ECOLOGY UNIT PLAN

Key Idea: 1
Living things are both similar to and different from each other and from nonliving things.
Performance Indicator 1.1 – Explain how diversity of populations within ecosystems relates to the stability of ecosystems.

Key Idea: 6
Plants and animals depend on each other and their physical environment.

The fundamental concept of ecology is that living organisms interact with and are dependent on their environment. Interactions of organisms with each other and non-living parts of the environment result in a flow of energy and a cycling of materials that are essential for life.

Competition can occur between members of different species for an ecological niche. Competition can also occur within species. Competition may be for aboitic resources, such as space, water, air, shelter, and for biotic resources such as food and mates. Students should be familiar with the concept of food chains and webs.

Essential Question

Why doesn't any one type of living thing take over the world?

Desired Results

Enduring Understandings

- 1.1 – Students explain how diversity of populations within ecosystems relates to the stability of ecosystems
- 6.1 - Students explain factors that limit growth of individuals and populations.
- 6.2 - Students explain the importance of preserving diversity of species and habitats.
- 6.3 - Students explain how the living and non-living environments change over time and respond to disturbances.

Guiding Questions

- How do nonliving things affect living things?
- How do organisms depend on each other?
- What happens when one organism starts to increase in numbers?
- Why don’t carnivores take over the world?
- Who likes waste?
- How do populations change over time?
- Why is it good to be different?
- What happens to an ecosystem after a flood or a fire?

Knowledge and Skills

- Differentiate biotic and abiotic factors.
- Make food chains and webs
- Identify relationships between organisms
- Understand energy and biomass pyramids
- Explain the carbon and water cycles
- Explain carrying capacity
- Describe effects of limiting factors
- Understand that increased biodiversity yields increased stability and chances of survival
- Explain succession

Assessment Evidence

- Imagine that you are a plant. What abiotic factors are necessary to keep you alive and why each of them is important to you?
- Lab Report from aboitic factor's effect on plants lab.
- List the foods you ate for dinner. Make a food chain for each one.
- Concept maps on nutritional relationships and on the scientific method.
  In Central Park gray squirrels eat acorns and red-tailed hawks eat gray squirrels. Draw a food chain to show the flow of energy. Label any producers and consumers.
- Make a poster of pictures representing you niche in the world. Highlight areas in which you experience competition.
- "Eating lower on the food chain" is said to be better for the environment. Explain this concept clearly in a way that your English teacher will be able to understand easily.
- Write an essay from the point of view of a water molecule telling of your adventures in the water cycle.
- Write an essay from the point of view of a carbon atom telling of your adventures in the carbon cycle.
- Oh Deer! Lab Report
- Willow, Hare, Lynx Worksheet
- Biome poster and study guide
- In some areas rewards are given to hunters for killing certain animals. Animals such as coyotes and foxes are, therefore, hunted for the rewards. Farmers and ranchers often claim that these animals are bad because they kill farm animals, although these predators also kill wild animals such as rabbits, mice, and moles. Biologists think these animals are important to the areas where they are found. Write a short paragraph explaining why these animals are important and what might happen if they are all killed.
- Your neighbor decides that all bugs in the world are annoying and should be killed. Make a poster, video, song, poem, skit, or essay to convince your neighbor of the consequences of killing all bugs.
- Explain the similarities and differences between the terms "succession" and "evolution."

Learning Activities

- Abiotic Factor Plant Lab
  What is the effect of (a particular abiotic factor) on lentil growth?
- Draw food chains and web to accompany a specific story.
- Make a concept map of key terms.
- Describe effects on food chins of changing numbers of particular organisms.
- Play "Oh Deer!" (limiting factors)
- Kaibab Deer Lab (carrying capacity)
- Diversity Game
- Put pictures of stages of succession in order.

UNIT SKETCH

Essential Question: Why doesn't any one type of living thing take over the world?

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Essential and Guiding Questions	**Why doesn't any one type of living thing take over the world?**	How do nonliving things affect living things?		How do organisms depend on each other?	
Learning Opportunities	Answer question and list limiting factors which are then grouped into biotic and abiotic. Use Venn diagram to connect biotic, abiotic, and ecosystem. Look at a picture/drawing or outdoor setting list examples of biotic and abiotic factors.	Abiotic Factors plant Lab Part I	Abiotic Factors plant Lab Part II	Read story and draw food chains and a food web to accompany it. Label or color producers and consumers Vocabulary: producer consumer predator prey herbivore carnivore autotrophic heterotrophic	Concept maps of vocabulary plus new vocabulary: decomposer scavenger parasite host
Assessments and Reflection	Journal entry on essential question. Imagine that you are a plant. What abiotic factors are necessary to keep you alive and why each of them is important to you?	Problem, Hypothesis, Materials, and Procedure of Lab Report	Lab Report	List the foods you ate for dinner. Make a food chain for each one.	Concept Maps Make a concept map for the topic of "Lab Reports" using the words provided.
Standards: 1	1.2a	1.2a, 2.3, 2.4	1.1a, 1.2a, 1.3, 3.1, 3.3	1.2a	1.2a
4	Key Idea 6, 6.1e	6.1e	6.1e	1.1a, 6.1a, g	6.1a, g

Essential Question: Why doesn't any one type of living thing take over the world?

	Lesson 6	Lesson 7	Lesson 8	Lesson 9	Lesson 10
Essential and Guiding Questions	How do organisms depend on each other?	What happens when one organism starts to increase in numbers?	Why don't carnivores take over the world?	Who likes waste?	
Learning Opportunities	Concept Map presentations (Class grades presenters using rubric)	Make food chains/web about Borneo's DDT problems. Define niche as lifestyle. Describe effects of changes.	Use data to construct a bomass pyramid. Relate to energy pyramid.	Water cycle Nitogen cycle (George Washington Carver)	**Carbon cycle** (Holt EnvSci Invest3.2)
Assessments and Reflection	Presentations In Central Park gray squirrels eat acorns and red-tailed hawks eat gray squirrels. Draw a food chain to show the flow of energy. Label any producers and consumers. Explain what might happen to the hawks and squirrels if one year there was a shortage of acorns. Give reasons for your answer.	Make a poster showing pictures (drawings or cut-outs) of your niche in the world. Please indicate areas in which you experience competition.	Energy pyramids "Eating lower on the food chain" is said to be better for the environment. Explain this concept clearly in a way that your English teacher will be able to understand easily.	Write an essay from the point of view of a water molecule telling of your adventures in the water cycle.	Write an essay from the point of view of a carbon atom telling of your adventures in the carbon cycle.
Standards: 1	3.5b	1.2a	1.1a		
4	6.1a, g	1.1c, d, f, Key Idea 6, 6.1a, f	6.1b, c	6.1b	6.1b

Essential Question: Why doesn't any one type of living thing take over the world?

	Lesson 11	Lesson 12	Lesson 13	Lesson 14	Lesson 15
Essential and Guiding Questions	How do populations change over time?				Why is it good to be different?
Learning Opportunities	Construct deer food chain and pyramid. Play Oh Deer!	Oh Deer! continued	Kaibab Deer Lab (Carrying Capacity)	Biome Project	Diversity game
Assessments and Reflection	Lab Report	Willow, Hare, Lynx worksheet	**Lab Report Write a short paragraph explaining why predators are important and what might happen if they are all =killed.**	Project	Lab Report Your neighbor decides that all bugs in the world are annoying and should be killed. Make a poster, video, song, poem, skit, or essay to convince your neighbor of the consequences of killing all bugs.
Standards: 1			1.1c, 1.2a		1.1c, 1.2a
4	1.1c, d, e, 6.1d, f	1.1c, d, 6.1d, f	1.1f, 6.1d, f	1.1b	6.2a, 6.3a

UNIT SKETCH

Essential Question: Why doesn't any one type of living thing take over the world?

	Lesson 16				
Essential and Guiding Questions	What happens to an ecosystem after a flood or a fire?				
Learning Opportunities	Put pictures of stages of succession in order (Think, pair, share)				
Assessments and Reflection	Pictures Explain the similarities and differences between the terms “succession” and “evolution.”				
Standards: 1	1.2a				
4	6.3b, c				

Lesson # 1

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> Students are introduced to essential question: "Why doesn't any one type of living thing take over the world?"

Objectives

Students will be able to:

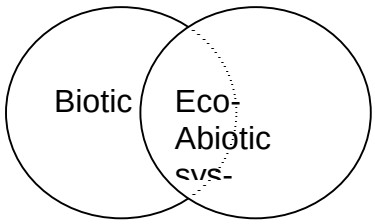
- **Differentiate biotic and abiotic**
- **Understand relationships among "biotic", "abiotic" and "ecosystem"**
- List some possible limiting factors.

