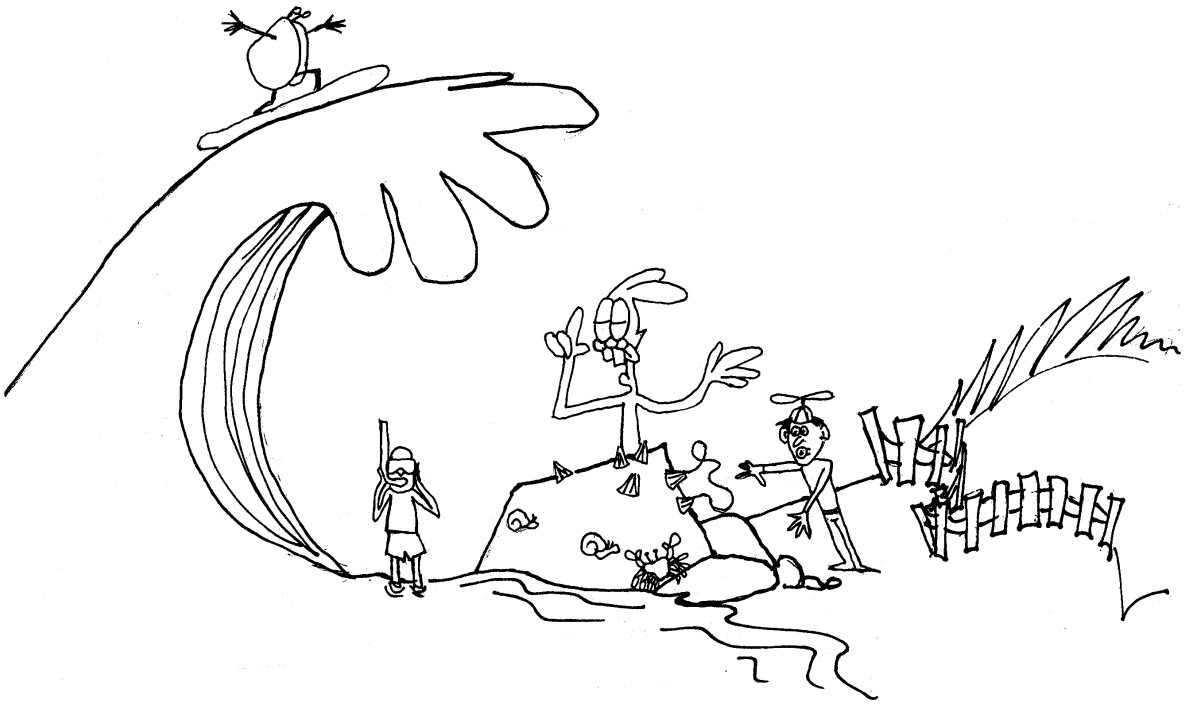
Ferry Beach Ecology School
Pre-Visit Activity Booklet



This **Pre-Visit Activity Booklet** is designed to help you, the classroom teacher, prepare your students academically for their trip to FBES. The booklet includes the *FBES Vocabulary List,* as well as descriptions of activities you can do in the classroom to introduce these vocabulary words to your students before your trip. We hope you have time to look over the activities in this packet and to try them out with your class(es). The activities are designed specifically for use in the classroom, and can be done together as part of an ecology unit, or on their own. All the activities are simple to prepare, don't take long to perform, and best of all, they're fun!

We've learned from experience that learning basic ecological concepts in the classroom will make your students' learning experience at FBES more meaningful. <u>At the very least, we request that you have your students learn the basic vocabulary list</u>. When the students arrive knowing these terms, it frees up a lot of time on lessons which can be spent doing more hands-on learning! Please call if you have any questions, comments, or concerns.

