DROPS OF KNOWLEDGE FOR RIVERS OF CHANGE

GLOBAL TEACHING AND LEARNING MATERIAL

A hands-on guide to teaching
and learning about
water, sanitation, hygiene,
and the environment

SWAROVSKI
WATERSCHOOL

GLOBAL VERSION / MODULE 7

BACKGROUND INFORMATION

Biomes are regions defined by their climate type, plants, and animals. Forest, tundra, aquatic, grassland, and desert are some examples of biomes around the world. Scientists classify biomes in different ways, but the most important way is by a region's distinguishing features – its climate, flora, and fauna. As with all of the Earth's beings, the biomes depend on water and allow only the particular types of life that are adapted to survive within them.

Different countries have different biomes, but they are all connected to each other, and any change in one biome will affect another. For instance, changes in the Andes Mountains in South America have an impact on the forests in the Amazon. Changes in the Sahara Desert have an impact on the forests in Central Africa. At the same time, changes in the Indian and Pacific Oceans have an impact on the tropical forests in Asia.

In each biome, water plays a vital role by supporting life and connecting ecosystems. Aquatic biomes, for example, are represented by marine and freshwater regions. Considering marine biomes, oceans are the largest and most diverse of the ecosystems. Salt water coming from the oceans evaporates and turns to rain, which falls on the land regions, sometimes in forests, sometimes in grasslands, sometimes in tundras. At the same time, freshwater regions are the most important sources of freshwater for drinking, and include lakes, ponds, streams, and rivers around the world. They are crucial to our existence on Earth, and only a very small part of all water on this planet is freshwater.

DID YOU KNOW? Around 30% of the world's freshwater is stored underground in the form of groundwater (in shallow and deep groundwater basins up to 2,000 meters below the surface, and as soil moisture, swamp water, and permafrost). This constitutes about 97% of all the freshwater that is potentially available for human use

SOURCE: United Nations Environment Programme, "Global Water Resources," August 2006 [Adapted from: UNEP (2002). "Vital Water Graphics: An Overview of the State of the World's Fresh and Marine Waters," http://new.unep.org/dewa/vitalwater/index.html]

Freshwater is not only on the surface: sometimes it is in the atmosphere, crossing different biomes and different countries. The "flying rivers" phenomenon in South America, for example, brings water vapor from the Amazon in Brazil, in the equatorial zone, to Argentina, in the temperate zone. The humidity carried by these flying rivers is responsible for much of the rain that falls in the south and southeast of Brazil, in places like

São Paulo and Rio de Janeiro, which are thousands of kilometers from the Amazon.

Rivers also run underground in aquifers, the reservoirs for groundwater. Aquifers fill with water from rain or from melted snow that drains into the ground. Wells drilled into them provide water for drinking, agriculture, and industry. Conserving our biomes and our biodiversity, therefore, is crucial for the water and for our quality for life.

WATER TESTING, SWS BRAZIL

"Protect the Earth for children. We must safeguard our natural environment, with its diversity of life, its beauty and its resources, all of which enhance the quality of life, for present and future generations. We will give every assistance to protect children and minimize the impact of natural disasters and environmental degradation on them."

— UNITED NATIONS, A WORLD FIT FOR CHILDREN[34]

34 United Nations, "Resolution Adopted by the General Assembly: A World Fit for Children," New York, October 11, 2002, A/RES/S-27/2, paragraph 7, section 10. Available at: www.unicef.org/specialsession/wffc.

THEMATIC CONCEPTS

Underground water – A large part of the available freshwater in the world is stored in underground aquifers, which provide 50% of all drinking water, 40% of industrial water, and 20% of water for irrigation. [35]

Ecosystems – An ecosystem approach integrates the management of water, the associated land, and living resources in a way that maintains ecosystem health and productivity, in balance with sustainable water use by humans. [36]

Watershed – Watersheds supply drinking water, provide recreation, and sustain life. A watershed approach involving all stakeholders is essential to address today's water resource challenges. [37]

ACTIVITY 7.1: THE SOIL FILTER (WATER AND SOIL) (Adapted from Swarovski Waterschool Austria)

Good-quality soil is essential for plant growth, the recycling of dead materials, regulating and filtering water flow, supporting buildings and roads, and providing habitats for many plants and animals. Healthy soil provides us with food and filters our water.

