A Guide to the Environment

Conservation Champions

Patch Program and Guided Activities

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How to use this Guide

Environmental Science is a rapidly expanding discipline in the sciences. It focuses on combing aspects of biology, chemistry, ecology, engineering, and physics to study and solve real world problems surrounding the environment. The **environment** includes all of the physical and biological factors which interact with individual organisms or whole communities. Humans are a part of the environment, and like any other factor, can change the environment by our behavior. The environment is a fluid, ever changing series of relationships.

Every day, things you do impact the world around you. It is important to understand how choices we make today can affect how the world looks tomorrow. Girl Scouts supports good stewardship practices, meaning we leave the world a better place than we found it. This guide is designed to help you learn more about the environment, and human interactions with the environment, so that you can better understand the consequences of our choices.

At the beginning of this booklet, you can find information about the patch: Conservation Champions. The patch was designed to help girls explore contemporary environmental issues, particularly those of significance to Florida. Following the patch requirements are labs that can be completed to help complete a patch requirement. Not all labs in this booklet must be completed, however, a wide variety have been offered for various age levels and subjects to customize the experience to better fit the girls' interest. Each lab activity will present a scientific concept in the introduction, provide a materials list, directions on how to complete the activity, followed by suggested discussion questions and follow up resources for the girls to look at if they are interested in learning more. In a column on the left side of each lab, the general subject of the lab, predicted time to complete, and suggested age levels are listed as a guide.

The labs included are not a required portion of the patch, but are meant to assist and provide inspiration. All activities in this booklet can be completed in the Marine Biology lab located at Camp Wai Lani. The lab is an excellent council resource which is open for troops to use.

This guide book, patch, and all lab activities were developed and written by Courtney Clark as an Honor's Thesis Project at the University of South Florida.

If you have any questions, please contact GSWCF.
http://www.gswcf.org/

Patch Program

Introduction

Girl Scouts of the USA is dedicated to building girls of courage, confidence, and character, who make the world a better place. Environmental stewardship and wildlife conservation education inspires girls to take leadership in their communities to promote a better world. The purpose of the Conservation Champions patch is to encourage girls to explore how learning about the environment can help them:

- Develop leadership skills they can use now and in the future
- Explore Careers
- Discover how their actions can impact the planet
- Learn how to identify and solve problems in their community.

Program Requirements

This patch program is designed for Girl Scout Brownies, Juniors, Cadettes, Seniors, and Ambassadors. Girls should choose at least one activity from each category (Discover, Connect, Take Action) and a minimum of two starred (*) activities. Below are the numbers of activities required to be completed by each age level:

Brownies……..at least 5 activities	Cadettes…..…….at least 7 activities
Juniors……...at least 6 activities	Seniors/Ambassadors…..at least 8 activities

Discover

A. *****Learn about Florida's state animal. What is it? Where does it live? What does it eat?

B. *****What is the difference between a native and a non-native species? What is an invasive species? Learn about some invasive species and what government and non-profit organizations are doing to address the issue.

C. Energy is a very important resource. What do you use every day that requires energy? Research 3 major sources of energy. What are their impacts on the environment? What does your local area use for its energy?

D. Did you know that less than 3% of Earth's water can be used by humans? Learn about water resources. Where does your drinking water come from? What is the water cycle? How do human actions impact earth's water supply?

E. Scientists are always coming up with new ways to help the environment. Discuss with your troop different ways you can reduce, reuse, and recycle. Discuss at least 3 recent inventions that have made the world more environment friendly. Make a plan to be more environmentally friendly at home.

F. Explore air pollution. What is the major human source of air pollution? What are natural causes of air pollution? What are some ways to reduce air pollution?

G. Florida has a wide variety of habitats, but one of the most unique to our region is mangroves. Learn about the different types of mangroves and how to identify them. Find out what types of animals live in or around mangroves.

H. Conservation may be important for the environment, but it is also important for the economy. Learn how ecotourism impacts Florida's economy. Contact a local business that encourages ecotourism and find out what they offer, when they are open, how they attract business, and what they contribute to the community.

I. *****Investigate the 1972 Clean Water Act. Why was it so important? What did it do? How has it changed US public policy?

Connect

A. *****Sleepover at Busch Gardens or Sea World! Pick an educational track and learn about the animals in the park, conservation efforts and possible careers. (Council events may be offered)
B. Design a house that is environmentally friendly. Draw pictures showing the new features you would add and explain how they help the environment.
C. Interview an environmentalist, marine biologist, or park/camp ranger on their career. What type of education would you need? What kind of opportunities are available to women?
D. Go on a nature hike with your troop. Walk around a park or a Girl Scout camp. Pay attention to the plants, animals, and trees. Sketch pictures of any flowers you see. After the hike, try to identify the flowers you sketched.
E. *****Take a trip down a river exploring native Floridian flora and fauna. See how many different species you can see and identify while canoeing or kayaking.
F. Tour a Water Treatment Facility. Learn more about what happens to your waste and the importance of conserving resources.
G. *****Participate in a "Coastal Trekkers" event: explore Fort De Soto on a guided expedition, learning about marine life and the role they play in their habitats.
H. Explore the girls' only section on Girl Scouts of the USA website where you can connect online. Find out about Girl Scout Legacy Naturalist badges, post photos, play environment related games and quizzes, watch videos and hear stories at forgirls.girlscouts.org/

Take Action

A. *****Participate in a Beach Clean-Up day in your community. Take the pledge to turn the tide on ocean trash and support healthy oceans. (See resources to find one near you!)
B. Grow a garden/window box. Research native Florida plants. Talk to a specialist at your local home improvement store or nursery about including plants that conserve water.
C. Learn about the history of conservation and our national parks. What is the difference between conservation and preservation? Stage a debate, presenting arguments on both sides of the issue.
D. *****Volunteer with a group of younger children to teach them about environmental stewardship. Talk about the importance of protecting the environment and give suggestions on how they can help.
E. Hold an event at a community park. Incorporate activities which feature what you have learned about the environment and the importance of conservation.
F. Write an editorial about the importance of environmental stewardship. Print it in your school or local newspaper.
G. Invent something that can help reduce pollution or protect natural habitats. Share it with your community. Explain how it works and why it should be used. (council events may be offered)
H. Create a PSA on any environmental issue that you feel passionate about. Upload it to speakout.girlscouts.org/create

The Marine Lab at Camp Wai Lani

What is it?
An air conditioned room, right on the gulf, set up to perform experiments, activities, and classroom-type discussions.