New Terms:

biotic abiotic ecosystem limiting factor

Materials/Preparations:

Pictures of parts of ecosystems (optional)

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer, "**Why doesn't any one type of living thing take over the world?**" They can do this in journals or on separate paper. You will want to keep this paper to compare with the student answers at the end of the unit.	Writing (Motivation)
10	Students share answers with the class. • *Record the answers on the board* in short form (food, water, predators, etc.) Do this unobtrusively *in two columns*, biotic and abiotic. Do not label the columns.	Feedback
10	If the students have not noticed them already, *point out the two columns* you have made. • Have the students suggest headings for the two columns. (Students will probably suggest "living" and "nonliving.") • *Write* "biotic' and "abiotic" *on the board* and ask if anyone can figure out what they mean. Some related words which might help are: <u>bio</u>logy <u>bio</u>diversity <u>bio</u>graphy <u>a</u>theist <u>a</u>sexual <u>a</u>typical • Clearly *define the words* and correctly *label the columns*. • *Briefly introduce* the concept of limiting factors.	Compare and contrast Vocabulary development
5	*Define* ecosystem. *Make Venn diagram* of the terms biotic, abiotic, and ecosystem.  • *Draw circles on board.* • *Ask students* to fill in words.	Vocabulary development
10	Students use pictures of parts of ecosystems to identify and record biotic and abiotic factors. If pictures are unavailable, students can write about the	Assessment

	classroom environment, a schoolyard, or another nearby outdoor setting.	

Suggested Homework:

Imagine that you are a plant. Introduce yourself by telling me what kind of plant you are. Then tell me what abiotic factors are necessary to keep you alive and why each of them is important to you.

Standards Addressed

MST Standard 1 – 1.2a

MST Standard 4 – 1.1b, c, Key Idea 6, 6.1e

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> How do nonliving things affect living things?

Objectives

Students will be able to:

- Differentiate control and variable
- Determine problem question
- Write hypothesis with reason
- Understand criteria for procedure
- Use observations to develop scientific explanations
- Use various methods of representing and organizing data
- Insightfully interpret organized data
- Assess correspondence between the hypothesis and the actual result and reach a conclusion

New Terms:

control
independent variable
dependent variable

Materials/Preparations:

One bag of lentils, paper cups (in which to grow lentils), enough soil for each group to fill at least two cups, thermometers, pH paper, water, vinegar, bleach, oil, plant food

Lab Report Rubric

N.B. On the first day the students are not actually using the materials. The materials are to give them ideas. The materials listed above are suggestions. Include any materials you feel will help the students think. . (Lentils grow quickly, easily, and reliably but other seeds are fine.) For the actual experiments you may want students to use 5% (or less) solutions instead of full-strength liquids.

LESSON 2

Time (min)	**Development**	**Instructional Strategies**
5	Do Now: Please list as many abiotic factors that you can think of that might affect the growth of a plant.	Assessment
5	As a whole class students share information and *record* it *on the board*.	Feedback
15	***Explain* the upcoming project to the whole class. *** **Each group is going to study the effect of changing ONE abiotic factor while growing a plant from a seed. Each group will design and write up their own experiment. (You may want to discuss Redi's experiment in order to elicit the steps of the scientific method/lab report. It is important that students understand the meaning of "control" and "variable.")** **You may want to *have the students list abiotic factors* that they could change and *help them list some possible problem questions*. Problem questions will probably be in the form of, "What is the effect of _____ on lentil seed growth?"**	Direct Instruction / Motivation
5	Students choose partners, choose abiotic factors, and write problem questions.	Group Work
5	Students share and revise (if necessary) problem questions.	Peer Feedback

5	Students write hypotheses with partners. Hypotheses will probably be in the form of, “If ____ then_____ because _____”	Group Work

5	Establish criteria for writing lab report procedures (for example): Use command form Explain step by step Put each step on a different line Be neat Write in clear English Write with specific details Identify control and variable There are several ways this can be done. • **If you have time you could have a separate lesson in which students write directions to a third grader on how to do some task. The students can then look at those directions to determine the qualities that good directions have.** • **If you have less time you could provide samples of procedures and have students use these to determine the qualities that good directions have.** • If you have no extra time you could tell the students what you expect from their procedures. **Whichever method you choose you must either make or provide a rubric. One possible rubric for the entire lab report is attached.**	Rubric Development

* This lesson assumes a basic comfort with the scientific method and with writing lab reports. Students are also expected to understand concepts of sample size, control, and variable. Although control and variable are presented as new terms, this cannot be the only teaching of these words.

Suggested Homework:

Write list of materials and a clear, concise procedure for your lab, following the guidelines of the rubric.

LESSON 3 IS TO BE DONE ONCE THE STUDENT-WRITTEN PROCEDURES FROM LESSON 2 HAVE BEEN REWRITTEN AND APPROVED BY THE TEACHER

(There may actually be a lesson or two between these two lessons.)

LESSON 3

Time (min)	Development	Instructional Strategies
5	Do Now: Please explain what differences you might see in your two plants over time.	Motivation
5	As a whole class students share information. • *Write* ideas on the board.	Feedback
5	*Ask students* how they are going to keep track of the changes. • *Design a data table* with the students. This might include the date, plant color, plant height, amount and type of liquid given, and a space for comments.	Create a Chart
15	Have students set up experiments, making sure they record all relevant data.	Experimentation / Assesment
10	Design and set up a graph to record height data over time. Make sure the independent variable is on the *x*-axis and the dependent variable on the *y*-axis.	Graphing

* The students must briefly observe and take data on their plants for a period of time before they can draw conclusions. They can take data in the first few minutes of class before moving on with the lesson.

Suggested Homework:

ONCE STUDENTS HAVE SUFFICIENT DATA - Write a conclusion for your lab report. Make sure you compare your observed results to your hypothesis, offer possible reasons for your results, and discuss sources of error. Use your rubric as a guide.

Standards Addressed

MST Standard 1 – 1.1a, 1.2a, 1.3, 2.3, 2.4, 3.1, 3.3
MST Standard 4 – 6.1e

Date: _____ Name: _____

Environmental Science Rubric Class: _____

LAB REPORT RUBRIC FOR LAB _____

(Designed by R. R. Green H. S. of Teaching Science Department)

Category	Exemplary 4	Adequate 3	Developing 2	Beginning 1
Hypothesis	An adequate response to the question, with supporting reason(s), that makes sense and/or is supported by observation.	An adequate response to the question, with some reason.	A response without a reason.	Hypothesis is not a response to the question.
Experiment	Experiment tests hypothesis. Logical and sequential procedure with no steps skipped. All controls and variables identified as such. Sample size adequate to draw conclusion.	Experiment tests hypothesis. Procedure and preparation clearly described. Controls and variables included.	Missing one of the requirements for a 3.	Experiment done. Missing two or more of the requirements for a 3.
Results	Clear, accurate description. Numbers are provided. Graphs clear and accurate. Some analysis or accurate statistics are included.	Description provided. Numbers provided. Graphs clear and accurate. Analysis or statistics may be missing or inaccurate.	Numbers provided. Graphs present but may be poorly plotted.	Description provided.
Conclusions	Relates hypothesis to results in a logical manner. Confirms or rejects hypothesis. Gives a logical reason for results.	Relates hypothesis to results. Confirms or rejects hypothesis. Gives a reason for results.	Discusses results, but may not relate results to hypothesis. May not mention error or	Data explained poorly. May not relate results to hypothesis.

			attempt to explain results.	
Grammar	Strong facility with language. Varied sentence structure. Range of vocabulary. Few, if any, errors.	Facility with language. Good use of vocabulary. No major errors.	Sentence construction below mastery. Some major and many minor errors.	Frequent and noticeable errors in grammar, usage, and sentence structure. Unclear meaning. may be hard to read.

Comments: _____
_____
_____
_____
_____

Lesson # 4 - 6

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> How do organisms depend on each other?

Objectives

Students will be able to:

- **Identify the relationships among producers, consumers, and decomposers.**
- Differentiate autotrophic and heterotrophic nutrition.
- **Understand that energy for food chains usually originates from the sun.**
- Describe the flow of energy in a food chain.
- Draw food chains and food webs.
- Describe interactions among organisms (producer/consumer, predator/prey, parasite/host)
- Produce a concept map.