An ecosystem can be disturbed by natural disasters (hurricane or drought) or human causes such as roadways and other construction, and by the use of pesticides and other chemicals. When we mismanage, pollute, or overexploit our land, we cause a disruption of the ecosystem that affects the land's fertility and healthy production capacity.

35 WBCSD, "Facts and Trends: Water," Geneva: World Business Council for Sustainable Development, 2006, p. 1. Open PDF from: www.unwater.org/downloads/Water_facts_and_trends.pdf. **36** UNEP, Water Security and Ecosystem Services: The Critical Connection, Nairobi: United Nations Environment Programme, March 2009. Open PDF from: http://www.unepdhi.org/publications. **37** EPA, "A Watershed Approach," Washington, DC: U.S. Environmental Protection Agency, September 12, 2013, http://water.epa.gov/type/watersheds/approach.cfm.

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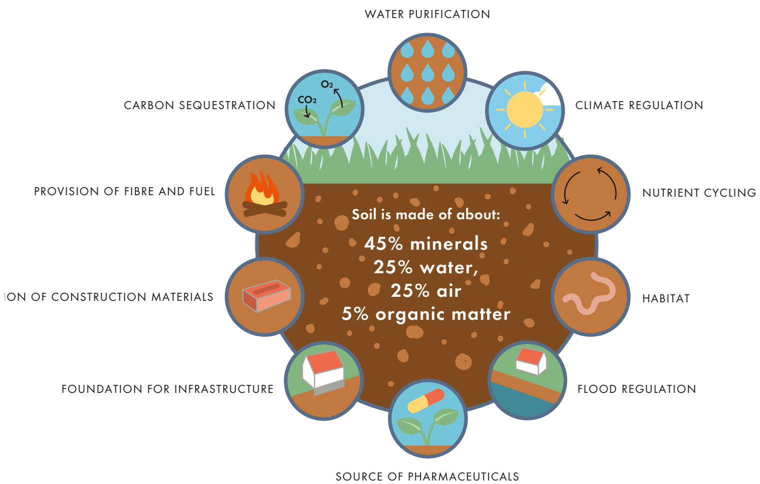
"Information about climate is fundamental to an assessment of the land's capability and suitability for various kinds of use. Areas of uniform climate are also used to identify ecosystem units because climate acts as the primary input of energy and moisture into the system. As the climate changes, the kinds and patterns of dominant life forms of plants and animals change, as do the kinds of soils."

— ROBERT G. BAILEY[38]

38 Bailey, Robert G., "Ecological Climate Classification," USDA Forest Service, Inventory & Monitoring Institute, November 21, 2003, p. 1.

The simple experiment in this activity is designed to promote students' understanding of water in the Earth and stimulate discussion on aquifers. Before beginning the activity, prepare the students by discussing the following questions: When water flows across roads, paths, or other surfaces, the dirt and debris it picks up are often clearly visible. Rainwater will also contain various pollutants that we cannot see, such as fertilizers from agriculture. How can it be that we still find clean water? Why can you drink spring water that gushes out of the ground? How does rainwater become clean in a natural system?



Source: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/oh/soils/health/?cid=stelprdb1143889
http://www.fao.org/soils-2015/en/

Time: 30 minutes / **Thematic Areas:** Science, Mathematics / **Goal for Learning:** Gain an understanding of how water sinks through the various layers of soil and is filtered and cleaned in the process; become aware of the natural purification system of the soil and the fact that the cleansing effect can decrease with heavy contamination.

