Santa Cruz County

Outdoor Science School

Classroom Teacher Curriculum Guide

2016-2017

Overview of the Outdoor Science School Teaching Philosophy

We have very much enjoyed working on our recent curriculum revisions with the goal of aligning our curriculum with the Next Generation Science Standards and continuing to foster a reverence for the natural world in the students that we teach through constructivist learning. Our naturalists will lead students through the field study classes in search of exploring four ESSENTIAL QUESTIONS; How does matter move through the ecosystem? How do organisms survive in their environment? How can we use scientific investigation to learn about the world? How am I a part of a watershed?

During field study classes at the Outdoor Science School we strive for…

Less of this…	***More of this…***
• Telling facts	• Asking students questions
• Delivering information through talks, chants and activities	• Opportunities for students to explore, observe, investigate and make sense
• Vocabulary memorization	• Meaning-making
• Games and simulations	• Exploration of nature
• Activities that are demonstrations of science concepts	• Activities that guide students to explore and make sense of the natural world
• Instructor-centered instruction	• Student-centered instruction
• Students as a passive audience	• Students as active individuals exploring and discussing ideas
• The scientific method	• Authentic practices of science used to investigate the natural world
• Naming of organisms	• Observing and getting to know organisms
• Narrow questions	• Broad questions
• Content delivery at beginning of hikes	• Learning cycle based instruction on hikes
• Students regurgitating information	• Open-ended discussions with students
• Correcting students wrong ideas	• Helping students adjust, build and expand on their ideas
• Telling	• Listening
• Entertaining	• Engagement

The Next Generation Science Standards

The NGSS outline the core ideas and practices in science that students should master in order to achieve college and career readiness. The focus of the NGSS is less on memorization of facts and more on scientific processes and overarching concepts that students can understand on many different levels as they grow through their K-12 school career. The following is an overview of the framework.

The Three Dimensions of the Framework

1. SCIENTIFIC AND ENGINEERING PRACTICES

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating and communicating information

2. CROSSCUTTING CONCEPTS

1. Patterns
2. Cause and Effect: Mechanism and explanation
3. Scale, proportion and quantity
4. Systems and system models
5. Energy and matter: flows, cycles and conservation
6. Structure and function
7. Stability and change

3. DISCIPLINARY CORE IDEAS

PHYSICAL SCIENCES

PS1: Matter and its interactions
PS2: Motion and stability: Forces and interactions
PS3: Energy
PS4: Waves and their applications in technologies for information transfer

LIFE SCIENCES

LS1: From molecules to organisms: Structures and processes
LS2: Ecosystems: Interactions, energy, dynamics
LS3: Heredity: Inheritance and variation of traits
LS4: Biological evolution: Unity and diversity