New Terms:

producer	autotrophic	food web
consumer	heterotrophic	decomposer
predator	herbivore	scavenger
prey	carnivore	parasite
food chain	omnivore	host

Materials/Preparations:

"The Alligator and the Hunter" (<u>Keepers of the Animals</u> p193-194), vocabulary chart paper (with above vocabulary and the word “disease” listed on it), chart paper (1 sheet per group), small sticky notes (20 per group plus extra), markers, tape to hang up concept maps, concept map rubric (quantity needed = one per student plus the number of students multiplied by the number of groups presenting), concept map worksheet (only used for classes new to concept mapping – one per student)

LESSON 4

Time (min)	**Development**	**Instructional Strategies**
5	Do Now: Students read, “"The Alligator and the Hunter." • Students highlight or underline anything in the story that relates to eating or being eaten.	Reading (Motivation)
5	*Discuss* why the Choctaw would have told this story. Students share “Do Now” answers with the class. • *Record the answers on the board.*	Feedback
10	*Describe* food chains. (Use any example e.g. corn ➜ chicken ➜ human) • Point out that arrows show flow of energy. • Elicit that plants get energy from the sun but explain that the sun is normally assumed in a food chain. Food chains usually start with producers.	Direct Instruction Assessment

	• Students develop as many food chains from story as possible. (make up a suitable producer e.g. grass) **Have students leave lots of room under each food chain.** • Share answers and *record on board*.	
5	*Define* producer and consumer. • Students label or color/highlight producers and consumers in each food chain. • Teacher checks work by *walking around room*. • Share answers and *record on board*.	Vocabulary development
10	*Define* herbivore, carnivore, omnivore, predator, prey, autotrophic, and heterotrophic. • Students label these in each food chain. • Teacher checks work by *walking around room*. • Share answers and *record on board*.	Vocabulary development
5	Draw food web from story. • Start with producers on the bottom. • Have students help you fill in the upper levels.	Modeling

Suggested Homework:

(This same homework appears as a handout at the end of lesson 5)

List the foods you ate for dinner. Make a food chain for each one. You will have to figure out where the food came from. For instance, a food chain for a pork chop might be:

corn → pig → person

Label any producers and consumers in each food chain.

Fill in the following table using all of the organisms in your food chains. You may need to put an organism in more than one column. The food chain above has been done for you.

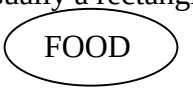
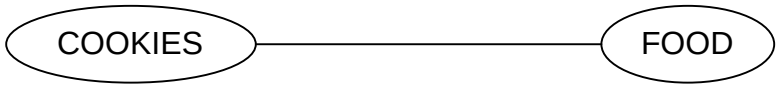
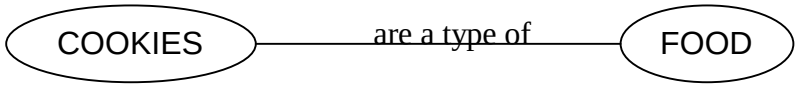
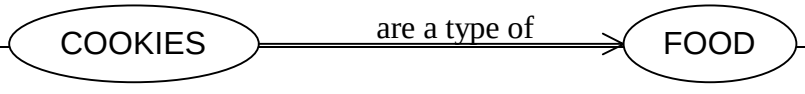
Herbivore	**Carnivore**	**Omnivore**	**Predator**	**Prey**	**Autotrophic**	**Heterotrophic**
		pig person	person	pig	corn	pig person

LESSON 5

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer, "Please write down any patterns you noticed from last night's homework." Students who did not do the homework can work on that instead.	Analysis of data
5	Students share "Do Now" answers with the class. • *Record the answers on the board.*	Feedback
5	*Ask students* what happens to animals when they die. *Define* decomposer, scavenger, parasite, host. • Students write short sentences relating these words to each other and/or to other words on the vocabulary list. • Share answers and *record on board*.	Vocabulary development (Motivation)

At this point you have several options, depending on your students' comfort with concept maps.

Option 1: For students who have not used concept maps.

10	*Post* vocabulary chart paper on board. *Explain* that a concept map is a way of showing relationships among related words, or concepts. Have students choose a topic and list approximately five related words. (Feel free to limit students to words that you can concept map easily.) *List the rules of concept mapping* as you map their topic and related. (Please note that there are different ways to concept map. Use the rules with which you are comfortable.) • Put the topic at the top of the paper. FOOD • Draw an appropriate shape (usually a rectangle or oval) around the topic word.  • Think of a sentence you can make with the topic word and any other word in the list. Cookies are a type of food. • Write down the second word in an appropriate shape and then connect that word with the topic word using a line.  • Write the connecting word(s) on the line.  • Draw an arrowhead on the end of the line indicating the direction in which a person is supposed to read. 	Direct Instruction

	• Continue to connect words until all of the words have been used up. *Hand out* one *rubric* to each student.	
10	Students fill in prepared concept map while teacher *circulates room, providing assistance and guidance* when needed.	Assessment
5	Fill in overhead of prepared concept map as a class.	Review

Option 2: For students who have some experience with concept maps.

5	*Post* vocabulary chart paper on board. *Review* concept mapping rules by eliciting them. (Please note that there are different ways to concept map. You may modify these rules and the rubric as you see fit.) • Put the topic at the top. • Use the patterns listed on the board from the "Do Now" and knowledge of the words to make a concept map of the words. • Each line connecting two words must have at least one connecting word on it and must include an arrow to show the reader which way to read the connection. • Every two words and the connecting word between them should form a complete thought which make sense when read in the direction of the arrow. *Hand out* one *rubric* to each student.	Direct Instruction
20	Class designs and produces a concept map together while teacher *writes on board* • Continually refer students to the rubric to check quality of concept map.	Concept mapping

Option 3: For students who are ready to make their own concept maps.

5	*Post* vocabulary chart paper on board. *Describe* procedure to follow. (Please note that there are different ways to concept map. You may modify these rules and the rubric as you see fit.) • Each group will put each of the vocabulary words listed on the vocabulary chart paper on a separate sticky note. • Each group must use all of the words on the vocabulary list but is not limited to those words. Extra sticky notes are available for anyone who wants to add words. • Each group will use the patterns listed o the board from the "Do Now" and their knowledge of the words to make a concept map of the words. • Each line connecting two words must have at least one connecting word on it and must include an arrow to show the reader which way to read the connection. • Every two words and the connecting word between them should form a complete thought which make sense when read in the direction of the arrow. • Once the group has agreed on the structure of the concept map, the	Direct Instruction

	group will draw in the connecting lines, arrows, and words in marker. • This concept map will be presented by the group on the next class day and will be graded using the rubric provided. *Divide students into groups*. *Hand out materials* (one piece of chart paper and 20 sticky notes per group) *Hand out* one *rubric* to each student.	
20	Students design and produce concept maps while teacher *circulates room*, *providing assistance and guidance* when needed. *Remind students* to refer to the rubric for guidance.	Concept mapping

Suggested Homework:

Make your own concept map for the topic of "Lab Reports" using the words below. Please feel free to add any extra words you want.

problem	question	hypothesis
materials	procedure	results
conclusion	data table	graph

LESSON 6

For teachers who used Option 1 or 2 yesterday:

Time (min)	Development	Instructional Strategies
5	Do Now: Students use rubric to assess their homework. (Students who did not do the homework can work on that instead.)	Assessment (Motivation)
5	*Explain* that students will work in pairs to produce one excellent concept map on the topic "Lab Reports." • Each group will put each of words from the homework on a separate sticky note. • Each group must use all of the words on the vocabulary list but is not limited to those words. Extra sticky notes are available for anyone who wants to add words. • Each group will use the patterns listed on the board from the "Do Now" and their knowledge of the words to make a concept map of the words. • Each line connecting two words must have at least one connecting word on it and must include an arrow to show the reader which way to read the connection. • Every two words and the connecting word between them should form a complete thought which make sense when read in the direction of the arrow. • Once the group has agreed on the structure of the concept map, the group will draw in the connecting lines, arrows, and words in marker. • This concept map will be graded using the rubric provided. *Pair students.* *Hand out materials* (one piece of chart paper and 10 sticky notes per group) *Hand out* one *rubric* to each student.	Direct Instruction
10	Students design and produce concept maps while teacher *circulates room, providing assistance and guidance* when needed. *Remind students* to refer to the rubric for guidance.	Concept Mapping
20	Students present concept maps to class as classmates use rubric to assess them. **Project grade will be 50% average of class assessment and 50% teacher assessment (all using same rubric.)** Teacher must *collect rubrics* after each presentation.	Assessment

For teachers who used Option 3 yesterday:

Time (min)	Development	Instructional Strategies
5	Do Now: Students use rubric to grade their concept maps from yesterday.	Assessment (Motivation)
5	*Explain* that each student will use the rubric to assess the work of the other students in the class. Students will present concept maps to class as classmates use rubric to assess them. **Project grade will be 50% average of class assessment and 50% teacher assessment (all using same rubric.).**	Direct Instruction

30	Students present concept maps to class as classmates use rubric to assess them. • Teacher must *collect rubrics* after each presentation.	Assessment

Suggested Homework:

In Central Park gray squirrels eat acorns and red-tailed hawks eat gray squirrels.
Draw a food chain to show the flow of energy.
Label any producers and consumers.
Explain what might happen to the hawks and squirrels if one year there was a shortage of acorns. Give reasons for your answer.