How many people can it fit?
There is enough seating for 32 girls max.
4 tables, each capable of fitting 8 girls.

What makes it special?
It is positioned just above a mangrove forest, and sits next to the gulf, making it an excellent place to learn about native Florida habitats. It contains 3 stereoscopes for girls to use. It also has a well-stocked touching lab, with shells and various preserved marine remains. There is a small library containing reference books on a wide range of environmental topics. There are a number of prepared activities and labs, including dissection kits and glassware, stocked in the lab's shelves.

All resources were provided by a Community Action Grant from the American Association of University Women to Mya Breitbart. They provided all the funding Dr. Breitbart used to outfit the lab.

Who can use it?
Any Girl Scout troop or event. You don't need special science training.

Do I have to be camping at Wai Lani to use it?
No. Anyone can rent the room. It can be used for just a regular troop meeting if the space is available.

For more information on reserving the room email: campreservations@gswcf.org

Would You Drink That?

Water Conservation

Best suited for:
J, C, S, A

Time
Session 1: 20 minutes
Session 2: 30 minutes

Introduction

Water is one of the most important natural resources on this planet. Without water, life as we know it would not exist. Pollution has compromised much of the water we use for drinking or around the house. Now many countries around the world, rich and poor, are experiencing greater demands for clean water (also known as potable water). Fresh water sources are extremely limited; less than 3% of water on Earth can be used for human consumption. Scientists are working to answer the question: how can we provide more potable water? One solution is to purify water collected after it was used in urban areas.

Objective

- Brainstorm multiple solutions to a stated problem
- Test multiple hypotheses
- Assess the effectiveness of different methods

Materials

- Water
- Sand, dirt, assorted leaves and debris (anything easily found outside to "pollute" the water)
- Buckets – the marine lab has 500 mL plastic beakers which work well with this activity
- 2 filter sets found in the marine lab
- Paper, pens, markers, crayons
- If desired – extra filter tools, such as coffee filters or cheese cloth.

Instructions

Session 1

Prior to activity: mix sand, dirt and leaves with water in two buckets. Divide the girls into two even groups. Hand out the set of filter screens. Consider providing other materials such as coffee filters or

cheese cloth. Also provide extra clean buckets to each team.

Instruct the girls they can only use the materials in front of them to attempt to clean the water. Encourage them to talk about different ways they could try to clean the water. For example, would the order in which they pour the water through the filters (based on filter size) impact how well they clean the water? Let them experiment. At the end of the time, compare team A's final water to team B's to determine which method worked the best.

Session 2

After girls get some hands-on experience with trying to clean water, provide them with paper and pens or markers. Encourage them to consider what went well and what was difficult with cleaning water in their experiment. Let them talk with each other to imagine ways that they could clean the water with better equipment.

Discussion Questions

1) What are some sources of water we could purify?
2) Would you want to drink cleaned water? What could you use it for?
3) If you had more resources what do you wish you could use?
4) Where does our drinking water come from?
5) How does your county clean our water?
6) Are there other ways to produce clean water?
   Consider researching reverse osmosis and desalination facilities with older girl troops.
7) Are there ways to conserve good drinking water?
   Research 'reclaimed' water: how it's made and how it's used in the Tampa Bay area.

Chemistry

Best suited for:
B, J, C

Time:
45 mins

What is a shell made of?

Introduction

Have you ever walked along a beach and seen a sea shell in the sand? Have you ever wondered what it's made of? This lab will teach one way scientists can test to determine what chemical compounds are in an object. Sometimes chemicals when combined will make a reaction. For instance, calcium carbonate and acids release carbon dioxide gas! The presence or lack of a reaction when two chemicals are combined, and the nature of that reaction, are clues to help answer the question: what is it made of?

Objectives

- Determine what shells are made of
- Practice good observation technique
- Explain phenomenon observed

Materials

- Seashells (take a few days to fully dissolve)
- Sand dollars (takes about 30-60 minutes)
- Vinegar
- Beakers
- Stirring rod (can use a plastic utensil)
- Paper and pen/pencil

Instructions

Clean out beaker. Place a few sea shells or one sand dollar in the beaker. Pour in enough vinegar to cover the shells. Record observations (including what you see and smell). Leave the beaker on a table where it won't be disturbed. Regularly observe what happens and write down what you notice. At the end of the meeting time, gently tap the shell or sand dollar with the stirring rod. Observe what happens. Can be disposed by throwing contents in garbage and washing out beaker.

Discussion Questions

1. What makes sea shells?
2. What are sea shells used for in nature?
3. What else is made of calcium?

Biology

Best suited for:
B, J

Time:
Prep: 10 mins
Activity: 20 mins

Brrr. That's Cold

Introduction

Not everyone lives in climates similar to Florida. Some places are cold year round, like the arctic. How do animals stay warm in cold climates? Some animals, like the arctic fox have thick fur, while fish tend to have a lot of fat. These animals may look different from ones you are used to seeing. That is because they have adapted to their cold environment. One adaption is blubber. Blubber is a special kind of fat which helps animals stay warm.

Objectives

- M ake scientific observations
- U nderstand qualitative analysis
- U nderstand the need for adaptation

Materials

- P ackage of Crisco or lard
- Z iplock bags
- B owl/bucket
- I ce water (lots of ice)
- L atex gloves (if desired)

Directions

Scoop some Crisco into a Ziploc bag. The bag should be full enough that it sufficiently covers a hand inserted in the bag, with preferably about half an inch of fat. If you are using latex gloves, pass one out to each girl, if not a second ziplock bag can be placed inside the one containing the fat, and girls will place their hand inside the clean ziplock.

Fill the bowl with ice and water. Let the water chill until near freezing. The bowl should be

large enough for a girl to submerge both hands at the same time.

Instruct the girls to place their hand, either in their gloves or in the clean ziplock bag within the Crisco. Help them hold their hand in the bag carefully to prevent them from getting excess fat on their hands. Submerge most of their hand into the ice water, while keeping the opening of the bag above the water line. Try to keep the Crisco from getting wet, as it gets very messy, and hard to use multiple times.

Submerge both hands, the "blubber" covered hand and the bare hand into the ice water at the same time. Have the girls compare how long they can keep their bare hand in the water compared to the blubber hand. Instruct the girls to describe what they feel.