EARTH AND SPACE SCIENCES

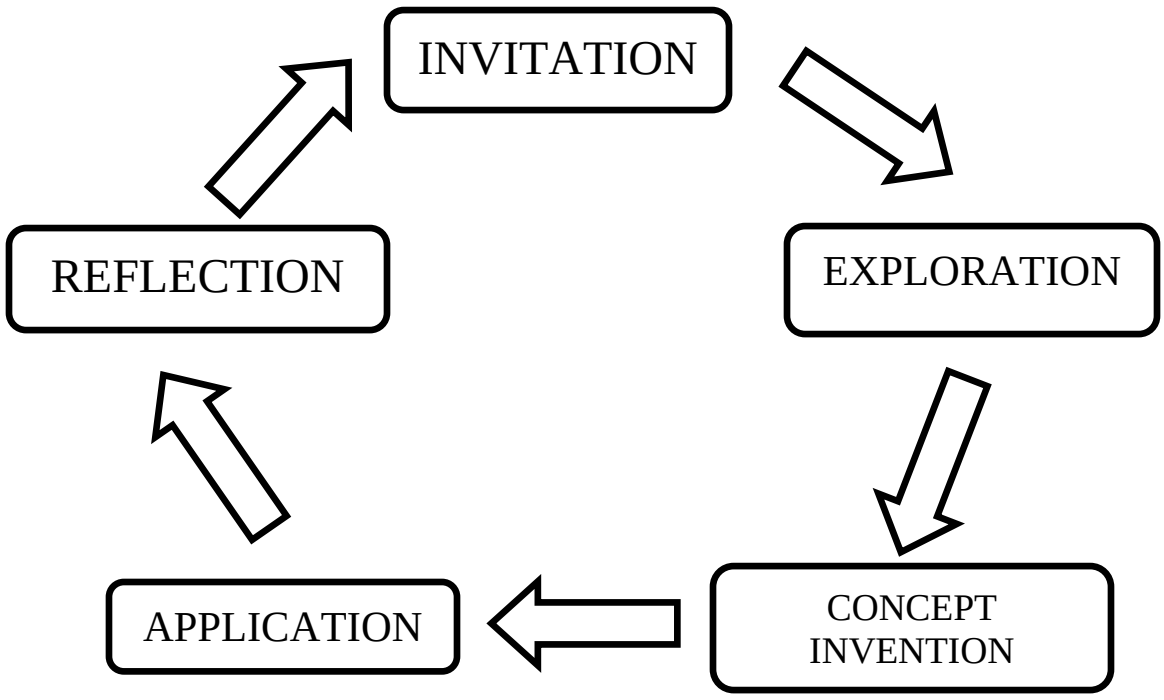
ESS1: Earth's place in the universe
ESS2: Earth's systems
ESS3: Earth and human activity

ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

ETS1: Engineering design
ETS2: Links among engineering, technology, science and society

Learning Objectives at the Santa Cruz County Outdoor Science School

At Outdoor Science School we focus on delivering curriculum in ways that can't be achieved in the classroom. Our instruction is based on a constructivist philosophy and on the learning cycle which includes the following stages of learning (from the BEETLES project www.beetlesproject.org):



The naturalists will plan activities in the field designed to address our four ESSENTIAL QUESTIONS and to meet our learning objectives. They are adept at assessing the students' prior knowledge and adjusting how they approach the objectives each week. As it is in any variable learning environment, there is a possibility that not all naturalists will reach each learning objective in the limited amount of time that they have with your students. If you would like the naturalists to focus, specifically, on certain questions and objectives and/or to modify their approach to meeting the learning objectives when teaching your students (e.g. striving for more advanced discussions, focus on exploration time, etc.), please let them know during the Teacher/Naturalist meeting on the afternoon of your arrival day.

The following two pages list our learning objectives and their alignment with the Next Generation Science Standards' Scientific Practices and Disciplinary Core Ideas.

***Note: We are continually working to improve the quality of our instruction and may add to or revise these learning objectives throughout the school year as necessary. As always, we welcome your feedback!*

Science Practices: Observation and Investigation	Students will:	
	- Discuss such questions as, "What is science?" and, "Why is it important?	SP1
	- Ask questions about the natural world around them	SP1
	- Deepen their observation skills through guided observation activities	
	- Work with their field study group and naturalist to plan an investigation of natural phenomena in the field	SP3
	- Collect, analyze and interpret data (through words, drawings, numbers, graphs, etc.) and construct explanations of findings	SP3,4,6
	- Distinguish evidence from opinion and use evidence to back up conclusions	SP7
	- Engage in scientific argument and discussion	SP7

