

BIOLOGICAL SCIENCES

Introduction to Ecology

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INTRODUCTION TO ECOLOGY

Summary:

This lesson is classified as “beginner” in difficulty. Teacher familiarity with basic concepts of Ecology is recommended.

The students will be introduced to the concepts of biodiversity and interrelatedness through the exploration of the West Struve Slough, a habitat unique to the Watsonville wetland system, the only major coastal freshwater wetland area between Arcata and San Diego. Through this unit, students will begin to understand and learn to describe a stable environment. Students will also have the opportunity to describe or predict how interactions between the biotic and abiotic components of an ecosystem can impact the stability of that ecosystem. The students will examine the native flora and fauna populations, learning how different abiotic conditions such as the water, carbon, and nitrogen cycles provide an environment conducive to photosynthesis and respiration to support the flora and fauna species. By studying the ecosystem, the students will learn the ecological importance of biodiversity, interrelatedness, and the possible short and long-term effects of changes to local/ global climate and or human impact upon fragile ecosystems both locally and globally.

Subject Area(s): Biology

Integrated Science

Environmental Science

May also be applied in topic area discussions of Ecology and Human Impacts

Grade level(s): 9-10th grades

Lesson Duration/Instructional Sequence: 4 class periods

- 1 day for pre-assessment, introduction of basic concepts and vocabulary and use of the Model of an Ecosystem Visual Organizer.
- 1 day to check for understanding and application of basic concepts and vocabulary and use of the Model of an Ecosystem Visual Organizer. Allow students to acquire background information on Ecology and apply their understanding of biodiversity and its relationship to humans.
- 1 day for field exploration and the a completion of the data sheet
- 1 day for the synthesis/review of completed exploration and discussion of data.

California Content Standards:

Ecology, grades 9-12

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:
 - a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
 - b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of non-native species, or changes in population size.

- d. Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
- e. Students know a vital part of an ecosystem is the stability of its producers and decomposers.

Assessment: “Successful” is being defined as 75% complete and 70 % accurate

1. Successful completion of the anticipatory set and concept maps or pre-assessment of student understandings as related to the identified Learning Objectives
2. Successful completion of the Ecology vocabulary Word-squares
3. Successful completion of the Models of an Ecosystem examples
4. Successful completion of the Notes on Ecology Worksheet.
5. Successful completion of the Questions on Ecology Worksheet.
6. Successful completion of the Bumper Sticker
7. Successful completion of the data sheet and associated focus questions
8. Successful completion of the student created Model of the West Struve Slough ecosystem and answers to focus questions 1-6 from the data sheet

Learning Objectives:

1. Familiarize students with the basic vocabulary associated with the study of Ecology.
2. Provide students with a tool (“Model of an Ecosystem Visual Organizer”) that will allow students to describe and understand the relationships between the two main components of an ecosystem.
3. Provide an opportunity for students to understand the relationship between the concepts of biodiversity and interrelatedness.
4. Provide students with a mechanism to describe and understand the impacts of changes that can occur within an ecosystem.

Equipment, Materials, and Resources:

1. Student copies of the anticipatory set (copies for students and an overhead for the instructor)
2. Ecology vocabulary terms and definitions (overhead recommended)
3. Examples of word-squares (overhead recommended)
4. Example of the Model of an Ecosystem visual organizer (overhead recommended)
5. Student copies of Notes on Ecology and Questions on Ecology
6. Example bumper stickers
7. Student copies of Data sheets (overhead recommended)
8. Planet Earth DVD used to facilitate the practice/completion of the Model of an Ecosystem visual organizer
9. Equipment for the field trip: Contact Fitz WERC for the following items:
Binoculars, hand lenses, sediment corer, dip nets, colored pencils, water sampler (water grab) bird field Guides, plant field guides, amphibian and reptile field guides, etc.

Lesson Narrative/Procedure:

Day 1: Goals of 4-day unit are introduced in this day's lesson agenda. Describe this lesson in terms of its daily context in the identified content area.

- Identify learning objectives and communicate each to students in “student-friendly” language, for example by “I can ...” or “I am ... statements.”
 - a. “I am familiar with the basic vocabulary associated with the study of Ecology.”
 - b. “I can use the Model of an Ecosystem Visual Organizer to describe and understand the relationships between the two main components of an ecosystem.”
 - c. “I understand the relationship between the concepts of biodiversity and interrelatedness.”
 - d. “I can describe and understand the impacts of changes that can occur within an ecosystem.”
- Provide a means of communicating learning goals to students.
- A pre-assessment will ask students to state their understandings of each identified learning objective. The pre-assessment may be accomplished using a Likert-scaled assessment tool with choices for students to communicate their level of understanding for each CLO. Examples of this scale may be worded as:

1- I do not know this.
 2- I know a little of this.
 3- I know some of this.
 4- I know this very well.