Safety consideration: restrict how long the girls keep their hands in the ice water. It should not exceed more than a few minutes. Girls may feel numbness in the exposed hand.

Discussion Questions

1. What differences did you notice between your exposed and "blubber" covered hand?
2. If you lived in freezing water, what other adaptations might you want?

Geology

Best Suited for:
B, J, C, S, A

Time:
20 minutes

Can you clean that?

Introduction

Oil is a liquid that is found in the earth's crust. We use oil to create energy. It is used in our cars, and to make electricity. But do you know where oil comes from? Companies use big drills to dig into the ground and remove the oil. Sometimes they even drill into the ocean floor. Occasionally accidents happen, and oil spills into the environment. Oil can be very bad for fish, birds, and other animals. If animals eat oil it can make them very sick.

In 2010, there was a large oil spill in the Gulf of Mexico. Scientists observed how oil impacted local animals. Sea birds were especially endangered by the oil. When they landed in the oil-infested water, their feathers became slick with oil. During restoration projects, scientists tried to clean the oil off the birds. Can you clean oil off bird feathers?

Objectives

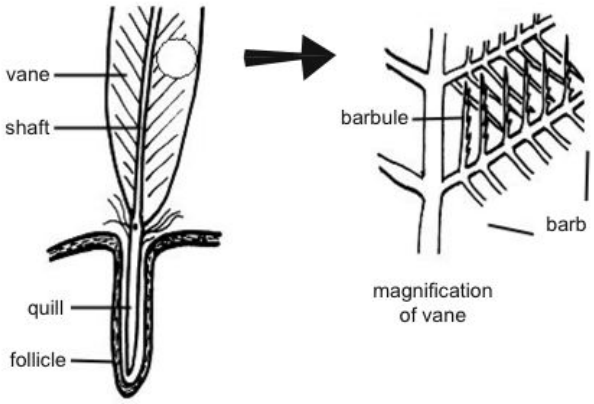
- Learn about miscibility of liquids.
- Discover anatomy of birds
- Practice field techniques

Materials

- Feathers (assorted feathers are kept in the lab)
- Vegetable or olive oil
- Dawn dish soap (dawn works the best)
- Water
- Bowls or other baskets large enough to hold the feathers

Instructions

Fill container with a few inches of water: enough to fully submerge feathers. Not every girl needs a feather, roughly one per 2-3 girls. Allow the girls to touch and examine the feathers. Rub the feather in one direction, then rub it in the opposite direction. Observe the difference in the texture depending on the way you stroke the feather. Next, show the girls how the barbs interlock with each other like a zipper.



Next submerge the feathers in the water. Let the girls feel a wet feather. Now pour a small pool of oil into the container. Show the girls how the oil sits on top of the water – it doesn't mix. This is known as immiscibility. Now dip the feather in the oil sitting on top of the water. Explain that during an oil spill, oil will pool on top of the water, and sea birds will become covered in the oil when they land in the water. Explore the texture of the feather. Compare its relative weight covered in oil to a clean wet feather.

Finally, tell the girls they are biologists who want to help save the birds after an oil spill. Place a small squirt of dawn dish soap in the oily water and watch it repel the oil. Then pass around containers of soapy water and let the girls wash the feathers. Once the feathers are clean, rinse them in clean water and gently pat them dry (if you are using Marine Lab feathers, place them back in the bin to reuse once dry).

Discussion Questions

1. Can you put the barbs back together after you have pulled them apart?
2. What does the oily feather feel like?
3. Is a feather covered in oil heavier or lighter than a clean feather? Will a bird be able to fly easily with oily feathers?
4. Were you able to get ALL of the oil off the feather?

Microscopy

Best suited for:
J, C, S, A

Time:
Session 1: 20 minutes
Session 2: 30 minutes

Can you see that?

Introduction

Microscopes are a tool used by scientists in many different fields of research. They help us see things that are too small for the human eye to see, like cells and bacteria. Scientists have made great discoveries in medicine and every scientific discipline because of the microscope. It is one of the most commonly used tools in science.

The earliest known microscope was made in 1590. At the time it was just two pieces of curved glass in a tube. Since then we have developed lots of different microscopes. Some use light and lens to magnify, or make small things look big. Others use electrons to capture an image of something really small.

Objectives

- Learn the parts of a microscope
- Learn how to properly use a microscope

Materials

- Microscopes (available in the Marine Lab)
- Slides (available in the Marine Lab)
- Copies of worksheets provided
- pens

Instructions

Microscopes are very delicate instruments. Please do not move them or pick them up. Always turn the lights off and unplug the microscope if you are not using it.