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The FBES Vocabulary List

- **Abiotic factors**- Non-living things or factors in an ecosystem. Examples of abiotic factors include sunlight, soil, rocks, water, temperature, wind, nutrients and periodic disturbance.
- **Biosphere**- The sum of all the planet's ecosystems. The biosphere is a relatively thin layer consisting of seas, lakes, rivers and streams; the land to a soil depth of a few meters; and the atmosphere to an altitude of a few kilometers.
- **Biotic factors**- Living things in an ecosystem. Living things are divided into three basic ecological groups, the producers, consumers and the decomposers.
- **Climate**- The average course or condition of the weather at a place usually over a period of years and decades. Microclimatic factors that vary among ecosystems include humidity, temperature, wind and amount of sunlight.
- **Consumer**- An organism which must consume other organisms to get their nutrients.
- **Decomposer**- An organism that gets nutrients by breaking down matter into its simpler components. In ecology, the term decomposer refers to fungi and bacteria.
- **Disturbance**- An event which interrupts the process of succession.
- **Diversity**- The number of different species of organisms in an area.
- **Ecology**- The study of the interrelationships between the living and non-living things on Earth.
- **Ecosystem**- The non-living and living things in an area which function together as an ecological unit.
- **Niche**- The functional role of a species in a community; that is, its occupation, or how it earns its living. For example, the scarlet tanager is a bird that lives in a deciduous forest habitat. Its niche, in part, is finding insects from the canopy foliage.
- **Nutrient**- A source of nourishment. Nutrients are substances which organisms use to grow and to sustain life. The most important nutrients on earth are hydrogen, oxygen, carbon and nitrogen.
- **Nutrient Cycle**- A general term for the course traced by any particular life-essential substance as it moves in an endless cycle through the physical (abiotic) and biological (biotic) environment. Nutrient cycles are basic concepts in ecology. Essential nutrient cycles include those of carbon, water (H_2O), and nitrogen. Many other elements and compounds, such as potassium, phosphorus and sodium are also essential, even if only in trace amounts.
- **Organism**- A living thing.
- **Photosynthesis**- The process by which plants and most other producers take nutrients out of the atmosphere and/or soil and use sun energy to convert them into sugar. A majority of the mass in plants comes from two sources: carbon in the atmosphere, and water in the soil. Basically, the equation for photosynthesis goes like this: CO_2 (carbon dioxide)+ $2H_2O$ (water) + light energy -->CH_2O (Sugar, a carbon compound)+ O_2 (oxygen). The sugars produced in photosynthesis are the building blocks for making other substances like complex carbohydrates, proteins and fats!
- **Producer**- Organisms that can produce their own food, most through the process of photosynthesis.
- **Productivity**- How much living mass the producers in an area can generate in a given amount of time.
- **Succession**- Change in the community composition of an ecosystem as the available competing organisms (and especially the plants) respond to and modify the environment.
- **Topography**- The shape of the land.
- **Watershed**- An area of land where in which all the water drains into one large river that eventually empties into the ocean.
- **Weather**- The state of the atmosphere in a given area at a given time. The elements that make up weather include humidity, temperature, cloudiness, wind, pressure and precipitation.

Activities

Abiotic Factors

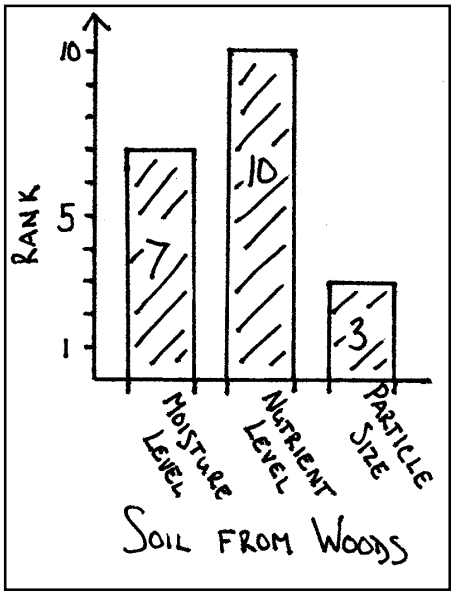
The non-living things or factors in an ecosystem. Examples of abiotic factors include sunlight, soil, rocks, water, temperature, wind, nutrients and periodic disturbance.