Disciplinary Core Ideas	**Life Sciences**	**From Molecules to Organisms: Structures and Processes**	Students will:	
			- Make detailed observations about the characteristics of organisms in the redwood forest	
			- Examine how different structures perform different survival functions for organisms (e.g. growth, reproduction, protection from predators and environmental factors, etc.)	LS1.A; LS1.C
			- Define and find examples of various stages of plant and animal life cycles	LS1.B
			- Compare human (diurnal) senses to those of nocturnal and crepuscular animals	
		Ecosystems: Interactions, Energy, and Dynamics	Students will:	
			- Explore the roles that physical (abiotic) components such as sunlight, soil, water, and air play in an ecosystem (i.e. providing food, water, shelter, etc.)	LS2.A
			- Find evidence of interdependence between organisms and the environment (e.g. food chains, food web)	LS2.A
			- Discuss the way matter cycles and moves through ecosystems	LS2.B
			- Debate the relative health of observed ecosystems and effects of introduced species or environmental changes	ESS3.A; ESS3.C
		Heredity: Inheritance/ Adaptations and Variations of Traits	Students will:	
			- Discuss how inherited traits/adaptations may help animals and plants survive to reproduce	LS3.A
			- Discover variation in the traits of plants, animals, and fungus in the forest (e.g. differences in leaves, teeth, seeds, feathers, etc.)	LS3.B
		Biological Evolution: Unity and Diversity	Students will:	
			- Find evidence of how changes in habitat can be beneficial or harmful to different species (e.g. wildfire, logging, drought)	LS4.C

Disciplinary Core Ideas (cont.)	**Earth and Space Sciences**			
		Earth's Place in the Universe	Students will:	
			- Observe the night sky and any visible constellations/asterisms, planets, and the moon	ESS1.A; ESS1.B
		Earth's Systems	Students will:	
			- Define water cycle and watershed	ESS2.C
			- Identify Corralitos Creek, the Pajaro River, and the Pacific Ocean on a watershed map	ESS2.B
			- Conduct a field investigation to determine stream health and/or the health of the surrounding ecosystem including (but not limited to): * Measuring the air and water temperature * Measuring the pH and turbidity of the water * Surveying the evidence of human activity and impact * Collecting macroinvertebrate specimens and identifying their pollution tolerance with journal reference	SP3,4,6,7
			- Examine sedimentary rocks and their variable mineral components	ESS2.A; ESS1.C
			- Investigate and identify the causes and effects of erosion	ESS1.c; ESS2.A
		Earth and Human Activity - Conservation and Stewardship	Students will:	
			- Discuss the implications of human impact on the redwood forest	ESS3.A; ESS3.C
			- Identify natural resources and propose variable solutions to overuse of natural resources	ESS3.A
			- Examine the effects of logging and wildfire on the redwood forest ecosystem	ESS3.A; ESS3.C
			- Practice conservation techniques in daily routines and build one's sense of civic responsibility	ESS3.C

Personal Growth	Students will:
	- Become more comfortable being outdoors and in nature
	- Sit quietly in nature and reflect on one's surroundings
	- Build one's sense of place and personal connection to nature
	- Develop one's sense of independence, responsibility, and accountability
	- Increase one's self-confidence and face personal challenges
	- Explore one's own creativity and self-expression
	- Participate in team building challenges
	- Build interpersonal relationships with new people while respecting different cultures, backgrounds and abilities

Santa Cruz County Outdoor Science School
Relevant Vocabulary

As mentioned in our teaching philosophy, and in support of the Next Generation Science Standards, our focus at the Outdoor Science School is on constructing meaning and understanding of scientific concepts rather than memorizing vocabulary. It may, however, be helpful for your students to be introduced to some of the scientific terms that they may be exposed to during their field study class.

Abiotic – The non-living parts of an ecosystem (water, rocks, soil, etc.)

Adaptation – A structure or behavior that allows an organism to survive in its environment. In science an adaptation is an inheritable trait and not the same as a single organism changing its behavior to "adapt" to its surroundings. Populations adapt, individuals do not.

Aquatic – Growing or living in or near water

Bacteria - A large group of unicellular microorganisms that have cell walls but lack organelles and an organized nucleus.

Biotic – Living elements including animals, plants, fungus and bacteria

Carbon Dioxide – A chemical plants need to produce their own food in the process of photosynthesis

Climate - The weather conditions prevailing in an area in general or over a long period of time.

