apply to paved areas.
7. Compost yard waste (leaves, grass, etc.). Don't blow waste into the street or storm drains.
8. If your family's home is on a septic system, maintain the system according to regulations. (This was not mentioned in the demo.)
9. If watering is allowed outdoors, check the sprinklers often and adjust so only the lawn is watered and not the sidewalk or street.
10. Turn the water off when you shampoo your hair, then turn it back on to rinse.
11. Turn the water off when brushing your teeth. (We all know this one by now.)
12. Use mulch around plants to reduce evaporation.
13. Take short showers instead of baths.
14. Throw trash in a trash can and do not flush it down the toilet.
15. Run the washing machine or dishwasher only when the loads are full.
16. If washing by hand, don't let the water run while washing and rinsing. Fill one sink with wash water and one with rinse water.
16. Solicit other ideas from the students.

A River Runs Through It Activity (20-30 min):

This hands on activity can be used to illustrate both point and non-point source pollution. In addition you will be able to explain the various effects of water pollution and how communities located near bodies of water can determine the impact they have on local watersheds. Explain the effects decision making can have on other communities located down stream and eventually at the mouth or delta where river water is discharged.

*Note: This activity is designed to be outside, but can be done in the classroom by replacing nature props with pencils, crayons, erasers, etc.

1.) Use a long piece of rope or string 20-30 ft. in length as your simulated "river."
2.) Lay rope on ground to reflect the lay of a river and explain that students will be put into groups along the "river."
3.) Break student into groups of 3-4 and designate each group to be in charge of constructing a business along the river front property.
4.) In sequential order starting at the top of the river's headwaters or "mountains," explain that the first group will construct a ski resort. Next, heading "downriver" will be a gas station, restaurant, car wash, farm and at the end a community park.
5.) Each group will have 5-10 minutes to gather natural materials e.g., pine cones, bark, leaves, etc. to construct their mini-business along the river.
6.) Facilitator will use poker chips or some other material to represent "pollution" or "pollution chips" that will be dispersed among the businesses according to the level of contaminants each business releases into the river.
7.) Following a discussion of each business practice, allow students a few minutes to revamp their business to be river friendly or eco-friendly. Collect a few poker chips from each group to reflect a reduction in pollution levels.

8.) Discuss what changes were made by each group to reduce their impact on river health. Relate activity to real life river practices and conservation efforts. Draw connection to local Sierra Nevada river headwaters, communities and the san Joaquin Valley.

Conclusion

Water is a limited and precious resource. There are hundreds of ways to conserve water and reduce water pollution. Challenge the students to find ways in their own school and homes to accomplish better stewardship of the water resources in their community. Invite the students to visit Sequoia and Kings Canyon National Parks with the fee waivers provided. Encourage them to share what they have learned with their families.

Vocabulary

Accumulation—noun—the water that falls to the earth collects both above and below the surface of the ground

Aquifer—noun—a layer of permeable rock or sand beneath the surface that holds large amounts of water

Condensation—noun—the process by which water vapor changes to a liquid

Conservation—noun—the act of saving or protecting any type of matter from loss or waste; preservation

Drought—noun—a prolonged period of little or no rainfall

Evaporation—noun— the process by which water becomes vapor or gas

Filter—noun— a material that is used to remove impurities or suspended particles from a mixture. In nature, it is a layer of soil, sand and porous rock material through which the water percolates

Ground water—noun— water that collects in rock layers below the surface of the ground

Solution—noun— a mixture in which a substance, solid, liquid or a gas is dissolved

Watershed—noun—the region or area drained by a river, stream etc

Water cycle—noun—a process whereby the earth's water is moved by the energy from the sun and the force of gravity through a cycle of evaporation, condensation, precipitation and accumulation

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Model—noun—a simplified representation of a system or phenomenon

Nonpoint source pollution—noun—a source of water pollution that comes from many diffuse sources, such as excess fertilizers or herbicides from agricultural or residential areas; and oil, grease and other chemicals from urban run-off and energy production

Percolate—verb—the movement of water through the various layers of soil, sand and rock material

Point source pollution—noun—any specific point (pipe, ditch, channel, tunnel, well, vessel etc.) from which pollution is discharged

Pollutant—noun—a substance that is dissolved or placed in the environment, such as pesticides, paints, oil, harmful bacteria etc. that renders the air, soil, water or other natural resource unsuitable for a specific purpose

Precipitation— a process whereby the products of condensation (water, snow, hail) in the atmosphere fall to the ground

Reservoir—noun—a natural or artificial place where water is collected and stored for use

Sediment—noun—the matter that settles to the bottom of a liquid

Watershed—noun—the region or area drained by a river, stream etc

Water cycle—noun—a process whereby the earth's water is moved by the energy from the sun and the force of gravity through a cycle of evaporation, condensation, precipitation and accumulation

Well—noun—hole in the ground from which ground water may be pumped to the surface