Accompanying Activity: Soil Sampling

Goal: For students to examine closely an important abiotic factor in their local ecosystems. To compare different soils in a small geographic area.

Materials Needed: small zip-loc bags, soil from students homes, pre collected samples of : wet soil, dry soil, nutrient rich soil and nutrient poor soil.

Assign your students the task of collecting a small amount of soil from around their homes and bringing it to class. Show the students how to determine the nutrient level of their soil-- soil which is high in nutrients is very dark, while soil which is nutrient poor is light in color. (If possible, have examples of very moist, nutrient-rich soil (clay) and very dry soil (sand) to illustrate extremes.) Next, show them how soils with smaller particle size, such as clay, holds more water, while soil with larger particle size, such as sand, holds less water. (Once again, samples of sandy soil vs. clayey soil are good to have available.) Now, have the students rank their soil on a 1-10 scale for moisture level, nutrient level and particle size. (Number 1 being the least moisture, nutrients and smallest particles and 10 being the most moisture, nutrients and largest particles.) Once each student has assigned their soil a number value based on this scale, have them check it with another student to see if that student agrees with their assessment. The students should then create graphs showing the different values of their soil (see graphic). Additionally you may want to locate each sample on a large map of the town.



Connecting Concepts: How many different abiotic factors have been discussed in this activity (water, soil, nutrients)? What is the correlation between particle size and moisture level? What affect might nutrient level of the soil have on plant life and animal habitat? Why is soil important?

Biosphere

The sum of all the planet's ecosystems. The biosphere is a relatively thin layer consisting of seas, lakes, rivers and streams; the land to a soil depth of a few meters; and the atmosphere to an altitude of a few kilometers.

Accompanying Activity: (See Ecosystem)

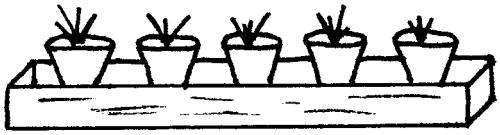
Biotic Factors

Living things in an ecosystem. Living things are divided into three basic groups, the producers, consumers and the decomposers.

Accompanying Activity: Sprouting Seeds

Goal: To understand the dependence of living things on non-living things.
Materials Needed: film cannisters or Dixie cups, fast germinating seeds (Wisconsin fast plants, turnips or marigolds), students soil samples, water and available sunlight or lamplight.

Have each student fill a film cannister or Dixie cup with the soil collected from their backyards in the *Soil Sampling* activity. Give each student a couple seeds to plant about a half inch below the surface. Make sure each cup receives an equal and adequate amount of water and sunlight. Poke a hole in the bottom of the cup or cannister so water can drain. Have the students monitor their seeds on a daily basis (they could keep track of their observations in a seed journal). Correlate seed growth to nutrient level and particle size of the soil, as previously observed by the students. As an addition to this activity, you can try to grow the seeds in other types of soils such as sand or in clay and see what the results are.



Connecting Concepts: What do living things need to survive? What do plants need to make their own food? How are plants affected by the soil in which they are grown? Are plants producers, consumers or decomposers, and why?

Climate

The average course or condition of the weather at a place usually over a period of years. Fairly constant, predictable conditions. Examples of climatic factors include humidity (wetness vs. dryness), temperature, wind and amount of sunlight.

Accompanying Activity: Climate Comparison

Goal: for students to understand how climatic factors affect humans and other populations of living things.
Materials Needed: access to library or internet research materials.