Community – A group of living things within a particular type of area (forest, meadow, pond, etc.)

Conservation - Preservation, protection, or restoration of the natural environment, natural ecosystems, vegetation, and wildlife

Consumer – A living thing that gets energy by consuming or eating other things

Crepuscular – An animal that is active at dawn or dusk

Cycle – A series of events or phenomena that recur regularly and usually lead back to the starting point.

Decomposer – An organism that obtains its energy by breaking down waste products and dead organisms

Diurnal – An animal that is primarily active and awake during the day

Ecology – The scientific study of the relationships between living and non-living things in the environment

Ecosystem – An area where living and nonliving things interact. All components are linked together through energy and matter interactions.

Energy – Usable power that can exist in several forms including; heat, kinetic or mechanical energy, light, potential energy, electrical.

Evidence - The available body of facts or information indicating whether a belief or proposition is true or valid.

Evolve – To develop a characteristic by evolutionary processes

Evolution – Change in the properties of populations of organisms that transcend the lifetime of a single individual.

Explanation – A statement or account that makes something clear.

Extinct – No longer existing or living; as in an extinct species.

Food Chain – A hierarchal series of organisms, each dependent on the next as a source of food.

Food Web – Show how plants and animals are interconnected by different paths.

Fungus - Any of a group of unicellular, multicellular, spore-producing organisms feeding on organic matter, including molds, yeast, mushrooms, and toadstools

Habitat – The area where an animal naturally lives. It must include food, water, shelter and space suitable to the animal's needs

Inherit – To receive a characteristic from one's parents by genetic transmission

Interact – To act in such a way as to have an effect on one another

Interdependence – The concept that everything in an ecosystem or community is related to everything else

Invertebrate – An animal that does not have a backbone (insects, worms, banana slugs, jellyfish, squid, etc)

Macroinvertebrate - Organisms without backbones, which are visible to the eye without the aid of a microscope

Matter – A substance which has mass and occupies space

Natural Resources - Materials or substances such as minerals, forests, water, and fertile land that occur in nature and are used by humans for survival and for economic gain.

Nocturnal – An animal that is primarily active and awake at night

Observation – The action of observing something carefully in order to gain information

Organism – A living thing that has the ability to function independently, eg. plant, animal, fungus, bacteria, etc.

Oxygen – A chemical that animals need to breathe. It is a waste product of photosynthesis and is released by plants

Photosynthesis – The process by which green plants utilize sunlight, carbon dioxide, water and nutrients to produce their own food