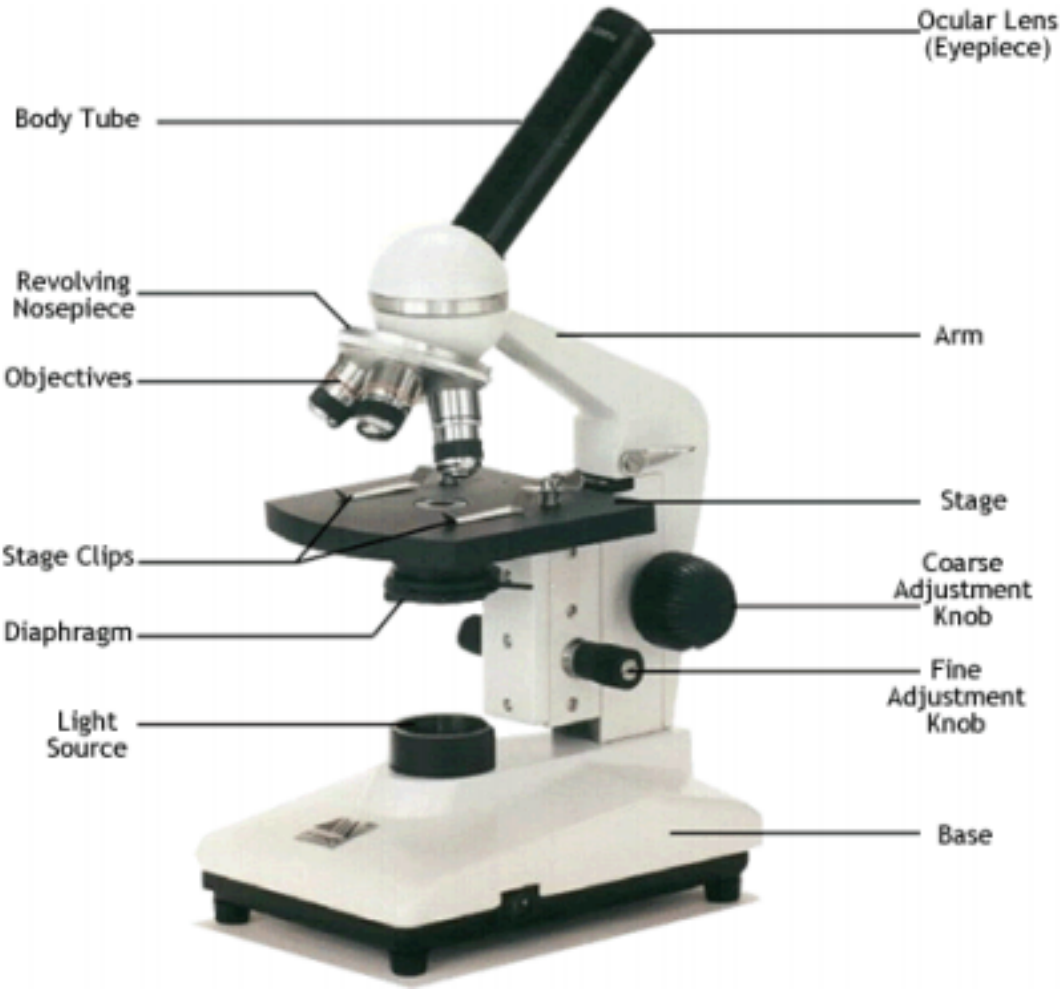
Session 1: Before you begin work on the microscopes you should first learn what a microscope is. Go over the "anatomy" of a microscope, using the guide below, to teach the girls the proper terminology for the parts of a typical light microscope. (If working in the Marine Lab, you should also go over the parts of a stereoscope, also known as a dissecting scope).

Microscope

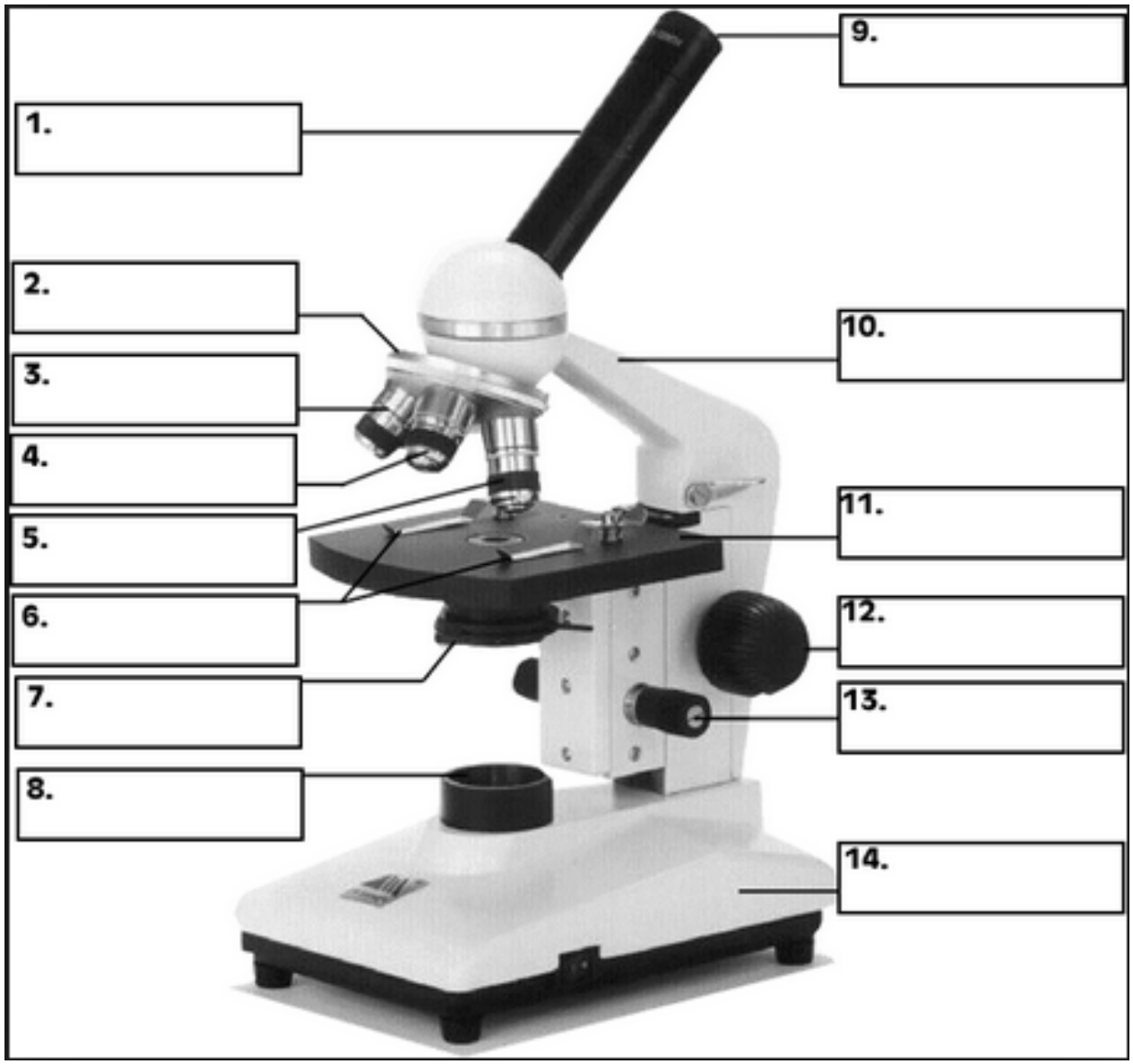
Parts Reference

Your microscope has 3 magnifications: Scanning, Low and High. Each objective will have written the magnification. In addition to this, the ocular lens (eyepiece) has a magnification. The total magnification is the ocular x objective.