Standards Addressed

MST Standard 1 – 1.2a, 3.5b
MST Standard 4 – 1.1a, 6.1a, g

Date_____ Name: _____

Environmental Science HW Class: _____

FOOD CHAINS

1) List the foods you ate for dinner. Make a food chain for each one. You will have to figure out where the food came from. For instance, a food chain for a pork chop might be:

corn → pig → person

2) Label any producers and consumers in each food chain. (You can just write "producer" or "consumer" above the organisms already listed in your food chains in part 1.)

PLEASE NOTE THAT THERE IS A SECOND PAGE TO THIS ASSIGNMENT

3) Fill in the following table using all of the organisms in your food chains. You may need to put an organism in more than one column. The food chain already given in Part 1 has been done for you.

Herbivore	**Carnivore**	**Omnivore**	**Predator**	**Prey**	**Autotrophic**	**Heterotrophic**
		pig person	person	pig	corn	pig person

Date: _____ Name: _____

Environmental Science Rubric Class: _____

CONCEPT MAP RUBRIC

(Adapted from L. Karl and L. Stevens)

Category	Exemplary 4	Accomplished 3	Developing 2	Beginning 1
Content	Information is well-organized. More details are included to add meaning.	Information is well-organized. An attempt is made to add meaning.	Concept map demonstrates a basic understanding of content and information.	Limited effort is made to understand content. Content presented at a simplistic level.
Links	All links include informative, logical arrows and connecting words, establishing a smooth, dependable, map.	All links include arrows and connecting words, establishing a dependable, informative map.	Most links are accurate.	Links have been used, but not all ideas are connected.
Presentation	The selection of graphics, line styles, and arrangement options enhances the	The selection of graphics, line styles, and arrangement options enhances the layout of the concept map.	The selection of graphics, line styles, and arrangement options serves the layout of the concept map.	The selection of graphics, line styles, and arrangement options may confuse the layout and meaning of the concept map.

	enhances the layout and meaning of the concept map.	concept map.		

Topic of Concept Map: _____

Group Members: _____ _____

_____ _____

Comments: _____

_____

_____

Lesson # 7

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> What happens when one organism starts to increase in numbers?

Objectives

Students will be able to:

- Explain that organisms compete for resources which limits population growth.
- Explain how one population increases or decreases based on the level of another population.
- Describe disruptions in numbers and types of species caused by changes in population of linked species.
- Differentiate niche and habitat.

New Terms:

niche
habitat

Materials/Preparations:

DDT in Borneo story handout

Time (min)	**Development**	**Instructional Strategies**
7	Do Now: Students read "DDT in Borneo" worksheet and write as many food chains as they can from it, labeling the producers and consumers. (Students can use rice as the food for the cockroaches and the rats.)	Reading (Motivation)
3	Individually students use food chains to construct a food web. (One food chain will not fit into the food web.)	Assessment
5	As a whole class students share information and *record* it *on the board*.	Feedback
5	As a whole class *discuss* what changes DDT caused and why. • Draw up/down arrows above organisms in food chains/web showing effect • Focus the discussion on the effects of decreasing the wasps and decreasing the cats. • Briefly discuss limiting factors.	Analysis of exemplar
5	*Explain* that habitat is to home as niche is to lifestyle. • *Define* habitat and niche. • Explain that generally organisms can share the same habitat, but not the same niche. • Identify habitats and niches of organisms in the Borneo story.	
15	Think/pair/share for each of the following situations, assuming no DDT effects. (Use the previously drawn food web as a base.) Students should describe what happens to each other member of the food web when the following occurs. 1) The wasps increase. 2) The rice decreases. 3) The gecko's decrease.	Think/pair/ share

	4) The cockroaches increase. • Students determine the answers on their own, using arrows on existing food chains/webs to record their answers. (Students can draw a new food web/chain for each situation.) • Students pair up and compare answers, coming to consensus on the correct answers. • Pairs share answers with the class. During the sharing, *point out* that when the cockroaches increase, the rats can increase because in our example they both compete for the same food (rice) and if the cockroaches do not eat the rice then there is more for the rats.	

Suggested Homework:

Make a poster showing pictures (drawings or cut-outs) of your niche in the world. Please indicate areas in which you experience competition.

Standards Addressed

MST Standard 1 – 1.2a
MST Standard 4 – 1.1c, d, f, Key Idea 6, 6.1a, f

DDT IN BORNEO

(From BSCS Biology - An Ecological Approach p57-58)

Borneo is an island in Southeast Asia. In 1955 the World Health Organization used the pesticide DDT to kill the mosquitoes that carry the disease malaria. The DDT killed the mosquitoes and relieves the malaria problem on Borneo, but it also caused an undesirable chain reaction on the island.

First, the thatch roofs on the houses of Borneo started collapsing. What did this have to do with the DDT? The DDT had killed the wasps that ate the thatch-eating caterpillars. Without the wasps around, the caterpillars multiplied and devoured the thatch roofs.

Meanwhile, the DDT also landed on Borneo's cockroaches. The cockroaches were eaten by geckos (a kind of lizard). The geckos suffered nerve damage from the pesticide, causing their reflexes to become slower. Because the nerve-damaged geckos moved so slowly, most of them were eaten by housecats. After the cats ate the geckos, they also suffered from the DDT and died in great numbers. Without the cats around, rats started moving in from Borneo's forests. On the rats came fleas, which carried the bacteria that cause the plague. Finally, officials resorted to bringing healthy cats into Borneo to control the rat population!

The unforeseen chain of events occurred because the living things on the island were connected to each other in an ecological system called an ecosystem.

Lesson # 8

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> Why don't carnivores take over the world?

Objectives

Students will be able to:

- Produce and explain the significance of an energy pyramid.
- Understand that at each link in a food web some energy is stored but much is lost as heat.

New Terms:

energy pyramid
biomass pyramid

Materials/Preparations:

Wonderful Wetlands handout (one per student)

Time (min)	**Development**	**Instructional Strategies**
5	Do Now: Students answer "Think of the biggest, meanest living carnivore you can. Why hasn't that organism taken over the world?"	Assess prior knowledge (Motivation)
3	As a class, students share answers.	Feedback
10	*Introduce* Wonderful Wetlands *activity*. • Students will work alone for three minutes • Students will then work in pairs for three more minutes. *Hand out worksheet*. Students work, first alone, then in pairs (3 min each)	Direct Instruction Problem-solving
5	As a class students share answers and explain how they arrived at those answers.	Think/pair/ share
5	Individually, students fill in biomass pyramid. (You might want to *explain* that a real biomass pyramid uses dry weght, which is not what we are using. However, the positions of the organisms in the pyramid should not change even if we used dry weights.) • *Define* biomass pyramid. • *Explain* that the organism with the largest number eaten goes in the largest space, the smallest numbers in the smallest numbers in the smallest space, etc. • As a class share answers.	Create a chart
10	***Ask students* why 9,000 pond grass plants (135,000g) are needed to feed one hawk.** ***Explain* that only 10% of the energy (in calories) at any level is available for energy for the next level. (For instance, only 10% of the energy stored in the pond grass is stored in the grasshoppers.)** ***Ask students* what might happen to the other 90% of energy stored in the**	

	plants. ***Elicit* that energy is lost as heat and that not all of the plant is digestable.** *Define* energy pyramid. *Explain* that energy pyramids generally look like biomass pyramids.	
2	Individually, students answer, “Why don’t carnivores take over the world?	Assessment

Suggested Homework:

"Eating lower on the food chain" is said to be better for the environment. Explain this concept clearly in a way that your English teacher will be able to understand easily.