Materials: ☐ 1 plastic cup sized a half-liter (2 cups), plus 2 transparent cups of a quarter-liter (1-cup) size / ☐ Small knife or scissors / ☐ Drinking straw / ☐ Glue or caulk applicator, duct tape or packing tape / ☐ Clean gravel, sand, soil, and moss / ☐ 1 shallow bowl / ☐ Ink, washing-up liquid, salt, coffee, oil, etc. ("contaminants") / ☐ 1 gallon of water, or running water, if available from a tap

WATER FILTER ACTIVITY, SWS BRAZIL

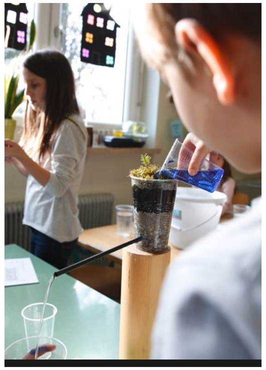
ACTIVITY STEPS:

1. Take the larger plastic cup and make a small hole in the side toward the bottom with a knife or scissors. The hole should be big enough that the straw fits in well.

2. Stick the straw halfway into the cup so that one end sits in the center of the bottom of the cup. Then glue or caulk the edges around the straw, on the inside and outside of the cup, so the straw is secure and watertight.

3. Add a layer of gravel in the bottom of the cup, making sure it covers the straw, then add layers of sand and soil, placing the moss on top.

SOIL FILTRATION ACTIVITY, SWS AUSTRIA



SOIL FILTER,
SWS AUSTRIA

4 Put the cup on a platform, such as a block of wood or a sturdy cardboard box, and place the shallow bowl under the end of the straw.

5 Pour clean water from one of the smaller cups into the larger cup (the "filter") and watch the water sink. Discover how groundwater reaches the bottom of the cup, then flows out of the straw like a spring.

6 Now, test the function of the soil filter by making a mixture of "contaminants" and water in one of the smaller cups. Pour a portion of contaminated water into the soil filter and observe whether it is possible to purify the water in this way. Compare the appearance and smell of the water that has flowed through the soil filter with the remaining contaminated water in the cup. Note that a similar process happens with aquifers (underground water), and that there is clean water in the soil that we can extract and use in our daily life.

OBSERVATION AND DISCUSSION:

After the first filtering of the contaminated water, pour the water from the shallow bowl back into a cup. Then pour the purified water from the shallow bowl repeatedly through the soil filter. Does the water get cleaner and clearer each time it goes through the cycle? Or is there a point where the filter is not as effective?

Even if the filtered water looks clean and clear, beware! It still may not be safe to drink.

ADDITIONAL RESOURCES:

Dr. Dirt K–12 Teaching Resources, "Soil Is a Filter," www.doctordirt.org/teachingresources/soilfilter

Oregon Agriculture in the Classroom Foundation, http://AITC.oregonstate.edu

Play with Water, "Introduction into the Water Cycle," Coordinated by the University of Applied Sciences Zurich, https://www.zhaw.ch/de/lsfm/dienstleistung/nachwuchsfoerderung-angebote-fuer-schulen/play-with-water/cleaning-water-with-plants/introduction-into-the-water-cycle/

Soil Science Society of America, "Soil Experiments and Hands-On Projects," www.soils4kids.org/experiments

SWS BRAZIL

DID YOU KNOW? On the Earth today, there is just as much water as when the planet was formed. There is no water lost; everything remains in the circuit.