1- I am not able to do this
 2- I am able to do part of this.
 3- I am able to do this well.

- Instructional activities/ materials sequenced for student learning and literacy development:
 - 5 min. Agenda for Day1 (Introduce learning objectives)
 - 10 min. Pre-assessment completed by the students/discussion
 - 10 min. Ecology Anticipatory set is completed
 - 5 min. Students help to generate a concept map illustrating background information and prior knowledge. Concept map is recorded by the instructor on the board or chart paper.
 - 10 min. Instructor shows a film and asks students to describe what they saw; possible outcomes include a list or a description of plants and animals as well as the presence or absence of water, soil, rock, mountains etc.
 - 25 min. Students complete word squares for the vocabulary terms.
 Students may be allowed to complete them in their native language and then translate them into English. Pictures that fit each vocabulary term might also be provided to some students. The instructor can choose to have students work on the word-squares as a group and present them to the class and create a class set. All word-squares can be graded on a sliding scale in regards to the complexity of the sentences and use of vocabulary terms.
 - 10 min. Students are introduced to the Model of an Ecosystem Visual Organizer.
 - 10 min. Students then ask questions and clarify vocabulary terms and use of the visual organizer.

- 8 min. Closure for the day and or as an extension the instructor may show another film clip and allow students to describe the new ecosystem using the visual organizer and new vocabulary terms.

Day 2: Background and in-class preparation. Students will learn the basic components of an ecosystem through direct instruction, viewing the Planet Earth DVD and a collaborative activity. Students will review and utilize the basic vocabulary associated with ecology and acquire new information through reading and structured note activity. As a culminating activity students will construct a bumper sticker meant to illustrate their understanding of the basic concepts of ecology, biodiversity, and their relationship to their lives (interrelatedness.)

- Describe this lesson in terms of its daily context in the identified content area.
- Provide a means of communicating learning goals to students.
- Instructional activities / materials sequenced for student learning and literacy development.

- 5 min. Students are reminded of the learning objectives and asked to identify those that have been completed thus far.
- 5 min. Warm-up: Show another film clip and have the students complete the Model of an Ecosystem Visual Organizer.
- 10 min. A selected student draws his/her example on the board and explains their answer. Students then ask questions and clarify vocabulary terms and use of the visual organizer.
- 20 min. Students read Notes on Ecology and complete the associated worksheets questions 1-7 (see materials.)
- 10 min. Teacher facilitates a review/ discussion of the Notes and Questions on Ecology questions 1-7. Note: Selected students may be allowed to complete this as a group and some questions may be answered with pictures or diagrams. Selected students may be allowed to answer the questions in their native language and translate the answers for homework. Selected students might also be allowed to answer fewer questions in order to gain a general understanding of the concepts. Selected students and or groups might be provided with more time to complete any of the assignments. All assignments can be graded on a sliding scale in regards to the complexity of the answers and completion of the work.
- 5 min. Instructor reviews the definition of biodiversity and then introduces the activity outlined in question 8 on the Questions on Ecology Worksheet.
- 15 min. Students complete the assignment in collaborative groups.
- 5 min. Selected groups will share/discuss their bumper stickers with the class. The bumper stickers can be displayed in the classroom for the rest of the unit.
- 15 min. Students are reminded of the field trip and as a class they are introduced to the site/ location and the data sheet that will be used the following day.

Day 3: Field trip to West Struve Slough. Students will be led on an exploratory hike by the instructors and Fitz WERC staff. Students will learn/practice techniques to identify common flora and fauna. Students will also make observations and inquiries into how the abiotic

conditions of West Struve Slough affect the flora and fauna. Three prompts provided by the instructor will also help to focus the student's attention on observations.