Predator – An animal that hunts other animals for food

Prey – An animal that is eaten by predators

Producer – An organism (usually a green plant) that produces its own food

Related – Belonging to the same family, group or type; connected

Riparian – A community in an area of moving water such as a creek or a river

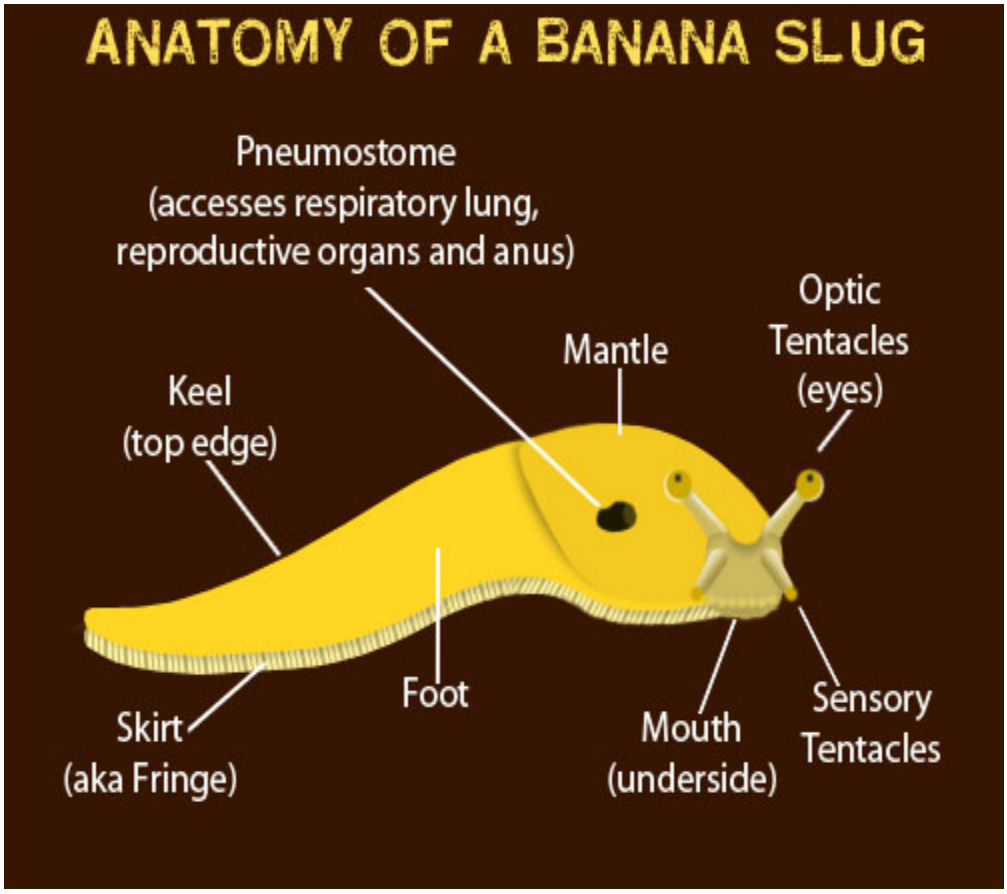
Soil - The upper layer of earth in which plants grow, a black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles

Species - Generally a group of individual, related organisms that are capable of interbreeding to produce fertile offspring in nature

Symbiosis - Interaction between two different organisms living in close physical association, typically to the advantage of both.

Vertebrate – An animal that has a backbone. The 5 types of vertebrates are: mammals, reptiles, amphibians, fish and birds

Watershed - An area or region drained by a river, river system, or other body of water.



Vocabulario de la Escuela de Ciencia al Aire Libre

Abiótico - Las partes no vivas de un hábitat (agua, rocas, suelo, etc.).

Adaptación - Un comportamiento o característica que le ayuda a una planta o animal a sobrevivir.

Algas - Una planta simple que no florece y es parte de un gran grupo que incluye a las algas marinas y muchas formas unicelulares. Las algas contienen clorofila, pero carecen de tallos verdaderos, raíces, hojas y tejido vascular.

Anfibios - Un tipo de animal que vive dentro y fuera del agua. Los anfibios tienen piel viscosa y muchos pueden respirar a través de su piel.

Acuático - Crece o vive en o cerca del agua.

Astronomía - La rama de la ciencia que estudia los objetos celestes, el espacio y el universo físico como un todo.

Bacterias - Un grupo de microorganismos unicelulares que tienen paredes celulares, pero carecen orgánulos y núcleo organizado.

Biótico - Seres vivos como animales, plantas, hongos y bacterias.

Camuflaje - La capacidad de un ser vivo para mezclarse con el entorno.

Dióxido de Carbono - Un químico que las plantas necesitan para producir su propia comida en el proceso de la fotosíntesis.

Carnívoro - Animal que principalmente se alimenta comiendo otros animales.

Chaparral - Comunidad de plantas matorrales que consta principalmente de arbustos enmarañados y arbustos espinosos, se encuentran principalmente en California y en la parte norte de la península de Baja California, México.

Chungo - materia vegetal en descomposición que cubre el suelo debajo de los árboles.

Clorofila – Químico en las hojas de las plantas que le brinda el color verde a la planta y le permite a la planta realizar la fotosíntesis.