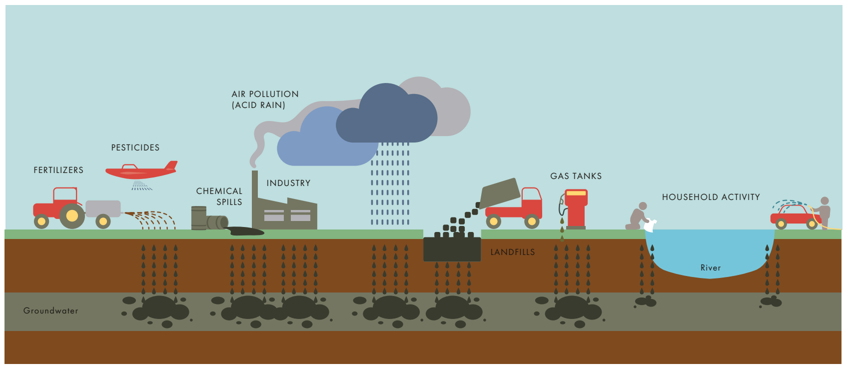
The distribution of water volumes, however, is unequal geographically and seasonally. For example, the groundwater level near a river rises and falls as the water level in the river becomes higher in rainy seasons and lower during dry seasons.

SOURCES: Lenntech, Water Facts and Trivia, http://www.lenntech.com/water-trivia-facts.htm, US Geological Survey's Water Science School, The Watercycle: Freshwater Storage, May 2016 http://water.usgs.gov/edu/watercyclefreshstorage.html

ACTIVITY 7.2: HOW WATER IS STORED AND DISTRIBUTED UNDERGROUND

The term "groundwaters" has been internationally defined as "the hydrologic system composed of a number of different components through which water flows, both on and under the surface of the land. These components include rivers, lakes, aquifers, glaciers, reservoirs and canals. So long as these components are interrelated with one another, they form part of the watercourse."[39]

Part of the available freshwater in the world is stored in underground aquifers. Communities all around the world rely on aquifers for access to drinking water, demonstrating the necessity of protecting these sources of water on Earth. This activity is designed to illustrate how water is stored in an aquifer, how groundwater can become contaminated, and how this contamination can end up in a drinking-water source.



Source: http://www.groundwater.org/get-informed/groundwater/contamination.html

Time: 20 minutes / **Thematic Areas:** Science, Geography / **Goal for Learning:** Gain a clear understanding of how careless use and disposal of harmful contaminants above the ground can lead to them ending up in the drinking water below the ground.

39 UN Watercourses Convention Online User's Guide, "Article 2: 2.14 Groundwater," Scotland: Centre for Water Law, Policy and Science, University of Dundee, 2015, www.unwatercoursesconvention.org/the-convention/part-i-scope/article-2-use-of-terms/2-1-4-groundwater.

Materials: ☐ 1 clear plastic cup 7 centimeters deep × 8.25 centimeters wide (2.75×3.25 inches) / ☐ Sand, enough to cover the bottom of the cup with a layer around 0.6 centimeters (1/4 inch) deep / ☐ 1 bucket of clean water and a small cup for dipping water from the bucket / ☐ Clay, enough to make a flat circle about 5 centimeters (2 inches) around / ☐ Approximately ½ cup of gravel (not artificially colored) or small pebbles / ☐ Red food coloring

ACTIVITY STEPS:

1. Pour the sand into the cup, completely covering the bottom. Pour water into the sand, wetting and mixing it in completely (there should be no standing water on top of the sand). Observe how the water is mixed around the sand, but is not absorbed into the sand particles, just as it would be in the ground.

2. Flatten the clay like a pancake and cover half of the sand with the clay, pressing closely to seal off one side of the cup. The clay represents a "confining layer" that keeps the water from passing through it. Pour a small amount of water onto the clay and observe that the water flows into the sand below only where the clay does not cover the sand.

3. Use the gravel or pebbles to form the next layer of earth. Place the gravel over the sand and clay, covering them entirely. Slope the gravel on one side of the cup to form a high "hill" and a "valley." Then observe that these layers represent some of the many layers in the Earth's surface.