Assign each student a different country of the world to research. The students should produce a report on the climate of that area-- the average rainfall, average temperature, how long the days are, how direct the sunlight is, what the seasons are like, etc. To make the connection between the climate of an area and what can grow there, have the students research what types of animal and plant life are dominant in this part of the world, and what the imports and exports of that country. Have the students present their findings to the entire class.
Connecting Concepts: Is climate abiotic or biotic? What types of factors make up the climate of an area? How does climate affect living things? How does climate specifically affect humans? What would happen if the climate of an area was dramatically altered? What kinds of things could produce dramatic climate change (glaciers, global warming)?

Consumer

An organism which must consume other organisms to get its nutrients.

Accompanying Activity: Pass the Poison

Goal: to understand how chemicals can accumulate in animals blood and bodies as you proceed up the food chain.
Materials Needed: 12 pictures of producers (grass), 6 pictures of primary consumers (rabbits), 3 pictures of hawks, 12 red pieces of paper (representing ChemLawn fertilizer), 1 picture of Joe or Jane homeowner.

By the time they reach fourth or fifth grade most students have a fairly good grasp of the differences between producers and consumers. It may help before playing this game to review with your students the different ways that organisms get their nutrients (either by making their own food or consuming other organisms). This game is designed to get students to think about the food chain in a more complex way. Each student should receive a picture (if string is attached they can wear them around their necks). They are now playing the role of whatever animal or plant is on their card. They should stand in three rows according to their level in the food chain. Pass the chemical cards to Joe/Jane who will then distribute them to each of the producers. Tell the students that Joe/Jane is adding ChemLawn to their yard to make sure their grass is green and lush. Next tell the primary consumers (the rabbits) that they are getting hungry. Where do they get their nutrients?

Why, from the grass, of course! Have the rabbits each "eat" two of the grasses. Make sure that the rabbits also take the ChemLawn from the grasses, as this is being passed along into their bodies. Now the hawks are getting hungry. Repeat the process-- have the hawks each eat two rabbits, and make sure the chemicals get passed along. At this point each hawk should have ended up with four ChemLawn cards. Inform the students that the chemical accumulation in animals can cause serious health problems and even extinction.
Connecting Concepts: How do organisms on each level of the food chain get their nutrients? How can the actions of a suburban homeowner affect other organisms? What are the benefits and drawbacks to using lawn fertilizer? Could the use of chemicals like ChemLawn affect humans?

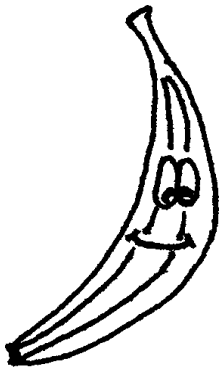
Decomposer

An organism that helps to break down matter into its simpler components. In ecology, the term decomposer refers to fungi and bacteria.

Accompanying Activity: Banana Vault

Goal: to examine and understand the decomposition process.
Materials Needed: 2 banana peels, a scale, tennis ball container, duct tape.

Take two freshly peeled banana peels. Weigh both peels. Have the students record the weight and appearance of both peels. Put one peel in the tennis ball container which has been wrapped in duct tape to prevent the entrance of any light. Cap the container and tape the top on. Put the other banana peel on the ground next to the one in the "vault" outside on the lawn or near a window in the classroom. Have the students make predictions about what will happen to each of the banana peels after one week. After the week, re-examine the banana peels and weigh them again.
Connecting Concepts: What were the differences between the two peels and why? Why might one peel weigh less than the other? What causes decomposition and what factors speed or slow that process? Why is decomposition important?



Disturbance

An event which interrupts the process of succession.

Accompanying Activity: Disturbance Charades

Goal: To get students to consider some natural and unnatural events that can impact the development of an ecosystem.

Materials Needed: index cards with different kinds of disturbance written on them, for example: fire, lightning strike, deforestation, hurricane, tidal wave, oil spill, drought.

First go over the definition of a disturbance with your students to make sure everyone is on the same page. Divide the students into small groups of three or four students each. Each group selects a card without looking at them. The students must act out the kind of disturbance listed on the card they selected without using words or sounds. The other students try and guess what it is that they are acting out.