- Instructional activities / materials sequenced for student learning and literacy development:
 - 5 min. Students are reminded of the learning objectives and asked to identify those that we have covered thus far.
 - 8 min. Warm up: Students are shown a picture of an ecosystem and asked to list the biotic and abiotic components of the picture. They are then asked to complete the Model of an Ecosystem Visual Organizer.
 - 10 min. Students are then introduced to the tools that are available to them during their exploration of the ecosystem (West Struve Slough.)
 - 8 min. The instructor facilitates a review of the data sheet and the day's objectives are discussed. The field exploration commences.
 - 15 min. Student directed exploration of the site.
 - 40 min. Complete data sheet/ exploration.
- Differentiated instructional plans: All students are allowed some time to explore the area before they begin their work. All students are allowed to choose which tools they will employ in order to complete their exploration. All students are encouraged to record any data that they feel is relevant.
- Students will be provided a variety of tools to use during their exploration of the West Struve Slough area. Those tools include but are not limited to hand lenses, field guides, sediment corers, fish-nets, binoculars, and clip boards.

Day 4: Classroom analysis and review of West Struve Slough field trip. Students will discuss observations as well as use the field guides to confirm identifications of the flora and fauna. Students will discuss and answer the three focus questions in small collaborative teams. Each group will then elect a representative to present their answers/findings to the rest of the class. As a class the students will construct a new model of the West Struve Slough ecosystem using flora and fauna identified by the students during the field trip. The instructor will then facilitate a class discussion meant to explore the basic concepts of ecology; specifically the concepts of biodiversity, habitat destruction, and the effects of human impact on an ecosystem.

- Instructional activities / materials sequenced for student learning and literacy development:
 - 5 min. Students are reminded of the learning objectives and asked to identify those that we have covered thus far.
 - 15 min. Students will discuss observations as well as use the field guides to confirm identifications of the flora and fauna. Students will discuss and answer the focus questions 1-6 in small collaborative teams.
 - 25 min. Each group will use their data to create their own model of the West Struve Slough Ecosystem as well as provide answers to focus questions 1-6
 - 25 min. Selected students are asked to present their models to the class. Students are urged to discuss the model and ask any questions necessary to clarify the

model or understanding of the concepts. During this discussion/ presentation the instructor emphasises the use of vocabulary, and the discussion around human impact and our relationship to the ecosystem.

20 min. Post-assessment: Students are asked to create a poster that demonstrates their understanding of the learning objectives.

- Differentiated instructional plans: Working in collaborative groups allows students to support each other in terms of their use and understanding of the exploration activity and the learning objectives. All students are urged to use complete sentences, diagrams and when necessary their native language to demonstrate their understanding of the exploration activity and the learning objectives. All groups can be provided with additional time to complete the assignment.

ECOLOGY VOCABULARY

Impact: influence: effect: to have an impact or effect on or to influence or alter.

Wetland: land that has a wet and spongy soil, as a marsh, swamp, or bog.

Habitat: the natural environment of an organism or the place that is natural for the life and growth of an organism.

Organism: an individual living thing

Population: a group of organisms of the same species occupying the same area

Community: all the populations of organisms living in a specific area

Climate: the typical weather conditions in a specific area

Interrelatedness: the connection that exists between all components of an ecosystem or environment.

Environment: the surroundings or conditions in which an organism lives

Biodiversity: the sum of all the different types of organisms living on Earth or in a specific area.

Biotic: the living components of an ecosystem

Abiotic: the nonliving components of an ecosystem.

Ecosystem: a community and the physical environment that it occupies.

Vocabulario de la Ecología

Impacto: influencia: efecto: tener un impacto o un efecto sobre algo, influenciar o alterar algo.

Wetland: terreno que tiene un suelo mojado y esponjoso, como un pantano.

Hábitat: el ambiente natural de un organismo o del lugar que es natural para la vida y el crecimiento de un organismo.

Organismo: una cosa viva e individual

Población: un grupo de organismos de la misma especie que ocupa la misma área

Comunidad: todas las poblaciones de organismos que viven en un área específica

Clima: las condiciones atmosféricas típicas en un área específica

Entre relacionado: la conexión que existe entre todos los componentes de un ecosistema o un ambiente.

Ambiente: los alrededores o las condiciones en los cuales un organismo vive.

Biodiversidad: la suma de todos los diversos tipos de organismos que viven en la tierra o en un área específica.

Biótico: los componentes vivos de un ecosistema

Abiótico: los componentes sin vida de un ecosistema.

Ecosistema: una comunidad y el ambiente físico que ocupa.

Name: _____ Date: _____ Period: _____

Ecology Anticipatory Set:

For each of the following questions you may provide an answer in written form or you may diagram/draw your ideas.