Clima - Las condiciones meteorológicas dominantes en una zona en general o durante un largo período de tiempo.

Comunidad - Un grupo de seres vivos dentro de un determinado tipo de área (bosque, pradera, estanque, etc.).

Conífero - Un árbol que tiene conos y agujas.

Conservación - Preservación, protección y restauración del medio natural, los ecosistemas naturales, la vegetación y la vida silvestre.

Constelación - Un grupo de estrellas que forman un patrón reconocible que es tradicionalmente llamado de acuerdo a su forma aparente o identificada con una figura mitológica.

Consumidor - Un ser vivo que obtiene energía comiendo o consumiendo otras cosas.

Crepuscular - Un animal que está activo durante el amanecer o atardecer.

Cuarzo - Un mineral duro de color blanco o sin color, compuesto de dióxido de silicio, que se encuentra ampliamente en las rocas ígneas, metamórficas y sedimentarias. A menudo teñido por impurezas (como en citrino amatista y cuarzo ahumado).

Caduco - Un tipo de planta que pierde sus hojas en el otoño.

Cuenca - Un área o región drenada por un río, sistema del río u otro cuerpo de agua.

Depredador - Un animal que caza otros animales.

Descomponedor - Un organismo que obtiene su energía al descomponer los desechos y organismos muertos.

Desgaste - El proceso de descomposición de la roca por fuerzas mecánicas y químicas, tales como, agua / hielo oxidación y el crecimiento de plantas (raíces).

Diurno - Un animal que principalmente está activo y despierto durante el día.

Ecolocación - El proceso de navegación y la búsqueda de alimentos mediante el sonido escuchando el eco. Utilizado por los murciélagos, delfines y otros animales.

Ecología - El estudio científico de las relaciones entre los seres vivos y no vivos en el medio ambiente.

Ecosistema - Un espacio donde los seres vivos y no vivos interactúan. Todos los componentes están unidos entre sí a través de la energía y el flujo de nutrientes.

Erosión - El desgaste del suelo o de la roca causado por el agua, el viento, las personas, los animales, etc.

Estrella - Un punto luminoso fijo en el cielo nocturno que es un cuerpo grande conformado por gases calientes que irradia energía derivada de las reacciones termonucleares que ocurren en su interior.

Falla - Una grieta prolongada en el cuerpo de roca, caracterizada por el desplazamiento relativo y la discontinuidad de los estratos en ambos lados de una superficie particular.

Feldespato - Un mineral abundante responsable por la formación de rocas típicamente en forma de cristales pálidos o sin color y que consiste en aluminosilicatos de potasio, sodio y calcio.

Hongo - Cualquiera de un grupo de unicelulares, pluricelulares productoras de esporas organismos que se alimentan de materia orgánica, incluyendo hongos, levaduras, y setas.

Galaxia - Un sistema de millones o billones de estrellas, junto con gas y polvo, unidos por la atracción gravitacional.

Geología - El estudio de la tierra, su historia, estructura, y las fuerzas que la afectan.

Gneis - Una roca metamórfica con una estructura de bandas foliadas, normalmente de grano grueso y consiste principalmente de feldespato, cuarzo y mica.

Hábitat - La zona donde vive un animal naturalmente. Debe incluir comida, agua, refugio y espacio adecuado a las necesidades del animal.

Herbívoro - Un animal que come plantas principalmente.

Hiel - Un crecimiento anormal formado en las plantas y los árboles, esp. robles, en respuesta a la presencia de larvas de insectos, ácaros, hongos.

Hipótesis - Una estimación comprobable, educada, explicación o respuesta a una pregunta.

Interdependencia - El concepto de que todo en un ecosistema o comunidad tiene que ver con todo lo demás.

Invertebrados - Un animal que no tiene una columna vertebral (insectos, gusanos, babosas de banano, medusas, calamares, etc.).