Connecting Concepts: What is a disturbance? Are there different kinds of disturbance in different ecosystems? Are there ecosystems which have more disturbance than others? Is disturbance always a bad thing?

Diversity

The number of different species in an area.

Accompanying Activity: Diversity Count

Goal: To achieve an understanding of what diversity means and what factors determine the diversity of an ecosystem.

Materials Needed: a six foot piece of yarn, tied into a loop, for each student

This activity works best if you try it around the schoolyard before sending students home to try it themselves. Bring all your students outside and explain to them that you are going to be counting the number of <u>different kinds</u> of living things in a given area. Next select a random plot. A good way to do this is to have one student spin around until you say stop. Then have another student pick a number between one and fifty. The student who was spun around should walk that number of steps in the direction he or she ended up facing. Now you have a randomly selected plot (It's okay to do this activity on a lawn type area, you'll be surprised at what you might find). Lay the circle of string down on the ground and have the students count the number of different kinds of living things in the loop. For instance; all the blades of grass count as just one kind of living thing (unless you can tell that there are two different types of grass present). Send the students home to take a diversity count from an area around their house. Make sure they use the string so that the amount of space sampled is the same for all students. This activity can be done in conjunction with the *Soil Sampling* activity having the students count in the area that they took their soil from. This can be a good way to talk about relationships between living and non-living things.

Connecting Concepts: Do abiotic factors such as nutrient levels in the soil influence diversity? Which ecosystems are the most diverse in the world? Which are the least? Why is diversity important?

Ecology

The study of the interrelationships between the living and non-living things on Earth.

Ecosystem

The non-living and living things in an area which function together as an ecological unit.

Accompanying Activity: Ecosystem Murals

Goal: to familiarize students with some of the biotic and abiotic factors in different ecosystems.
Materials Needed: posterboard, crayons, pencils, markers, magazine cut-outs.

Divide students into small groups of 2 or 3 students. Assign or have them select an ecosystem to research. Some possibilities include: forest, beach, ocean, tide pools, salt marsh, river, desert, rainforest, mountains, ponds and sand dunes. Each group of students produces a mural on the poster, detailing the biotic and abiotic elements of their ecosystem. All the ecosystems on Earth taken together make up the biosphere.
Connecting Concepts: What do all ecosystems have in common? What factors make them different from each other? Which ecosystems do you find in your part of the world?

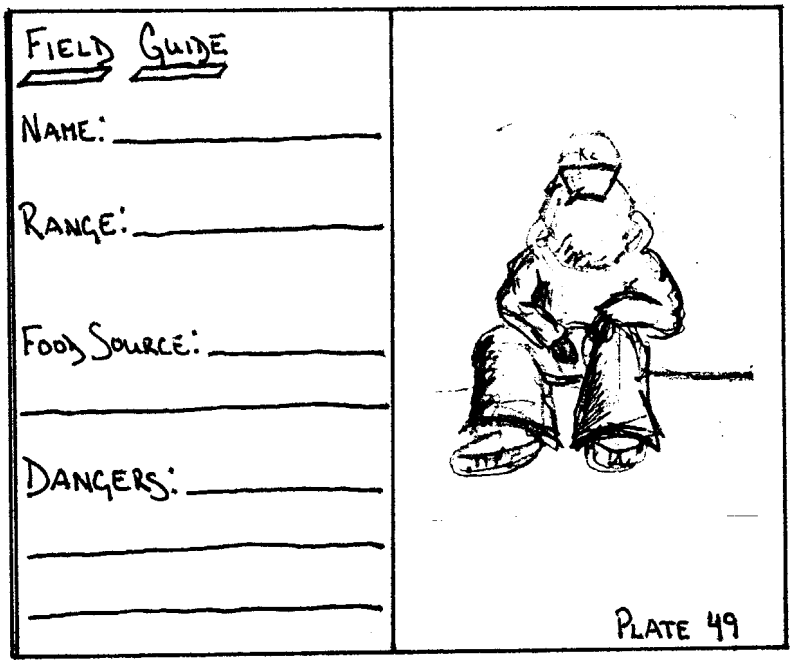
Niche

The functional role of a species in a community-- that is, its occupation, or how it earns its living. For example, the scarlet tanager lives in a deciduous forest habitat. Its niche, in part, is eating insects from the canopy foliage.