4. Pour water into the "aquifer" until the water level in the valley is even with the top of the hill. You will see the water stored around the gravel. These rocks are porous, allowing storage of water within the pores and openings between them. Notice that a surface supply of water (a small lake) has formed. You are now able to see surface and ground water supplies, both of which can be used for drinking water.

5. Put a few drops of food coloring on top of the gravel hill as close to the inside wall of the cup as possible. Observe the passage of the color not only into the rocks, but also into the surface water and into the sand below. This shows one way that pollution can spread through an aquifer over time,

demonstrating, for example, how when people use old wells or surface areas to dispose of chemicals, trash, or used motor oils, it can impact the drinking water below

OBSERVATION AND DISCUSSION:
Learn about and discuss as a group other traditional ways of finding water.

Look into what happens when too much water is taken out of aquifers. Think about the household chemicals that are used in your home and talk about how to keep the groundwater clean in your area.

Take note of the more protected layer beneath the clay in your cup and how a deeper well might be able to access a cleaner source of water.

ADDITIONAL RESOURCES:

Groundwater Foundation, www.groundwater.org

Vital Water Graphics, United Nations Environment Programme, http://new.unep.org/dewa/vitalwater/index.html

Worldwatch Institute, www.worldwatch.org

> "Approximately 40 percent of the world's population lives in river and lake basins that comprise two or more countries, and perhaps even more significantly, over 90 percent lives in countries that share basins."
>
> — UN WATER[40]

40 Task Force on Transboundary Waters, "Transboundary Waters: Sharing Benefits, Sharing Responsibilities," Zaragoza, Spain: United Nations Office to Support the International Decade for Action "Water for Life" 2005-2015, 2008, p. 1

ACTIVITY 7.3: EXPLORING YOUR RIVER – WATERWAY MAPPING AND HABITAT ASSESSMENT (Adapted from Swarovski Waterschool China)

As a main source of freshwater on Earth, the river network not only nourishes the land on which human civilizations are developed, but also plays a significant role in the evolution of the ecosystem. A river provides a habitat for the many plants, animals, and organisms that utilize water and nutrition from the river and produce "waste" for other organisms to use. Organisms in a "healthy" river can absorb excessive organic matter to clean the water. They are also part of food chains through which energy and nutrition can be fully used through the cycle of the system. As vessels of the biosphere, the rivers in a network also transfer water and nutrition to other freshwater biomes such as lakes, ponds, deltas, wetlands, and grasslands through on-the-ground and underground channels.

Human activities are changing the natural landscape. In rural areas, water withdrawal and pollution caused by agriculture, domestic usage, and industry are changing the water quantity and quality of rivers. In cities, issues of water shortages and pollution are even more serious. Artificial rivers such as canals and waterway transformation projects are radically different from rivers in nature, but they can still support life within or alongside them.

STUDENTS EXPLORING THEIR RIVER, SWS CHINA

A river is not merely running water: it is a delicate system in which water, environment, and all kinds of organisms interactively support each other. How are rivers in nature, villages, and urban areas supporting human activities and other living things? What kinds of plants, animals, insects, and other organisms live in the river ecosystem? What are the criteria and indicators to measure whether a river is healthy or not? This activity allows students to explore a selected river near their school, so they can learn by themselves and find answers of their own. The suggested age for this activity is 12–18 years old.

Time: 90 minutes / **Thematic Areas:** Geography, Environmental Education / **Goal for Learning:** Enhance students' awareness of the interrelatedness of the life-support system of rivers to humans and other species, and therefore promote understanding of the importance of conserving river ecosystems.

Materials: ☐ Map of the area where the activity will be performed / ☐ Gloves / ☐ Checklist and pens or pencils to record observations (see Step 3 below) / ☐ Bottles (to hold water samples) / ☐ Magnifying glass / ☐ Poster board or cardboard / ☐ Colored pencils or markers

ACTIVITY STEPS:

1 SELECTING THE SITE: Before beginning the activity, teachers should select a small section of a river, stream, or creek near the school or neighboring community as the site for observation, water sample collection, and measurement. When choosing a site, consult with a local administrative department to make sure the area is safe.