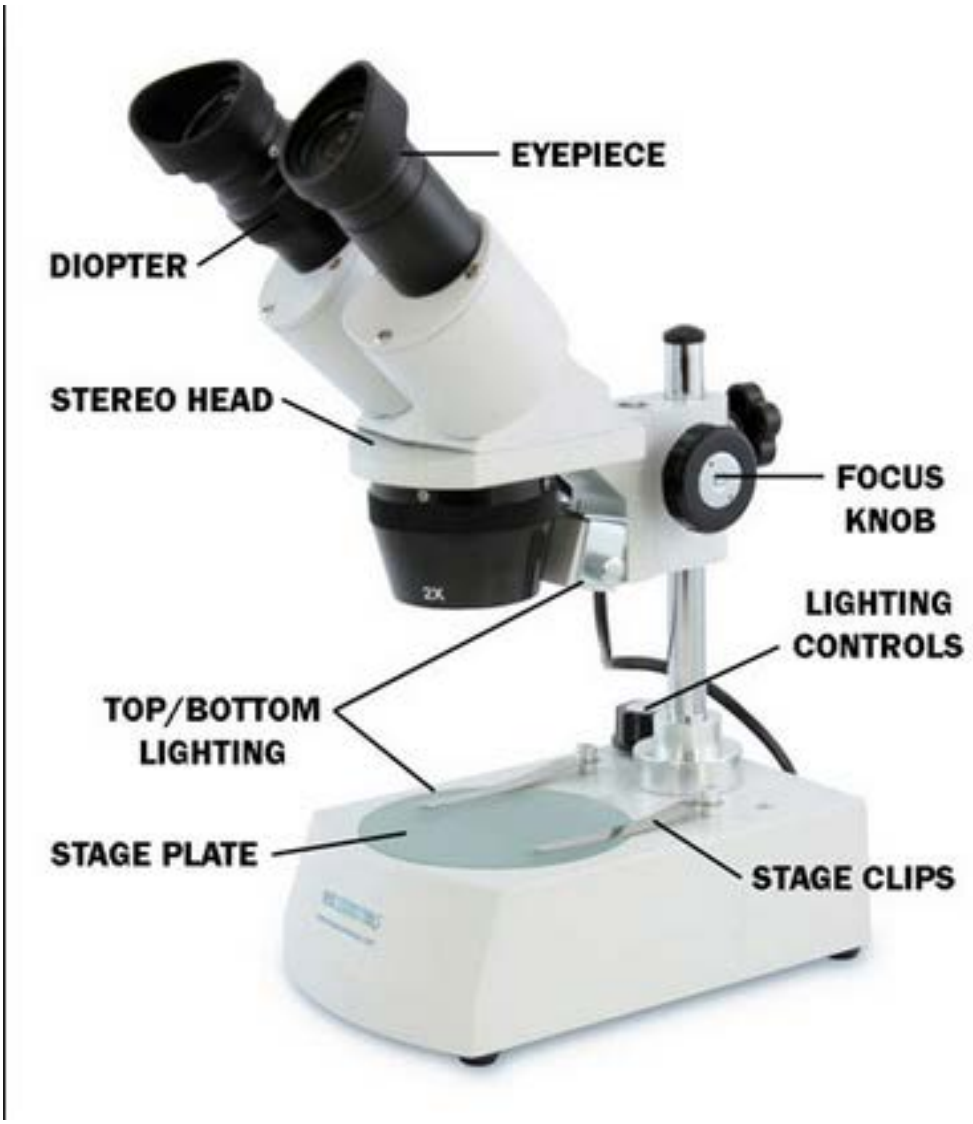
	Magnification	Ocular lens	Total Magnification
Scanning	4x	10x	40x
Low Power	10x	10x	100x
High Power	40x	10x	400x



Worksheet



Stereoscopes are used in biology. You can look at things like insects which are too big to look at under a light microscope. Sometimes stereoscopes are called dissecting scopes, because the stage is set far enough away from the magnification lens that you can perform dissections under the microscope. You use the stereoscope the same way you would a light microscope; it just may take some time to get used to the different controls!



Session 2: Now that you know a bit about microscopes, it's time to learn how to use one! If working with the scopes in the Marine Lab, there are boxes of slides you can examine. **Slides are made of glass and can easily break if dropped. Be very careful.** Follow the steps below to use a stereoscope!

1. Plug the microscope into a wall socket. Turn the switch on.
2. Make sure you only have one light source on. You should only be using the top lighting. There are dials on the side of the base which control this.
3. Set the magnification to the lowest setting.
4. Use the course knob to bring the specimen into focus. (May need to move the slide around some to find specimen. Do not use stage clips!)
5. If the specimen is still small, turn the objective lens to a higher magnification.
6. Use the course knob to bring the specimen into focus.
7. Use the fine knob to bring the specimen into clear focus.

Troubleshooting:

Image is too dark?

Adjust the lighting. Make sure lighting is on high. Also check there is nothing on/obscuring the lens.

Spot in the viewing field?

The lens is dirty. Have an adult use lens paper to clean the lens. Only lens paper should be used to clean microscopes.

I can't see anything in my viewing field!

Did you follow the steps? You need to find the specimen in low power before trying to see it in high power. If in low power and you still can't see it, try moving the slide around the stage to find the specimen. Verify there is no cap on the lens.

Suggested alternatives

Once girls are comfortable with how to use the stereoscopes, try out this activity!

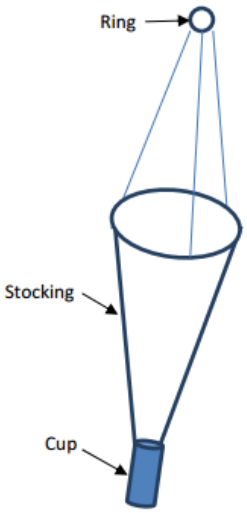
Observe live plankton!

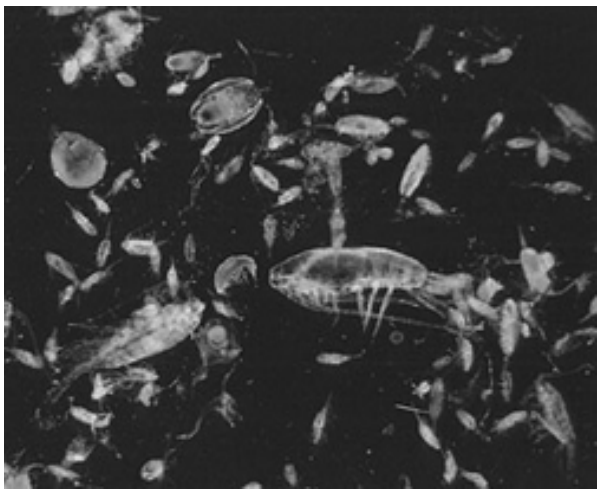
Plankton are microscopic organisms that float freely in bodies of water. Plankton is made up of tiny plants (called phytoplankton) and tiny animals (called zooplankton). Phytoplankton are primary producers (also called autotrophs), such as algae. As the base of the aquatic food web, they use chlorophyll to convert energy (from sunlight), inorganic chemicals (like nitrogen), and dissolved carbon dioxide gas into carbohydrates. Zooplankton are small or microscopic animals that eat other plankton. Some zooplankton are larval or very immature stages of larger animals, including mollusks (such as snails), crustaceans (like crayfish and crabs), fish, and jellyfish. Plankton is the first link in the aquatic food chain; it is eaten by many organisms, including mussels, fish, birds, and mammals.