Accompanying Activity: Field Guide Entry for Humans

Goal: to examine the role of humans in relation to other living and non-living things.
Materials Needed: paper, pencils, crayons/markers.

A good way to introduce this activity is by having the students read a few field guide entries from different books to see how they are designed. Discuss the various categories within each entry-- range, habitat, food source, behavior and niche. Then have the students design an entry for humans that might go in a field guide. Include descriptions of humans for each category of a field guide entry. Then students draw a picture of this strange species to accompany the entry.
Connecting Concepts: Are humans animals? How is human behavior similar to or different from other animals? What is the range of the human species? Are there any places humans can't live? What affect do humans have on the environment?



Nutrient

A source of nourishment. Nutrients are substances which organisms use to grow and sustain life. The most important nutrients on earth are hydrogen, oxygen, carbon and nitrogen.

ACCOMPANYING ACTIVITY: (SEE NUTRIENT CYCLE)

Nutrient Cycle

A general term for the course traced by any particular life essential substance as it moves in an endless cycle through the physical (abiotic) and biological (biotic) environment. The nutrient cycle is a basic concept in ecology. Essential nutrient cycles include those of carbon, water and nitrogen. Many other elements and compounds, such as potassium, phosphorus and sodium are also essential, even if only in trace amounts.

ACCOMPANYING ACTIVITY: NUTRIENT CYCLE PUZZLERS

Goal: To understand the cycle of nutrients through the living and non-living environment. To understand that all living and non-living things are made up of molecules and those molecules are used over and over again.
Materials Needed: paper, pencils, crayons/markers.

Before you give the students any of the puzzles make sure they have a fairly good understanding of the ways nutrients can move through living and non-living things. Some ideas to go over might include: nutrient absorption through ingestion (the food chain), through the air (breathing or transpiration), evaporation and precipitation (the water cycle), excretion (pooping and peeing -always a fun one with this age group!) and decomposition. Now give your students the puzzles and have them make up and illustrate the journeys these miraculous molecules take. Here are some puzzle examples:

Sample Puzzle: Wendy the water molecule started out inside the stomach of a chipmunk and ended up in a cloud. She made four stops along the way. Describe Wendy's journey.
Sample Answer: Wendy was peed out of the chipmunk and into the soil, she was absorbed into the roots of a maple tree and made her way through the tree into the leaf where she was released into the air. She condensed with some of her friends and made a cloud.

Sample Puzzle: Corey the carbon atom was part of a tree branch, until one day he ended up in the air as part of a carbon dioxide molecule. How did he get there?
Sample Answer: The branch that Corey was a part of was shaded out by a competing tree. Fungus began to grow on the branch until it weakened and fell to the ground. That branch was collected by a human who burned it in their campfire. Through the burning of the branch Corey was released into the air as a gas.

Connecting Concepts: All things are made up of atoms. How are molecules used over and over again? How do nutrients move from living to non-living things? What are some important nutrients for living things?

Organism

A living thing.

Photosynthesis

The process by which plants and most other producers take nutrients out of the atmosphere and/or soil and use sun energy to convert them into sugar. A majority of the mass in plants comes from two sources: carbon energy, CH_2O (sugar, a carbon compound) + O_2. The sugars produced in photosynthesis are the building blocks for making other substances like complex carbohydrates, proteins and fats.