Standards Addressed

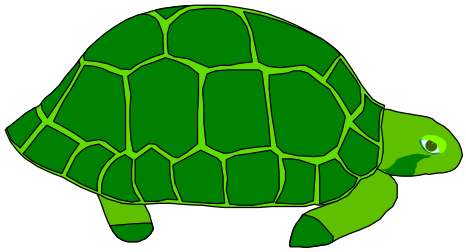
MST Standard 1 – 1.1a
MST Standard 4 –6.1b, c

Date_____ Name: _____

Living Environment Class: _____

WONDERFUL WETLANDS

(This activity is adapted from Holt Environmental Science Chapter 2, Investigation 2.3)

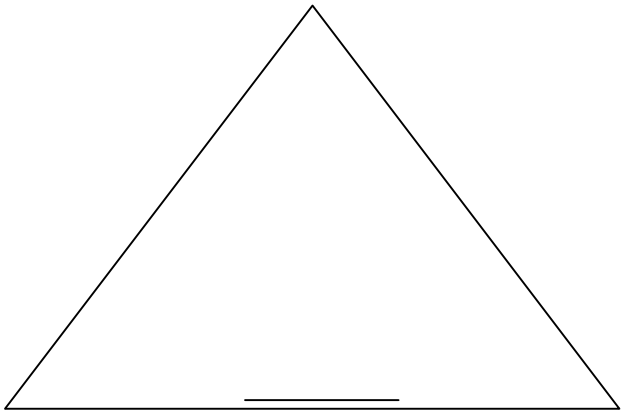


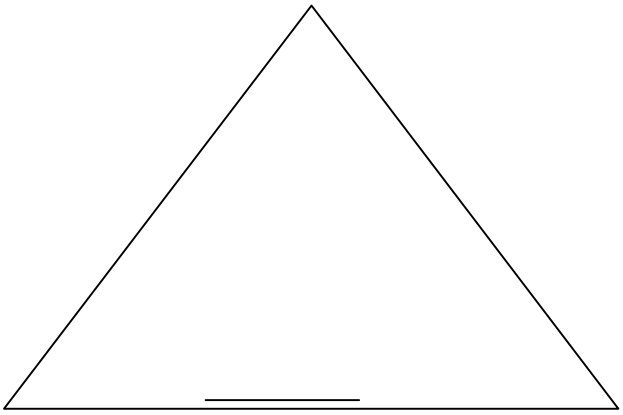
A wildlife biologist discovered the following:

A certain pond community includes hawks, sparrows, grasshoppers, and pond grass. Each hawk weighs 850g and eats 550g of sparrows each week. Each sparrow weighs 55g and eats 200g of grasshoppers each week. Each grasshopper weighs 1g and eats 15g of pond grass each week. Each pond grass plant weighs 5g.

How many grass plants are needed to feed all of the grasshoppers that are eaten by all of the sparrows that are eaten by one hawk in a week?

BIOMASS PYRAMID ENERGY PYRAMID





_____ _____

_____ _____

Lesson # 9

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> Who likes waste?

Objectives

Students will be able to:

- Draw and label the water cycle.
- Draw and label the nitrogen cycle.
- Understand that substances are cycled in ecosystems.

New Terms:

water cycle
nitrogen cycle

Materials/Preparations:

overheads (optional) of water cycle and nitrogen cycle, cold can of soda with condensation on the outside, Water cycle demo (Take a large, flat-bottomed, clear glass container with some water in the bottom. Place a much smaller empty container in the middle of the large container. It must be taller than the level of water in the large container so that the inside of the small container remains dry at the start. Cover the large container with plastic wrap and place a coin or some other weight in the middle of the plastic wrap cover. The weight should be directly over the small container. Put the whole set-up in the sun an hour or so before class starts. By the time class starts there should be condensation on the inside of the plastic wrap cover.), materials for a second water cycle demo (optional)

Time (min)	Development	Instructional Strategies
5	Do Now: Students look at the soda can with condensation on the outside and answer "This can was dry when it was put in the refrigerator. From where did the water on the outside of the can come?"	Assess prior knowledge (Motivation)
3	As a class, students share answers. • *Elicit* that the water came from the air. (This may not be easy. Make sure students give reasons for the answers they give.)	Feedback
5	*Show students water cycle demo. Explain* what it looked like when you set it up. (*If possible set up a new demo* in front of them.) • Individually students write from where the water in the small container came. • As a class students share answers.	Problem-solving
5	*Ask students*, as a class, to apply what they just saw to the natural world. • *Draw and label* the water cycle (or show the overhead)	Direct Instruction
2	*Explain* that water is one of many substances that it is cycled in the environment. *Explain* that nitrogen is also cycled.	Direct Instruction
5	***Ask* why George Washington Carver is famous.**	Direct

	(Students will probably say that he is famous for growing peanuts. *Ask* if they know why he was growing peanuts.) *Elicit/Explain* that the farmers were depleting the soil growing cotton and tobacco every year. Since peanuts "fix" nitrogen Carver was trying to convince farmers to plant peanuts in off years to improve the soil. The farmers didn't want to do this because they didn't know what to do with peanuts so Carver spent time thinking of uses for peanuts.	Instruction
10	*Draw and label* the nitrogen cycle.	Direct Instruction
5	*Model the homework* by working with the students as a class to tell the adventures of a nitrogen atom in the nitrogen cycle.	Modeling

Suggested Homework:

Write an essay from the point of view of a water molecule telling of your adventures in the water cycle.

Standards Addressed

MST Standard 1 –
MST Standard 4 –6.1b

Lesson # 10

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> Who likes waste?

Objectives

Students will be able to:

- Draw and label the carbon cycle.
- Understand that substances are cycled in ecosystems.

New Terms:

carbon cycle

Materials/Preparations:

overhead (optional) of carbon cycle

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer: "Organisms die all the time. Why isn't the world full of dead things?" • As students are working on the Do Now collect last night's homework and select one or two good ones to read aloud.	Assess prior knowledge (Motivation)
5	As a class, students share answers. Talk about decomposers and CO2 (respiration) • *Read aloud* the selected homework, explaining what you like about them and what minor improvements could be made. (Tonight's homework is similar but slightly more difficult. Students need to know what your standards are.)	Feedback
10	*Ask students*, where does the wood of a tree come from? • *Talk about* photosynthesis.	Direct Instruction
10	*Ask students*, how do we get the food we eat to give us energy?. • *Discuss* respiration as the reverse of photosynthesis.	Direct Instruction
5	*Draw and label* the carbon cycle. • Try to have students do as much of this as possible without teacher help.	Direct Instruction
5	*Students write:* Please explain why someone could say that there is no such thing as waste in an ecosystem. Please give examples to support your answer.	Assessment

*** You might want to make Winogradsky columns with the class to demonstrate cycling of materials. (See Holt *Environmental Science* Investigation 3.2 or search on-line for instructions.)**

Suggested Homework:

Write an essay from the point of view of a carbon atom telling of your adventures in the carbon cycle.

Standards Addressed

MST Standard 1 –

MST Standard 4 – 6.1b

Lesson # 11 - 12

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> How do populations change over time?

Objectives

Students will be able to:

- **List limiting factors.**
- Explain that organisms have the capacity to produce populations of unlimited size but must compete for resources.
- **Understand that as a population increases it is held in check by environmental factors.**
- Understand that ecosystems tend to show cyclic changes around a state of approximate equilibrium.
- Give examples of how carrying capacity is limited by resource availability.
- Give examples of how the growth and survival of organisms depends on abiotic factors.

New Terms:

limiting factor
carrying capacity

Materials/Preparations:

chart paper, Oh Deer Lab Sheet, graph paper, overhead projector, overhead of graph paper, Willow, Hare, Lynx Populations Worksheet
("Oh Deer" is best played outside in a yard or a park or inside in a gym)

LESSON 11

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer, "Please list as many reasons as you can why deer do not take over the world."	Assessment (Motivation)
3	As a class, students share answers which are recorded on the board. *Define* limiting factor. Explain that today's activity will focus on food, water, and shelter.	Feedback
5	Individually students draw a food chain and a food pyramid including deer. • Students share answers. • Incorporate as many words from the concept maps as possible into the discussion.	Assessment/ Review
5	*Prepare students* for "Oh Deer!" game. (Complete instructions follow Lesson Plan 12.) • Students count off by 4's 1=deer 2,3,4=food, water, shelter • Either choose one student to be the recorder or assign that task to yourself.	Direct Instruction

	• *Explain directions* (see attached)	
20	Students play game. • Count deer for 15 rounds. • Record, on chart paper, the number of deer remaining at the end of each round.	Modeling
2	Individually students copy data table onto lab sheets and write an explanation of why we played this game and what patterns they observed during the game.	Assessment

Suggested Homework:

Students graph data and answer lab questions.