Instructions:

1) There are nets in the Marine Lab, or you can create your own using nylons.
2) Tow the net through the water, collecting the plankton in the attached container. Remember they are microscopic so you won't see them!
3) Use a pipette to put some of the water in a petri dish.
4) Observe under a stereoscope.

Check out this website if you would like further instructions on how to make a plankton net: http://www.udel.edu/MERL/Outreach/Teacher%27s%20Guide/4.%20Plankton%20Net%20TE.pdf





Geology

Best suited for:
B, J, C

Time:
45 minutes

Edible Aquifers

Introduction

Water is a very important resource. Can you think of different ways you use water every day? Did you think about the water used to grow your food? Or the water used in manufacturing plants? There isn't enough water in lakes and rivers, and we can't use salty ocean water. Where else do we get our water from? What happens if we take too much?

Objectives

- Discover where water comes from
- Learn about sinkholes
- Discover what a well is.
- Explain the importance of water management

Materials

- Cups
- Spoons
- Straws
- Ice cream scoop
- 7 Up (or equivalent beverage)
- Vanilla ice cream
- Blue food coloring
- Chocolate/green sprinkles
- Rainbow sprinkles
- Other candy/cookies if desired (feel free to get creative with the "pollution")

Instructions

Before completing the activity, go over the classroom lesson on the next page. Teach the girls about aquifers and the importance of managing water in Florida. The following activity is meant to be a fun means of reinforcing these concepts.

1. Pass out one cup, one straw, and one spoon to each girl. Instruct them not to touch anything until told to do so.
2. Pour some 7 Up in each cup. About an inch works well, but servings can be adjusted to fit materials and number of girls present.
3. Drop 2 drops of blue food coloring into the 7 Up. This serves to make it actually look like water. This is your aquifer.

4. Place a scoop of ice cream on top. The ice cream resembles clay, and acts as a confining layer.
5. Put chocolate and/or green sprinkles on top to represent dirt/grass.
6. Use either rainbow sprinkles or any assorted candy to represent “pollution”.
7. Using the straw, instruct girls to “drill” through the confining layer, and pump out (drink) the aquifer. Some of the “pollution” should fall through and discolor the “aquifer”. Use this as a teachable moment to talk about water contamination.
8. As the girls drink the “aquifer” they should notice the “confining layer” sinking. This can represent what happens when wells are over pumped, causing sinkholes.
9. Allow the girls to eat their edible aquifer!

Aquifers!

What is an aquifer?

There are lots of holes in between the rocks which make up the ground, and water can fill those empty spaces. When water moves through the rock like an underground river, we call it an aquifer. Water in an aquifer is fresh, and the rocks act to filter out any impurities in the water to leave it very clean. Florida has the highest concentration of aquifers in the world.

Why does Florida have so many aquifers?

Florida’s bedrock, the ground we walk on, is made up of limestone. Limestone is a very weak, soluble rock. It is easy for water to move through the rock.

How does water leave an aquifer?

There are two natural ways. When the rock meets the ocean, the fresh water in the aquifer can flow out into the salt water, where it mixes. Water can also flow up to the surface through springs. Springs are natural holes in the ground where water from the aquifer can rise to the surface.

Humans have also developed a way to remove water from the aquifer. Companies, farmers, and sometimes even families drill down deep into the earth and make a well. They can then pump up the fresh, clean water to use to water crops, in showers, for drinking water, and many other tasks.

How does water enter an aquifer?

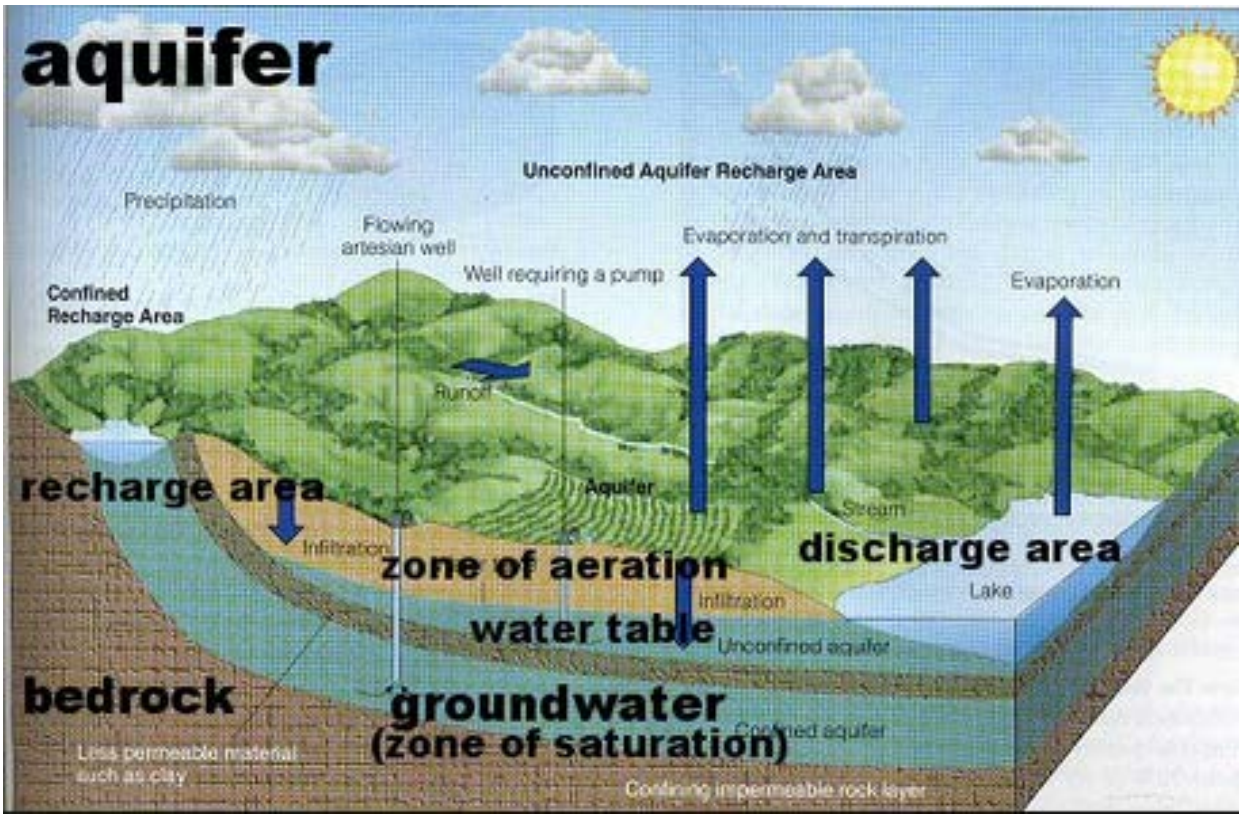
Water can percolate, or filter down through the soil until it reaches an aquifer. Sometimes rivers you see on the surface can run into impermeable rock, like granite, and they can get pushed underground. This is why it is very important not to pollute the environment. Anything in the soil can get picked up by water and carried into the aquifers. Since most of the drinking water we use in Florida comes from aquifers, it's important to keep our aquifers clean.