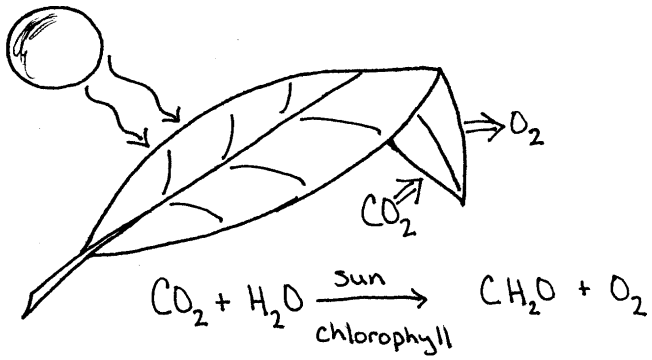
Accompanying Activity: Food Factory

Goal: to understand photosynthesis by using the metaphor of a factory.
Materials Needed: your imagination and maybe a chalkboard.

Draw a leaf on the chalkboard and explain to your students that this is not only a tree leaf but also a highly productive food factory. Go through the process of photosynthesis with your students using the metaphor of a factory. Listed below are some terms and analogies that may be helpful.

Raw materials: carbon dioxide (CO_2) and water (H_20).
Power source: the sun.
Product: CH_2O (simple sugar)
By-Product: Oxygen (O_2)

$CO_2 + H_2O \rightarrow CH_2O + O_2$



Your students do not have to understand the exact chemistry of photosynthesis in order to grasp the idea that sugar is being produced from carbon dioxide and water.

Connecting Concepts: How do different types of organisms get their nutrients? What nutrients are involved in photosynthesis? (carbon, hydrogen and oxygen) How are plants dependent on non-living things?

Producer

Producers are organisms that can produce their own food, most through the process of photosynthesis.

Accompanying Activity: (See Photosynthesis or Consumer)

Productivity

How much living mass the producers in an area can generate in a given amount of time.

Accompanying Activity: Rank An Ecosystem

Goal: to look at several different ecosystems in terms of their levels of productivity.
Materials Needed: pictures of several different ecosystems-- if you completed the ecosystem mural activity than

you can use the student's ecosystem murals.

This activity is pretty simple. Students examine photos or murals of different ecosystems and arrange them in order from least to most productive. It is often helpful to give students guidelines for such a scale. For example, have a picture of a desert to represent the least amount of productivity and a picture of a densely vegetated forest to represent the most productivity.

Connecting Concepts: Which ecosystems are the most productive? Which are the least? Can the students think of any abiotic factors that might affect the level of productivity in an ecosystem? How is productivity different from diversity? Could an ecosystem be very productive but not very diverse? (Yes-- for example, the salt marsh ecosystem is very productive, but only supports a few species of plants and animals.)

Succession

Change in the composition of an ecosystem as the available competing organisms (and especially the plants) respond to and modify the environment.

Accompanying Activity: Landscape Journals

Goal: to develop an awareness for the natural history of a specific area and what kinds of disturbance may have shaped that history.

Materials Needed: pre-made worksheet with clues to a secret ecosystem, pencils.

Students should be given a worksheet for their landscape journals. This worksheet can have clues that identify a specific ecosystem close by the school or green directions to a specific area or ecosystem near the school. An example of a green direction would be; "walk out the front door of the school and turn right when you reach the large oak tree." When students reach the area/ecosystem they should record any evidence of disturbance. They should be able to find at least one example of natural disturbance and one example of human impact disturbance. Have the students do a brief sketch of the area. When you return to school have the students draw what they think this area might have looked like 100 years ago, or 100 years into the future. (The accompanying activity for disturbance is an effective preface to this activity.)

Connecting Concepts: Can ecosystems change over time? What kinds of things produce dramatic change in an ecosystem? What kinds of things produce more gradual change in an ecosystem?

Watershed

An area of land where all the water drains into one large river that eventually empties into the ocean.