LESSON 12

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer, "If you visit upstate New York you will see the following sign, "Please don't feed the deer." Why do you think this sign is so common?"	Assessment (Motivation)
2	As a class, students share answers. *Elicit* that feeding the deer increases their numbers.	Feedback
13	Review lab reports. • Either show students an overhead of your version of the "Oh Deer!" graph or have a student graph the data in class. • Discuss answers to conclusion questions. In doing so, make sure that the objectives of the lesson have been met.	Assessment/ Review
15	Students apply knowledge to a new situation. • *Read*: A rabbit population suddenly decreases. You are a biologist studying the ecosystem of the area. You determine that there is no rabbit disease killing off the rabbits. What else might be causing the rabbit population to decrease? What would you look for to determine if you hypothesis were correct? (You might find it helpful to have the students set up a T-chart of "hypothesis' and "evidence.") • Students answer question individually, then in pairs, and then share with the class.	Assessment Think, pair, share
5	*Define* carrying capacity *Apply concept* to deer and rabbits.	Direct instruction

Suggested Homework:
Willow, Hare, Lynx Populations Worksheet

Standards Addressed

MST Standard 1 –
MST Standard 4 – 1.1c, d, e, 6.1d, e, f

Oh Deer!

(Adapted from Project WILD Secondary Activity Guide)

Explain to students that they will be playing a game that emphasizes the importance of limiting factors. The focus in on the role of food, shelter, and water in the lives of wild deer. Space is no less important, but is not addressed in this game.

Mark two parallel lines on the ground or floor 10-20 yards apart. (Cones or other objects can be used to mark the location of the ends of the lines instead of actually drawing the lines, if you prefer.)

Have the students count off by 4's. Have all of the ones line up behind one line and all of the rest of the students behind the other line. (Even though they counted off by fours you should have only two groups of students, the one's and then everyone else.) At this point the students no longer need to remember their numbers.

The one's become the deer. To survive they need food, water and shelter (and space, which we are assuming the have today). When a deer is looking for food it should clamp its hands over its stomach. When it is looking for water it should put its hands over its mouth. When it is looking for shelter it should hold its hands together over its head. A deer can look for any one of its needs during each round but **the deer cannot change what it is looking for during a round.** However, it can choose to look for something else in the next round, if it survives.

The two's, three's and four's become fod, water and shelter. Each student gets to choose at the beginning of each round which limiting factor he or she will be. Food should clamp its hands over its stomach. Water should put its hands over its mouth. Shelter should hold its hands together over its head. (The limiting factors use the same signs as the deer.) **The limiting factors cannot change what they represent during a round.** However, they can choose to ber something else in the next round, if they remain.

The game starts with all players lined up in their respective lines (deer on one side and limiting factors on the other **with their backs toward the students on the other line.**

The teacher asks all students to make their signs - each deer deciding what it is looking for and each limiting factor deciding what it is. Normally the teacher will notice a lot of diversity in the signs on both sides. If students later decide to confer with each other and make the same sign this is OK.

When the students are ready the teacher should count to three at which point the students on both sides should turn around to face the opposite group, continuing to hold their signs clearly.

When a deer sees a limiting factor it needs it should run toward it while continuing to hold its sign. The limiting factors can walk toward the deer, but are not to run away from them. If two deer run for the same individual limiting factor, the one who gets there first gets it. Each deer that reaches its necessary limiting factor brings the limiting factor back to the deer line. (The logic behind this is that a deer that got what it needed survived and was able to reproduce, thereby increasing the deer population.) Any deer that is not able to get what it needs "dies" and goes to the limiting factor line for the next round. Any limiting factor that does not get chosen just remains a limiting factor for the next round.

The teacher (or student who cannot play) keeps track of the number of deer present at the beginning of the game at at the end of each round. Continue the game for about 15 rounds, keeping the pace brisk.

At the end of 15 rounds discuss the activity with the students. Discuss what they saw and graph the data you gathered.

Date_____ Name: _____

Living Environment Lab Section: _____

OH DEER! LAB

Background: Limiting factors are _____
_____.
Three examples of limiting factors for deer in the woods are _____,
_____, and _____

Materials: chart paper

Procedure:

Play Oh Deer!

Results:

Trial	# of Deer Remaining
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Please graph the results on graph paper.

Conclusion:

1) What limiting factors affected the deer in this game?

2) What limiting factors affect deer but were not part of this game?

3) What happened to the deer population over time?

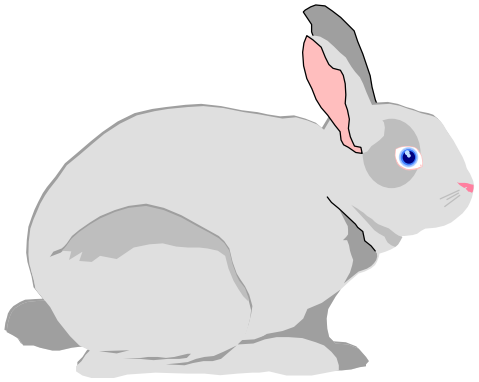
4) Why did the deer population sometimes increase after decreasing?

5) What might cause a deer population to decrease suddenly?

6) What might cause a deer population to increase suddenly?

Date_____ Name: _____
Living Environment Section: _____

WILLOW, HARE, AND LYNX POPULATIONS



It has been found that a major winter food of the hare is a small willow. As the hare populations grow, the use of the willow plants grows too. But, when the willow plant has been "hedged", or eaten back so far, the plant generates a toxin (poison) which prevents the hare from eating it.

Please answer the following in complete **sentences.**

1) What will happen to the hare population when the willow begins to produce the toxin?

2) Lynx eats hares. What will happen to the lynx population now?

3) At this point what will happen to the willow population?

4) Now what happens to the hare population?

5) Finally, what happens to the lynx population?

6) What happens to populations over a long period of time?

Lesson # 13

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> How do populations change over time?

Objectives

Students will be able to:

- Explain how populations are linked.
- Give examples of factors affecting carrying capacity.
- Take a stand on an issue based on both science and values.

New Terms:

carrying capacity

Materials/Preparations:

overhead (optional) of graph paper

Time (min)	**Development**	**Instructional Strategies**
5	Do Now: Students answer: "Wolves eat cattle and sheep on farms. Do you approve of killing the wolves? Give reasons for your answer."	Motivation
5	As a class, students share answers. • *Elicit pros and cons* of hunting.	Feedback
20	*Have students work* on Kaibab Deer Lab. • *Read and discuss background together.* • *Have students do graphing and answer questions on their own or in groups.* • *Teacher circulates room to help students and to assess understanding.*	Graphing
10	*Discuss answers to lab questions with students.*	Assessment

Suggested Homework:

In some areas rewards are given to hunters for killing certain animals. Animals such as coyotes and foxes are, therefore, hunted for the rewards. Farmers and ranchers often claim that these animals are bad because they kill farm animals, although these predators also kill wild animals such as rabbits, mice, and moles. Biologists think these animals are important to the areas where they are found. Write a short paragraph explaining why these animals are important and what might happen if they are all killed.

Standards Addressed

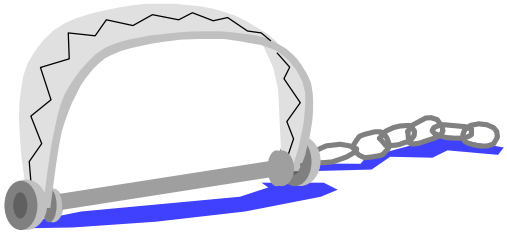
MST Standard 1 – 1.1c, 1.2a
MST Standard 4 – 1.1f, 6.1d, f

Date_____ Name: _____

Living Environment Lab Class: _____

KAIBAB DEER LAB

(Adapted from Addison Wesley *Environmental Science* p87)



Background: In 1906, the U.S. Forest Service began protecting a heard of deer in a 300,000 hectare range on Arizona's Kaibab Plateau. In previous years, the Kaibab forest area had been overgrazed by cattle, sheep, and horses. At this time the Forest Service estimated that the carrying capacity of the range to be about 30, 000 deer. Overgrazed means _____

_____

Carrying capacity is _____

_____

Materials: graph paper

Procedure:

1) Using the data table and the graph paper provided, plot the year along the *x*-axis, and the population along the *y*-axis.