The site should be an open area where students can safely get access to the water. The riverbank at the selected site should not be too steep, and a site with trails going from the bank to the water edge is preferred.

WATER QUALITY TESTING, SWS CHINA

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2 GENERAL INVESTIGATION: Using an amplified map of the area, students should investigate the stream and surrounding land and note locations and information on: > the patterns of land use, such as farming, grassland, uncultivated land, or forest > possible pollution sources, such as industry, factories, and wastewater outlets > environmental problems, such as soil erosion or littering > landmarks, including roads, drains, buildings, fences, and bridges

3 STREAM HABITAT ASSESSMENT: Stream habitats include the aquatic zone (the habitat found in the water) and the riparian zone (the habitat around the water). These zones are related to each other. Students should examine these zones and note the characteristics of different areas and types of vegetation and small animals found in specific areas, filling out a checklist similar to the one below.

Zone	Area type	Characteristics	Vegetation	Animals
Aquatic	Ripples	Shallow, rock or gravel ...		
	Pools	Deeper areas, slow-flowing water ...		
	Runs	Deeper than ripples and faster than pools ...		
Riparian	Top of bank			
	Face of bank			
	Sandbar zone			
	Toe of bank			

Students can collect water samples from different sites in the same watershed areas and compare them using a magnifying glass. They can record the findings from each of the places and compare the sediment concentration and other properties of the samples. If time permits, the students can draw conclusions relating to comparison of the samples with the local environment from which the samples were collected.

4 Observing the stream: Students should choose a site to take notes for one hour during a day or over a few days about the activities on or near this water resource. They should make a detailed list of how the water is used, by whom, and for what reasons.

5 Mapping the stream: Mapping involves drawing a detailed sketch of the site area, showing all the important features that affect the habitat or water quality. Use different colors and symbols to add information the students have collected through the investigation and habitat assessment to a basic map of the area. Ask the students to point out locations where they made the habitat assessment and recorded water usage activities. When these maps and lists are finished, display them in the classroom and discuss them

Optional Extension:

6 Additional physical-chemical assessments could be made, according to the students' course schedule and capabilities, and conditions at the observation sites. By measuring water temperature, depth, flow rate, and quality, students will gain a comprehensive understanding of how these factors are affected by and influence the riverbank's structure, including rocks, soil, and vegetation.

Regular monitoring of the biological, physical, and chemical changes at the site could be carried out so that students will see how supportive or destructive changes in one element or several affect the waterway and surrounding vegetation. The students' monitoring results can be used to generate conservation actions to protect the health of the stream.

OBSERVATION AND DISCUSSION:

What kinds of vegetation and animals live in the different zones of river habitats?

How do these various organisms utilize water resources? What supportive and destructive effects are they facing in their survival? How do you think these organisms have developed to adapt to their environment?

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How do humans directly or indirectly utilize the water resources? How did artificial construction change the river habitat?

What criteria do you think could be used to determine if the river is healthy or not? Do human activities positively or negatively influence the health of the river?

ADDITIONAL RESOURCES:

Southwest Florida Water Monitoring District, "Water Quality Monitoring," www.swfwmd.state.fl.us/education/kids/watermonitoring

U.S. Environmental Protection Agency, "World Water Monitoring Day," water.epa.gov/type/rsl/monitoring/monitoringmonth.cfm

"This activity made me realize that all the components in the ecosystem are interconnected. I planted trees in my school and also the village because they purify air and give out oxygen."