Why does the water stay in the ground?

There are many different types of aquifers, but the most common is a confined aquifer. Confined aquifers have a layer of non-permeable rock, or rock that water can't easily pass through, above the limestone layer where the water flows. This keeps the water from moving up. Confining layers are typically made of thick clays or hard rocks like granite.

What is a sinkhole?

A sinkhole occurs naturally when the load bearing rock collapses underground, which causes the soil and everything on top of it to fall into a depression in the ground. Sometimes sinkholes are caused when too much water is removed from an aquifer. If all the water that had been filling in the empty spaces between rocks is pumped out, then the rock can settle to fill in the empty holes. While sinkholes are natural, and usually not dangerous, they can damage buildings and roads which are very expensive to repair. This is why the government monitors wells and limits how much water can be removed from our aquifers.



CHEMISTRY

Best suited for:
C, S, A

Time:
60 minutes

Water Quality Testing

Introduction

Water is the most important resource on the planet. All life on earth is dependent on clean water for survival. Many people get water from their county provider, making it the government's responsibility to make sure the water sent to people's homes is clean and safe for drinking. There are lots of things found in groundwater you might not want to drink, including: bacteria, minerals, and particulate matter (dirt and other small things floating in the water). Each potential pollutant in the water has its own test, which can be applied.

There are some tests for general indicators, which can tell the general nature of the water quality. One such test is pH, which tells if the water is acidic, basic or neutral. Can you think of a food which is acidic? Do you know anything around your house which is basic? Humans tend to prefer neutral water.

Objectives

- Practice basic chemistry lab techniques
- Understand pH and how it applies to water quality
- Identify ways to measure watery quality
- Explain why water quality is important to humans and the environment.

Materials

- Water quality testing kit (in Marine Lab)
- Small and large test tubes with lids
- pH tablets
- D.O. tablets
- Color sheets
- Water samples
- Scissors
- Data tables

- Pen/pencil

Instructions

pH Test

What is pH? pH is a measurement of the acidic or basic quality of water. The pH scale ranges from a value of 0(very acidic) to 14(very basic), with 7 being neutral. Most aquatic animals prefer a range from 6.5-8.0. pH outside the normal range for an area can cause problems for animals and plants living in that water. pH can be affected by atmospheric deposition (acid rain), waste water or storm water discharge, and rocks found naturally in the area.

1) Fill the large test tube to 10 mL mark with water
2) Add one pH tablet
3) Cap the test tube
4) Shake until tablet is fully dissolved
5) Compare color of water to color sheet

Dissolved Oxygen

What is Dissolved Oxygen, or D.O. as scientists call it? Dissolve oxygen is a very important indicator to the health of aquatic ecosystems. Naturally, water which supports life tends to have high amounts of dissolved oxygen. Atmospheric oxygen is mixed into the water from wave and wind action, and it is this oxygen which fish and aquatic plants use for respiration. There are many factors which can affect the amount of oxygen in the water, such as temperature. Cold water can carry more oxygen than warm water. When measuring D.O. it is reported as "ppm" which means parts per million, in other words a value of 8 ppm indicates 8 molecules of oxygen per million water molecules. Human interference and pollution, along with natural events such as bacteria or rotting plant material, can reduce dissolved oxygen saturation (the amount of oxygen in the water) which negatively impacts anything relying on that water source.

1) Record the temperature of the water.
2) Fill the small test tube to the very top with water.
3) Drop two D.O. tablets in the tube. It should cause some water to spill over.
4) Screw the cap on.
5) Mix by shaking the tube. (Hint: best results if hold the cap end with thumb, and base with forefinger and repeatedly invert the tube. Be careful to keep a firm grip as spilled water could make it slippery, and the test tubes are made of glass.) May take up to 5 minutes.
6) Wait 5 minutes for the color to develop.
7) Compare the color in the tube to that on the color chart. Record the ppm.
8) Use the table in the booklet to match the ppm found and the temperature of the water to determine % saturation.

Discussion Questions

1) What are some ways human actions could affect pH or D.O. levels?

2) Try running the experiments with multiple water sources and compare your results. For example, compare water from a water bottle, to water collected off the end of the dock at camp.
3) Encourage the students to create their own data tables to record their findings. Have small groups report their results back and compare the results of the different tests. If done properly they should all be very similar.

Ecology

Best suited for:
C, S, A

Time:
45 minutes

What's in a Mangrove?

Introduction

Mangroves are a habitat native to Florida. They are very rare across the globe, and Florida has the highest concentration of mangroves in the world: nearly 500,000 acres. A mangrove is made of a specific species of tree which grows along the shore in saltwater. But why are they so special? How do they help Florida? Take a field trip to Camp Wai Lani to investigate mangroves and their role in Florida's ecosystem.

Objectives

- Define what a mangrove is.
- Identify animals that live in mangroves
- Understand the environmental importance of mangroves
- Explore natural Florida environments.