- 1 What is an ecosystem?
- 2 What is biodiversity?
- 3 What does interrelated mean?
- 4 What are the components or parts of an ecosystem?
- 5 Can one component in an ecosystem cause changes to occur in other parts of an ecosystem?
- 6 What is a community?
- 7 What is a population?
- 8 What factors can cause an ecosystem to change?
- 9 What purpose do producers, consumers and decomposers have as part of an ecosystem?
- 10 What is a wetland?
- 11 Do we have wetlands near us? If so, what are their names?
- 12 Are wetlands important? Please explain why or why not.
- 13 Are you connected to your environment/ local ecosystem? Please explain your answer by giving an example of how you are or are not connected to your environment/ ecosystem.

Name: _____ Date: _____ Period: _____

NOTES ON ECOLOGY:

Main idea: Ecologists study the interactions between the environment and the organisms that live there

Ecology is the study of interactions between living things and their surroundings. The word ecology comes from the Greek word *oikos*, which means “house.” This makes sense if you think of the Earth as home and all organisms, living things, as members of Earth’s household. A German biologist created the word ecology in 1866 to encourage biologists to consider the ways organisms interact or affect each other. Until that time, most scientists studied a plant or an animal as though it existed in isolation as if it did not affect its surroundings, and its surroundings did not affect it.

1. What does the underlined section of the paragraph mean to you?

Main idea: An ecosystem includes both biotic and abiotic factors.

All ecosystems are made of living and nonliving components. These parts are referred to as biotic and abiotic factors. (Write the definitions of biotic and abiotic in the space provided below)

2. Biotic:

3. Abiotic:

Main Idea: Changing one factor in an ecosystem can affect many other factors.

Biodiversity:

Some areas of the world have an unusually large amount of biodiversity. That means that there are many different types of species living in one ecosystem or area. For example, tropical rain forests, which are moist and warm environments, cover less than 7% of Earth. However, Rainforests contain over 50 percent of the planet’s plant and animal species. This large amount of biodiversity is one reason why we should conserve Rainforest’s around the world.

An ecosystem is a complex web of connected biotic and abiotic factors. You may not always think of yourself as part of an ecosystem, but humans, like other species rely on the environment for survival. The complex relationships in ecosystems mean that a change in a single biotic or abiotic factor, or a few broken “strings” in the food web can have a variety of effects. The change may barely be noticed, or it may have a large impact. All species are affected by changes to the biotic and abiotic factors in an ecosystem. A change in climate, habitat destruction by humans, and changes in population size can

have a drastic impact on an ecosystem. Furthermore, the size of a population in any ecosystem is determined by the birth rates, immigration, emigration and death rates.

4. How do we rely on our environment for survival? Give an example

Main Idea: Producers provide energy for other organisms in an ecosystem.

All organisms must have a source of energy in order to survive. However, not all organisms get their energy in the same way.

All ecosystems depend on producers, because they provide the foundation for the ecosystems energy. Even animals that eat only meat rely on producers. For example, Gray wolves are consumers that eat elk and moose. Elk and moose are consumers that eat plants, like grasses and shrubs. Plants are producers that make their own food. If the grasses and shrubs disappeared, the elk and the moose would either have to find some other plants to eat or they would starve. The wolves would also be affected because they eat the moose and elk. Even though the wolves do not eat plants and grasses for energy, their lives are tied to the grasses and shrubs that feed their prey.

Most producers use the process of photosynthesis to capture energy from the sun. The producers need nutrients supplied by the decomposers to grow. As a result of this relationship, the producers and decomposers are responsible for making any ecosystem stable and productive. The producers are responsible for bringing energy into the ecosystem.

Name: _____ Date: _____ Period: _____

QUESTIONS ON ECOLOGY:

Main idea: Ecologists study the interactions between the environment and the organisms that live there

Ecology is the study of _____ between the
_____ and the _____ that live there.

1. What does this statement mean to you? Rewrite the above statement in your own words.
2. What is the definition of an ecosystem?
3. According to the reading, what does an ecosystem include?
4. In the space below draw the "Model of an Ecosystem." Be sure to include all of the components of an ecosystem.
5. What is biodiversity?
6. Why are rainforests considered to be diverse?
7. In your own words, tell me why you think biodiversity is important.
8. Create a bumper sticker that would show others what biodiversity is and why it is important to all of us. Your bumper sticker must include a picture. It must also include one to two sentences explaining why biodiversity is important to everyone. The bumper sticker must be color and must be completed today.