— STUDENT, AGE 12, SWAROVSKI WATERSCHOOL INDIA

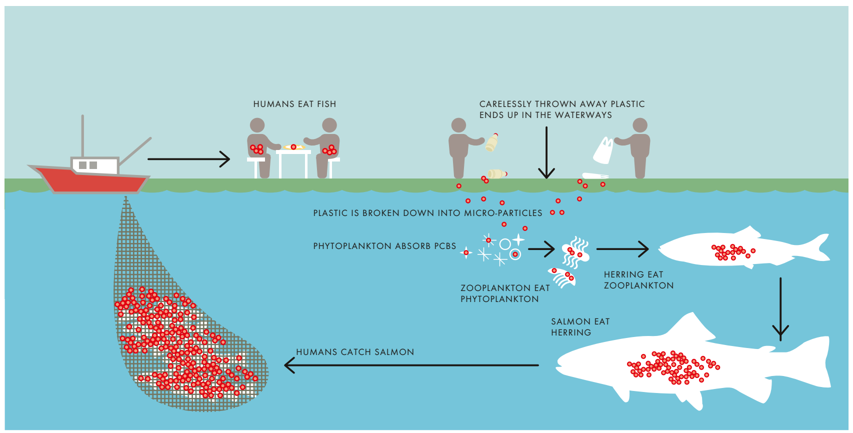
SWS INDIA

ACTIVITY 7.4: ECOSYSTEMS – THE WEB OF LIFE (Adapted from Swarovski Waterschool India)

Ecosystems are complex and interactive "neighborhoods" that are in place in many different climates and types of terrains or zones on our planet. Within a given ecosystem, the many different forms of life are dependent upon one another within the circle of life. In this case, all living things (plants and animals) are dependent upon water and other Earth elements for food webs and habitat formation. In India, the Swarovski Waterschool led by WWF refers to this complex system of give and take as a "holon"—a concept that is related to the theories of Professor Arthur Koestler and Nobel Laureate Herbert Simon.

This activity is designed to promote students' understanding of the meaning of "ecosystem." They will learn how to illustrate an interdependent system of life and discover ways to analyze a conflict occurring in nature by using the ecosystem model. This activity is ideal for students ages 10–18. The first part is a drawing session, and the second part is a role-play.

Time: 90 minutes / **Thematic Areas:** Ecology, Science / **Goal for Learning:** Gain the ability to express the characteristics of ecosystems as interdependent systems of life.



Source: http://www.ecy.wa.gov/programs/hwtr/RTT/pbt/

PART 1: Drawing and discussion on ecosystems (50 minutes)

Materials: ☐ Student workbooks / ☐ Colored pencils or markers / ☐ Flip chart paper / ☐ Rope (long enough for each person in the group to hold it at the same time)

ACTIVITY STEPS:

1 Divide students into groups of four or five and let each group pick a different theme for their ecosystem such as a mountain, river, forest, village, etc. Have them include the various characteristics like human beings, animals, plants, water, or the sun.

2 Let them draw and write about the ecosystem on a sheet of the flip chart paper, noting all the other aspects that are associated with their particular theme. They should be encouraged to include all the components of the ecosystem, whether big or small, and show how they are connected.

3 After 10 minutes, ask the groups to present their work and discuss it with the other groups. Ask them to describe their experience making the chart and what it meant for them.

4 Review the characteristics and structure of ecosystems, using the drawings they have produced and explaining connections and dependence between components.

DID YOU KNOW? Every part of the world, including each country, is divided into different ecological climate classifications, or "ecoclimatic" zones.

These zones are based on many factors, including short-term weather patterns, climate (the prevailing weather conditions over a long period of time), and examinations of vegetation within a particular ecosystem.

SOURCES: Bailey, Robert G., "Ecological Climate Classification," USDA Forest Service, Inventory & Monitoring Institute, November 21, 2003, p. 1.

PART 2: Web of life role-play (40 minutes)

Materials: none

ACTIVITY STEPS:

1. Ask the students to form a circle, and designate a name for each student based on an ecosystem component: for example, sun, grass, water, bird, fish, rabbit, tiger, vulture, gorilla, human, and so on.