Accompanying Activity: Surf Your Watershed

Goal: to familiarize students with the watershed in which they live.

Materials Needed: multiple copies of local and regional maps of your area, internet access is helpful but not necessary for obtaining these try www.epa.gov/surf.

Students should research what major bodies of water are closest to their homes. Using the local maps have them trace the stream closest to their homes to a major body of water; ocean, major river or lake. You can demonstrate this first with the stream or river closest to your school. Using the regional maps, students can trace the larger bodies of water to find where they ultimately meet the ocean.

Connecting Concepts: Bodies of water connect different ecosystems. What kinds of things can be transported between different ecosystems by a body of water? What does it mean to be downstream of somebody or something? How can people affect other people and places through their watershed?

Weather

The day to day variations of the atmosphere in a given area with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness.

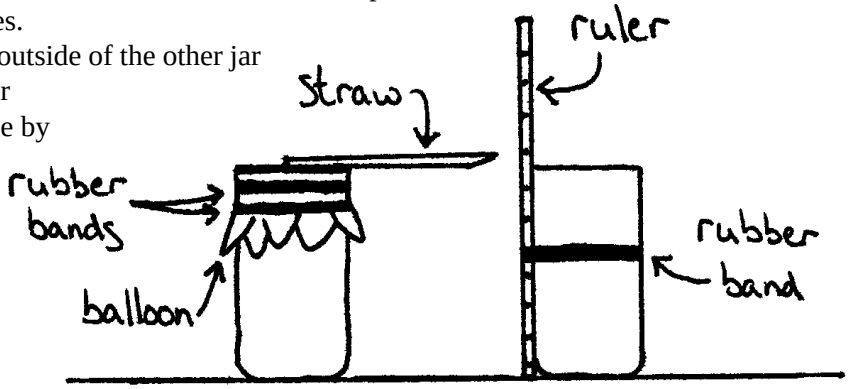
Accompanying Activity: Weather Predictors

Goal: to follow weather patterns from day to day, to begin to understand the forces that cause weather changes.
Materials Needed: a balloon, two empty jars, three rubber bands, a drinking straw, tape, a ruler, paper and pencil, (optional; thermometer, cloud chart, yarn, compass)

For the first part of this activity the students should designate part of their notebooks to be their Weather Journal. Each morning assign different students the task of observing different weather phenomena. This can be done by observation or by using some simple tools. Post a thermometer outside the classroom window to determine temperature. Using a cloud chart students can observe what type of clouds are in the sky and how much of the sky they are covering (e.g.. 50%, 75%). Students can figure out where the wind is coming from by going out into the schoolyard and dangling a piece of yarn-- you may want to use a compass. After the first few times, this activity need only take a few minutes of your day. After a few weeks students can examine their data and look for weather patterns.

For the second part of this activity students will build their own barometers. This activity helps to illustrate what we are talking about when we talk about air pressure and how that pressure creates weather systems.

1 Cut off the neck of the balloon and cut the balloon up one side
2 Stretch the balloon over the top a jar and wrap two rubber bands around it to keep it in place
3 Cut one end of the straw into a point. Tape the other end of the straw on top of the stretched balloon so it hangs off the edge of the jar about six inches.
4 Using a rubber band attach the ruler to the outside of the other jar so it is standing up straight alongside the jar
5 Set the jars in a safe spot. Place the jars side by side so that the straw almost touches the ruler.
6 Check the barometer you have built several times a day by recording the number indicated by the straw. Do this for several days, and record the results in the Weather Journal.



Connecting Concepts: Do you notice any patterns in the weather in your area? What is the weather like when the straw points high? What is the weather like when the straw points low? What causes changes in the weather?

Credits

The activity for building your own barometer in *Weather Predictors* was reproduced from: Archer, Cheryl Snow Watch Kids Can Press Ltd. Toronto, Canada, 1994.

All illustrations by Kim Schutsky, FBES Naturalist, March 2001.