Liquen - Un organismo simbiótico formado por hongos y algas.

Mamíferos - Un animal vertebrado de sangre caliente de una clase que se distingue por la posesión de pelo o pelaje, la secreción de leche por las hembras para la alimentación de los jóvenes, y (típicamente) el nacimiento de crías vivas.

Musgo - Una pequeña planta verde sin flores que carece de verdaderas raíces, crece en las alfombras o cojines bajos redondeados en hábitats húmedos y se reproducen por medio de esporas liberadas por cápsulas acechadas.

Recursos Naturales - Materiales o sustancias, tales como minerales, los bosques, el agua y la tierra fértil que ocurren en la naturaleza y son utilizados por los seres humanos para sobrevivir y para obtener beneficios económicos.

Roca Metamórfica - Roca cambiada por el calor y la presión.

Necrófago - Un animal que se alimenta de animales muertos.

Nocturnal - Un animal que es activo y despierto principalmente por la noche.

Oxígeno - Un elemento químico que los animales necesitan para respirar. Es un producto de desecho de la fotosíntesis y es liberado por las plantas.

Floema - Parte vascular de una planta que transporta nutrientes desde las hojas al resto de la planta.

Fotosíntesis - el proceso por el cual las plantas verdes utilizan la luz solar, el dióxido de carbono, el agua y nutrientes para producir sus propios alimentos.

Pabellón - Los árboles superiores o ramas de los árboles en un bosque, formando una capa más o menos continua de follaje.

Planeta - Un cuerpo celeste que se mueve en una órbita elíptica alrededor de una estrella.

Placa Tectónica - La teoría de que la corteza de la Tierra está dividida en placas que se mueven.

Presa - Un animal que es comido por otros animales.

Productor - Un organismo (generalmente una planta verde) que produce su propio alimento.

Reptil - Un vertebrado de sangre fría de una clase que incluye; serpientes, lagartos, cocodrilos y tortugas. Se caracterizan por tener una piel seca y escamosa, y por lo general ponen huevos de cáscara blanda en tierra.

Ribereña - Una comunidad en una zona de agua en movimiento, como un arroyo o un río.

Roca Ígnea - Roca formada por el enfriamiento y endurecimiento de magma.

Roca Sedimentaria - Sedimentos que se transportan, deposita en el agua y luego se comprime en roca.

Suelo - La capa superior de la tierra en la que crecen las plantas, un material marrón oscuro o negro que suelen consistir en una mezcla de restos orgánicos, arcilla y partículas de roca.

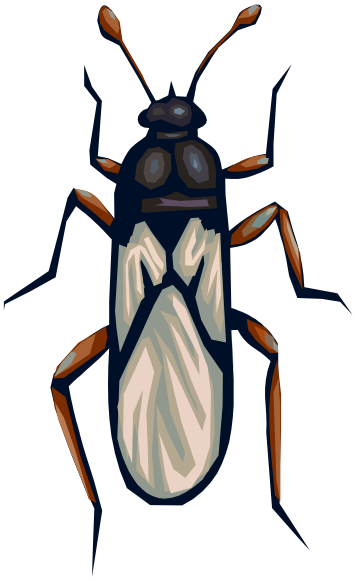
Siempre verde - Una planta que conserva parte o la mayoría de sus hojas durante todo el año.

Systema Solar - La colección de ocho planetas y sus lunas en órbita alrededor del sol, junto con pequeños cuerpos en forma de asteroides, meteoroides y cometas.

Simbiosis - La interacción entre dos organismos diferentes que viven en asociación física cercana, por lo general en beneficio de ambos.

Vertebrados - Un animal que tiene columna vertebral. Los 5 tipos de vertebrados son: mamíferos, reptiles, anfibios, peces y aves.

Xilema - Parte vascular de una planta que mueve el agua y los nutrientes desde las raíces hasta las hojas.