Deer Population 1905-1939

Year	Population	Year	Population
1905	4,000	1927	37,000
1910	9,000	1928	35,000
1915	25,000	1929	30,000
1920	65,000	1930	25,000
1924	100,000	1931	20,000
1925	60,000	1935	18,000
1926	40,000	1939	10,000

2) Draw a straight horizontal line across your graph beginning at the 30,000-deer level. Label this line *Carrying capacity*.

Results:

See graph paper.

Conclusion:

1) What was the relationship of the population of the deer herd to the carrying capacity of the range in 1915?

2) What was the relationship of the population of the deer herd to the carrying capacity of the range in 1920?

3) What was the relationship of the population of the deer herd to the carrying capacity of the range in 1924?

4) Who are the deer's' natural predators?

5) Describe the effects of the following actions taken by the Forest Service:

a) 1907: Hunting of deer was banned. Also, the Forest Service began a 32-year campaign to exterminate natural predators of the deer. Thousands of predators were killed.

b) 1920: Seeing that the range was deteriorating rapidly, the Forest Service reduced the number of livestock grazing permits.

c) 1924: The deer population was on the brink of starvation.

6) What do you think the forest service learned between 1905 and 1939?

7) What purpose do carnivores, such as wolves, play in an ecosystem?

Lesson # 14

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> How do populations change over time?

Objectives

Students will be able to:

- Describe a variety of ecosystems in terms of both biotic and abiotic factors.
- Create food chains and web for a specific biome.
- Create climatogram for a specific biome.
- Describe adaptations for life in a specific biome.

New Terms:

biome
climatogram

Materials/Preparations:

Beautiful Biomes sheet, Beautiful Biomes Grading Sheet, Climatogram sheet, Climatogram graph sheet, construction paper, magazines to cut up, glue and/or tape, graph paper

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer: "If you could visit anywhere in the world where would you go and why?"	Motivation
5	As a class, students share answers. • *List biomes* on the board along with examples of those places. • Students form groups. • Each group chooses a biome about which to make a poster and review sheet. • *Hand out instruction sheet and review with class.*	Direct instruction
30	*Have students work* on project. • *Teacher circulates room to help students and to assess understanding.*	Assessment

* No lesson plan has been written for the poster presentations. Please consider spending a period or part of a period for presentations.

Suggested Homework:

Finish poster and review sheet.

Standards Addressed

MST Standard 1 –
MST Standard 4 – 1.1b

Date_____ Name: _____
Environmental Science Class: _____

BEAUTIFUL BIOMES

A biome is defined as a region that has a distinctive climate and organisms and that contain many separate but similar ecosystems. You are going to take one of these biomes, research it, and teach the rest of us about it.

Please list some biomes below, along with the people working on them.

Biome	**Student Experts**

1) DESCRIPTION

Write a brief description of your biome. Make sure you mention shortages and abundances.

2) MAP

On a map of the world, color the parts where your biome exists.

3) ADAPTATIONS

Describe some special adaptations of organisms in your biome. Make sure you include at least:

two plant adaptations

three animal adaptations

4) FOOD CHAINS

Write at least four accurate food chains. Make sure they really happen in your biome.

5) FOOD WEB

Use your food chains to draw a food web. Make sure you put the producers at the bottom.

6) PICTURE

Either draw or cut out a picture or pictures of your biome. (DO NOT CUT the books please.)

7) CLIMATOGRAM

Make a climatogram for your biome.

8) POSTER

Put all of the above information on a beautiful poster for us to admire and use as a study aid.

9) STUDY GUIDE

Make a clear, easy-to-understand study guide for the other members of the class to use to learn about your biome. Try to make this no longer than one double-sided piece of paper.

Environmental Science
Biome_____

Class: _____
Student Experts

_____

_____

BEAUTIFUL BIOMES GRADING SHEET

SECTION	POINTS Poster	Study Guide
Description	_____/	**/2**
	/4	**/4**
	/4	**/4**
Map	**/5**	**/5**
Adaptations		
two plant adaptations (2 pts each)	**/4**	**/4**
three animal adaptations (2 pts each)	**/6**	**/6**
At least four accurate food chains (2 pts each)	**/8**	**/8**
Food Web (producers at the bottom)	**/5**	**/5**
Picture	**/4**	------
Climatogram	**/5**	**/5**
Presentation/Neatness/Creativity	**/5**	**/5**
TOTAL POINTS	**/52**	**/48**

Points for classroom presentation = _____ **/25**

TOTAL POINTS FOR BEAUTIFUL BIOMES = _____ /125

Comments:

CLIMATOGRAMS

CENTRAL PARK, NEW YORK USA

Located at *about* 40.78°N 73.96°W. Height *about* 40m / 131 feet above sea level.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-0.2	0.8	5.7	11.3	17.0	22.0	24.8	24.1	20.1	14.1	8.6	2.5	12.6

Source: derived from NCDC TD 9641 Clim 81 1961-1990 Normals. 30 years between 1961 and 1990

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	83.6	78.8	98.5	93.4	106.0	84.5	105.0	104.3	91.2	83.5	106.6	92.3	1128.9

Source: derived from NCDC Cooperative Stations. 49 complete years between 1944 and 1995

NOME, ALASKA (U.S.A.)

Located at *about* 64.50°N 165.40°W. Height *about* 11m / 36 feet above sea level.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-14.8	-14.9	-13.1	-7.2	1.6	7.6	10.2	9.8	5.5	-1.7	-8.7	-13.9	-3.2

Source: derived from GHCN 1. 1003 months between 1906 and 1990

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	24.1	19.8	18.8	17.3	16.8	28.1	60.8	83.1	64.6	37.5	25.6	23.8	422.2

Source: derived from GHCN 1. 1012 months between 1906 and 1990

TAMANRASSET, ALGERIA

Located at *about* 22.78°N 5.50°E.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	12.8	15.4	18.4	22.2	26.1	28.8	28.5	28.2	26.6	22.6	17.8	13.7	21.9

Source: derived from GHCN 1. 382 months between 1951 and 1990

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	2.1	1.0	1.6	2.5	4.8	5.3	3.7	9.5	8.5	2.6	2.1	2.3	46.7

Source: derived from GHCN 1. 700 months between 1925 and 1990

IQUITOS, PERU

Located at *about* 3.75°S 73.20°W. Height *about* 125m / 410 feet above sea level.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	26.3	26.3	26.3	25.9	25.9	25.5	25.2	25.9	26.3	26.5	26.6	26.5	26.1

Source: derived from GHCN 1. 497 months between 1949 and 1990

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	267.7	254.1	322.9	301.3	267.1	207.6	162.6	165.9	190.2	230.6	249.3	258.4	2879.2

Source: derived from GHCN 1. 484 months between 1947 and 1990

FORT MCMURRAY,ALTA., CANADA

Located at *about* 56.65°N 111.20°W. Height *about* 369m / 1210 feet above sea level.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-20.3	-16.0	-8.6	2.1	9.7	13.9	16.5	14.8	9.0	2.9	-8.7	-17.3	0.0

Source: derived from GHCN 1. 716 months between 1931 and 1990

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	20.4	16.0	19.2	20.5	36.6	61.5	76.9	65.5	50.1	28.5	24.1	22.5	443.1

Source: derived from GHCN 1. 716 months between 1931 and 1990

WICHITA, KANSAS, USA

Located at *about* 37.65°N 97.43°W. Height *about* 402m / 1318 feet above sea level.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-1.3	1.5	7.4	13.5	18.6	24.2	27.4	26.2	21.2	14.7	7.0	0.5	13.4

Source: derived from NCDC TD 9641 Clim 81 1961-1990 Normals. 30 years between 1961 and 1990

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	18.8	23.2	56.9	57.1	99.1	105.1	81.9	77.7	85.1	61.9	36.7	28.6	733.2

Source: derived from NCDC Cooperative Stations. 38 complete years between 1954 and 1995

LUBUMBASHI-LUANO, ZAIRE

Located at *about* 11.67°S 27.40°E. Height *about* 1276m / 4186 feet above sea level.

Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	20.7	20.3	20.6	20.7	18.8	16.9	17.6	18.9	22.0	23.1	21.6	20.4	20.1

Source: derived from GHCN 1. 165 months between 1951 and 1983

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	253.4	256.4	210.4	50.8	4.2	0.6	0.0	0.3	6.3	30.6	150.0	272.2	1223.4

Source: derived from GHCN 1. 737 months between 1912 and 1973

MIDDLE ATLANTIC COAST

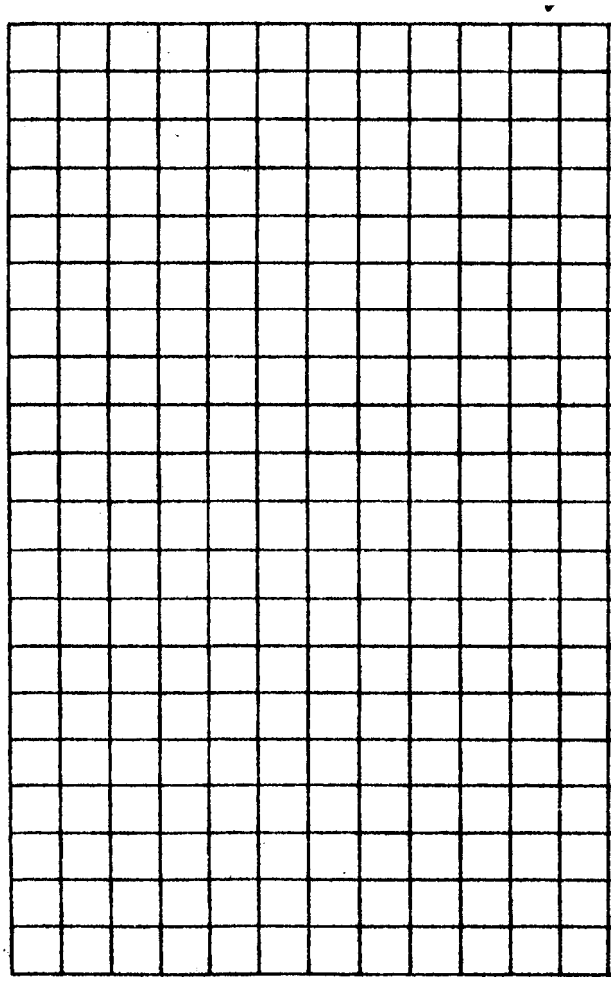
- **WATER TEMPERATURES IN DEGREES FAHRENHEIT**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Montauk NY	36	35	38	42	50	59	67	70	69	62	56	43
Sandy Hook NJ	37	36	40	44	52	60	67	72	70	61	51	43
Atlantic City NJ	37	35	42	46	54	62	69	72	72	63	53	44
Cape May NJ	37	37	42	48	56	67	71	74	73	63	52	42
Cape Charles VA	36	39	46	51	60	70	76	78	76	66	54	44
Baltimore MD	40	37	43	51	61	70	77	79	77	66	54	43
Annapolis MD	36	35	42	50	58	69	76	78	75	66	53	45
Washington DC	37	37	46	54	64	74	80	83	78	64	52	41

Date_____ Name: _____
Environmental Science Class: _____

CLIMATOGRAM

This is a climatogram from _____
This is located in the _____ biome.
Remember to put precipitation on the left and temperature on the right. Graph precipitation with a bar graph and temperature with a line graph.



Month

Lesson # 15

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> Why is it good to be different?

Objectives

Students will be able to:

- Explain how biodiversity increases the stability of an ecosystem.
- Give examples of how the interdependencies of organisms affect the development of stable ecosystems.

New Terms:

biodiversity

Materials/Preparations:

Small candies in a variety of types or flavor(30 per student or team). Try to set up a situation where students are inclined to choose all or almost all of one type or flavor. (e.g. Skittles)

Time (min)	Development	Instructional Strategies
5	Do Now: Students answer: "Why have we not yet found a cure for the common cold"	Motivation
5	As a class, students share answers. • *Elicit* that the common cold is not just one virus.	Feedback
5	*Have students play game.* • *Have each student or team of students choose* any ten pieces of candy from a container. • Once students have chosen their candies *explain* that the candies represent organisms in an ecosystem. *Example* Green = trees Pink = birds Yellow = grass Red = mammals Orange = insects Have students briefly write down what they took and why.	Modeling
5	*Continue playing the game.* • *Explain* that, as in any ecosystem, changes occur in this ecosystem. • *Explain* that a disease came and killed all of the mammals(red) so they must get rid of all of their red candies. (For this change and the next, choose the most popular candies.) • *Have students record* what is left in front of them. • *Explain* that now a disease comes and kills all of the birds(pink) so they must get rid of all of their pink candies. • *Have students record* what is left in front of them.	Modeling
5	*Assess student understanding.*	Assessment

	• *Ask the students* what has happened to their ecosystems and why. • *Elicit* that the most viable (healthiest) ecosystems are those with the most organisms left. • *Have the students* start over again. Have them *re-choose ten candies* with the goal of having the healthiest ecosystem. • *Have students briefly write* down what they took and why.	
5	*Continue playing the game.* • Explain that a disease came and killed all of the insects(orange) so they must get rid of all of their orange candies. • Have students record what is left in front of them. • Explain that now a disease comes and kills all of the mammals(red) so they must get rid of all of their red candies. Have students record what is left in front of them.	Modeling
5	*Ask the students* what has happened to their ecosystems this time and why. • *Elicit* that the healthiest ecosystem has the most diversity.	Assessment
5	*Ask students* any or all of the following questions so that they can apply what they have just learned. • *Display pictures* of monocultures and polycultures and ask what the students can tell you about them based on what they just learned. • *Ask students* which would do better if a big change (disease, climate, flood, fire) happened. • Farmers in the Midwest are being warned against planting nothing but wheat. *Ask why*. • *Explain* that there are some very poor prostitutes in Kenya who have been infected with HIV but have never gotten AIDS. *Ask why* this might be.	Application

* You might want to visit the *American Museum of Natural History* and tour the Hall of Biodiversity.

Suggested Homework:

Park rangers in Central Park and the city's other parks are very concerned about invasive plant species. These are plants that came from somewhere else but do well in our parks. These plants are happy in the park and are slowly taking over the land where the native plants live. The rangers in the parks, with the help of volunteers, pull up the invasive plants. This requires a lot of work. Please explain why these people would spend so much time and energy pulling up plants that are doing well.

Another possible homework, summative in nature:

Your neighbor decides that all bugs in the world are annoying and should be killed. Make a poster, video, song, poem, skit, or essay to convince your neighbor of the consequences of killing all bugs.

Standards Addressed

MST Standard 1 – 1.1c, 1.2a
MST Standard 4 – 6.2a, 6.3a

Lesson # 16

<u>Unit Topic/Essential Question:</u> Why doesn't any one type of living thing take over the world?

<u>Aim/Guiding Question:</u> What happens to an ecosystem after a flood or a fire?

Objectives

Students will be able to:

- Correctly sequence the stages of succession.
- **Give examples of organisms and disasters altering ecosystems.**
- Explain that one community replaces another, reaching a point of stability.

New Terms:

succession

Materials/Preparations:

Pictures of stages of succession (these can come from any source but make sure they are out of order. It is best if there is more than one set of pictures - maybe pond succession and forest succession), overhead cutouts of the succession pictures (optional), construction paper, glue

Time (min)	**Development**	**Instructional Strategies**
3	Do Now: Please put the pictures of the changing ecosystem in order. ▪ Teacher must hand out pictures as students enter room. ▪ Teacher may want to tell students which picture comes first.	Assess prior knowledge (Motivation)
2	Students share answers in pairs and come to an agreement. ▪ Teacher may want students to form quads to again come to agreement.	Think, pair, share
5	Students share answers as a class and come to a final agreement. ▪ Students must justify their answers to the class. ▪ Teacher may *have students order pictures* on the overhead.	Feedback
10	Define "succession" and "climax community." ▪ *Explain* that one community replaces another, reaching a point of stability. ▪ Have students glue their pictures on construction paper in order. ▪ Students write explanation of what is occurring under pictures.	Assessment
5	*Ask students* what might cause the cycle of succession to begin. ▪ *Elicit example*s of climatic changes and natural disasters. ▪ *Write examples on the board.*	Brainstorming
10	Make a T-Chart on the board as shown: <u>Succession</u> | <u>Evolution</u> ▪ Have students brainstorm similarities and differences. ▪ Write correct responses in chart. ▪ Spend some time discussing both concepts to clear up any misconceptions.	Assessment
5	Students write a short essay to clearly explain the differences between	Assessment

	succession and evolution.	

Suggested Homework:

Use all of the key concepts from this unit to clearly explain why no one organism has taken over the world.

Standards Addressed:

MST Standard 1 – 1.2a
MST Standard 4 – 6.3b, c