2. Ask the "sun" to hold one end of the rope, then pass the rope along the different components (students) in order of their position in the food chain. Ensure the rope is held taut.

3. Once all students are holding the rope and the "web" they have created is complete, ask one of the components to step away. Gradually ask other students representing different points on the web to step away until only a few remain.

4. Examine the condition of the web at this point. Ask the students what they observe. Is the rope still held up? Explain how this relates to the concept of interconnectedness in biodiversity and within a biome (or ecosystem).

5. Facilitate a brainstorming discussion to talk about which points affected others, why this happens, and what students can do to prevent the web of life (ecosystem) from being damaged. Observations might include: "Even the smallest components have utility, and all the components are impacted by one another."

OBSERVATION AND DISCUSSION:

Explore other examples of ecosystems in our daily lives, their components, and whether they are part of other ecosystems. What are the kinds of cooperation or conflict that we observe within and across ecosystems?

What is the relevance of this session to our local community? Ask students to note down their thoughts and feelings in their workbooks.

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ADDITIONAL RESOURCES:

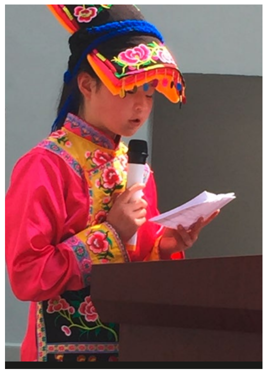
American Association for the Advancement of Science, "Chapter 5: The Living Environment," Science for All Americans Online, 1990, www.project2061.org/publications/sfaa/online/chap5.htm

Barrow, Mandy, "Food Chains," Primary Homework Help, www.primaryhomeworkhelp.co.uk/foodchains.htm

National Center for Ecological Analysis and Synthesis, "World Biomes: Freshwater," 2004, http://kids.nceas.ucsb.edu/biomes/freshwater.html

Shah, Anup, "Why Is Biodiversity Important? Who Cares?," Global Issues, January 19, 2014, www.globalissues.org/article/170/why-is-biodiversity-important-who-cares

CASE STUDY: COMMUNITY PROJECT, BAZHU RIVER, CHINA



STUDENT GIVING A SPEECH ON WATER PROTECTION, SWS CHINA

The Bazhu River is a tributary of the upper reaches of the Yangtze River in Yunnan Province, and is the primary source of water for drinking and agriculture for the Tibetan village of Bazhu. There is a strong connection between the local community and the watershed: indigenous knowledge, traditional practices, and cultural values play an important role relating to water conservation. For this reason, teachers and students have been very successful in their community outreach work, and have collaborated on activities such as a river cleanup and the development of eco-friendly livelihoods.

In 2013, a Bazhu conservation team was established with three staff from the Shangri-la Institute for Sustainable Communities and six local villagers to implement watershed monitoring and protection activities. The team chose to focus on investigating the seasonal changes and impact of human activities on the Bazhu River, as well as on learning about the significance of the local forest in conserving Bazhu's water resources.

During the months of September and October, a team of 13 people completed GPS mapping of the entire Bazhu River watershed. They discovered the watershed includes 23 sources, four branches, and around 30 sub-branches of the Bazhu River, as well as eight mountains and two water sources that are regarded as sacred.

A three-day workshop introducing information about the river's watershed was organized at the Bazhu Community Learning Center for about 40 participants from 21 villages in the Community Nature Reserve. Sustainable development from the perspective of Tibetan traditional culture was also discussed with participants during the workshop.

Taking into account the villagers' use of fertilizers at the beginning of April each year, as well as the burning of incense and other traditional religious activities that may affect the environment, the research team will continue to monitor quarterly changes in water quality. Data collected will be publicly posted and events will be held to raise local villagers' awareness of the effect of their daily behavior on local water resources.

WATER TESTING, SWS CHINA

TRADITIONAL PAINTINGS ON WATER, SWS CHINA

RIVER RESEARCH, SWS CHINA

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