Materials

- Should be performed in a region with mangroves (such as the Marine Lab)
- Following guided lessons.

Instructions

Read through the lessons below. Go out into a mangrove forest and attempt to identify what you learned.

What is a mangrove?

Mangroves are tropical plants that have adapted to loose, wet soils, salt water, and being periodically submerged by tides. There are more that 50 species of mangroves found throughout the world. Three species of mangroves are native to Florida: red mangrove (Rhizophora mangle), Black mangrove (Avicennia germinans) and White mangrove (Laguncularia racemosa). Red mangroves are easily identified by their "prop roots" which are tangled, reddish, aerial roots that originate from the trunk and branches. Their leaves are 1-5 inches long, broad and blunt on the tip, shiny, deep green on top, and paler on the underside. Black mangroves can be identified by numerous finger-like projections, called pneumatophores that protrude from

the soil around the tree's trunk. Black mangrove leaves are oblong, shiny green on top and covered with short dense hairs on the underside. Black mangroves are usually found in slightly higher elevations upland from red mangroves. White mangroves have no visible aerial root system like red and black mangroves. The easiest way to identify white mangroves is by the leaves. The leaves are up to 3 inches long, elliptical (rounded at both ends), yellowish in color, and have two distinguishing glands at the base of each leaf blade where the stem begins. White mangroves are usually located in elevations higher and farther upland than either the red or black mangroves.

What does a mangrove do?

1) Filter, trap, and cycle organic materials and other chemical elements in the environment.
They maintain water quality and clarity, filtering pollutants and trapping sediments originating from land.

2) Basic food chains and habitats provided (see examples in What lives here?-page 27)

3) Fish nurseries

Serving as valuable nursery areas for shrimp, crustaceans, mollusks, and fishes, mangroves are a critical component of Florida's commercial and recreational fishing industries. These habitats provide a rich source of food while also offering refuge from predation. Florida's fisheries would suffer a dramatic decline without access to healthy mangrove habitats.

4) Storm buffers

Mangroves protect shorelines from damaging storm and hurricane winds, waves, and floods. Mangroves also help prevent **erosion** by stabilizing sediments with their tangled root systems.

How did they adapt?

1) Roots

Root adaptations increase stability of mangrove trees in the soft sediments along shorelines. Red mangroves have prop roots descending from the trunk and branches, providing a stable support system. Shallow wide spreading roots, surrounds the trunks of black mangroves, adding to the structural stability of the tree.

2) Salt Tolerance

Through physiological adaptations, mangroves are able to live in harsh saline environments. Red mangroves occur where soil salinities range from 60-65 parts per thousand (ppt) while black and white mangroves are found in soils with over 90 ppt salinities. Salinities effectively limit competition from

other plants, while mangroves have salt exclusion or salt excretion adaptations allowing survival in these environments.

The ability to exclude salts occurs through filtration at the surface of the root. Root membranes prevent salt from entering while allowing the water to pass through. This is effective at removing the majority of salt from seawater. The red mangrove is an example of a salt-excluding species.

On the other hand, salt excreters remove salt through glands located on each leaf. Black and white mangroves are both salt excreters. White mangroves develop thickened succulent leaves, discarding salt as the leaves eventually drop.

3) Anaerobic sediments

Mangrove trees are adapted for survival in oxygen-poor or anaerobic sediments through specialized root structures. Plants require oxygen for respiration in all living tissues including the underground roots. In soils that are not waterlogged, air diffusion between sediment grains can supply this requirement. However, in waterlogged soils, these spaces fill with water containing lower oxygen levels than air.

In contrast to most plants, mangroves have poorly developed, shallow below-ground root systems while having well-developed aerial roots. These aerial roots allow for the transport of atmospheric gases to the underground roots. Red mangroves have prop roots extending from the trunk and adventitious roots from the branches. Although the black mangrove does not have prop roots, small air roots can be seen extending vertically from the soils surrounding the trunk. These air roots, called **pneumatophores**, extend upward from the underground roots above the soil surface. During low tides, air is taken up through open passages in the pneumatophores and transported to living root tissues.

4) Reproduction

All mangrove trees share two reproductive adaptations - **viviparity** and propagule dispersal. Similar to terrestrial plants, mangroves reproduce by flowering with pollination occurring via wind and insects. Once pollination occurs, the seeds remain attached to the parent tree. They **germinate** into propagules before dropping into the waters below. **Propagules** (seen right) are elongated juvenile trees, rather than seeds. Dispersal of live young rather than seeds is called "viviparity". The propagules either take root in the sediments near the parent tree or are dispersed with the tides and currents to other shorelines.

What lives here?

Animal	Function	Picture
Mangrove crab	Lives in canopy and mudflats, eats leaves and detritus	
Horseshoe Crab	Scavengers that eat dead invertebrates and detritus around mangrove roots	
Florida Gar	Predatory fish that hunts near mangrove roots	
Mangrove Water Snake	Top predator. Stays in canopy.	
Loggerhead Sea Turtle	Juveniles seek protection in the mangrove roots.	

Anhiga – “snake bird”	Eats fish and plant materials in the shallows.	

Discussion Questions

1) Red, White, and Black mangroves have been found on Wai Lani property. See if you can identify all three.
2) Find propagules. Discuss why they might be good or bad for seed dispersal.
3) Pneumatophores are easy to see outside the marine lab mangroves. Observe them at high and low tide. What do you notice about the water level?
4) What other animals can you think might live in a mangrove?
5) What danger do humans pose to mangroves? How can we prevent habitat loss?
   Research the Mangrove Trimming and Preservation Act.

Want to Learn More?

Check out these websites (with your parent's permission)!

Girl Scouts & the Environment

http://www.girlscouts.org/program/basics/environment/elliott_wildlife.asp
www.forgirls.girlscouts.org

Government Resources

Beach Clean-Ups: http://www.oceanconservancy.org/our-work/international-coastal-cleanup/sign-up-to-clean-up.html
Florida Wildlife: http://myfwc.com/wildlifehabitats/
Water Treatment Plant Tours: http://www.pinellascounty.org/utilities/teachers/tours.htm

Careers

Interviews with research scientists: http://myfwc.com/research/about/careers/scientist-interviews/
Connect with a female role model: http://www.fabfems.org/find

Information and Games

http://kids.sandiegozoo.org/
http://www.discoverwater.org/