SUGGESTED VOCABULARY ACTIVITIES

Fill in the Blank
Students make up sentences, leaving blanks for vocabulary words. They exchange papers with another student and fill in each other's blanks.

Flash Cards
Students make flash cards with an illustration on one side and the word on the back. Then they give mini lessons to other students.

Interview an Animal, Tree, Rock, Etc.
Students write interview questions using the vocabulary words. They research the things to be interviewed then interview each other.

Jingle or Poem
Students write a jingle or poem alone or with a partner using as many vocabulary words as possible. The final product is presented to the class.

Matching
Students create a worksheet, scrambling the words and their definitions. They exchange papers and match the words to the correct definitions.

Pantomime
Using only motions and gestures, students act out definitions. This can be used in a game format with team against team.

Rap Song
Students create a rap song, alone or with a partner. They include a designated number of vocabulary words and their definitions. The song is presented to the class.

Story
Students create a cooperative story with a partner, using all the words.

Stylize
Students write each vocabulary word artistically, such as painting or decorating each word with symbols and appropriate colors.

SUGGESTED ACTIVITIES FOR SOCIAL SKILLS PREPARATION

One of the goals of Outdoor Science School is for students to learn responsibility and cooperation through group living. Making new friends and getting along with others is part of the experience at Outdoor Science School.

SUGGESTED ACTIVITIES:

Personal Goals

Write the list of character traits on the board

cooperates	follows directions	listens
brags	thinks they're better	polite
likes to laugh	friendly	caring
positive	bossy	gossips
kind	truthful	respects others
teases	whines a lot	considerate
complains	understanding	selfish

Students should:

Draw a large cabin on a piece of paper.

Choose words on the list that would best describe the ideal person to share a cabin with.

Write the good traits inside the cabin and the traits they don't want outside the cabin.

Have the students draw a large mirror on a piece of paper

They should repeat the exercise choosing words that describe how they will act at Outdoor Science School.

Write the traits that would best describe them in the mirror.

Write the words that they hope would never describe them outside the mirror.

Situations

The following situations can be made into a role play or put onto cards and discussed in small groups.

1. Your best friend is homesick and misses his/her family. What can you do to help your friend?

2. Someone in your group started a rumor about your best friend. What could you do to stop the rumor? How could you help your friend feel better?

3. There is a student in your cabin who annoys you and you don't like it. You are getting very angry. What can you do to make the situation better? What could you do that might make matters worse? How could you solve the problem?

4. You notice that everyone at your lunch table knows each other except one person. How might he/she feel? What can you do to help make him/her feel more comfortable?

SUGGESTED REVIEW ACTIVITIES AND EXTENSIONS

The following activities are suggested to review and extend the Outdoor Science School experience. The materials can be displayed at open house, parent conferences, next year's parent orientation, etc.

Assembly
Give students an opportunity to share their experiences or lead songs they learned at Outdoor Science School in an assembly for next year's class.

Create a Newsletter
Include interviews from staff and teachers, comics, highlights of the week, menus, weather reports and other newsworthy events.

Draw a Mural/Art Creations
Students visually depict hikes and activities, including science concepts.

Make a Bulletin Board
Use photos, poems, hike descriptions, artwork, interesting science facts and short stories

Read and Discuss Related Books
The Desert is Theirs by Byrd Baylor
Hawk I'm Your Brother by Byrd Baylor
The Great Kapok Tree by Lynne Cherry
Dear Children of the Earth by Schim Schimmel
The Lorax by Dr. Seuss
The Whale's Song by Dyan Sheldon
Sierra by Diane Siebert
Just a Dream by Chris Van Allsburg
Old Turtle by Douglas Wood
Owl Moon by Jane Yolen

Write a Book/Create a Scrapbook
Each student contributes a page to a book including text and illustrations

Write Letters
Select a new friend from the other school or cabin group to be a pen pal, write advice to next year's class or write thank you notes to the Outdoor Science School staff.