**Integrated Activities – Middle School Level**

The following activities are linked to the Nebraska Mathematics Standards (2009), English Language Arts Standards (2009), and Science Standards (2010).

**Extra-Terrestrial Adventure:**

In this interdisciplinary lesson, teachers will use their knowledge of ratios, proportions, large numbers, and the relationship of rate and change to explore the requirements for life on other planets, moons, and celestial bodies. Students will write and communicate orally, justify choices, and perform web searches to explore the role of creativity in science.

**Lay of the Land:**

In the following series of activities students develop their mapping skills as well as their number sense while investigating the ecology and topography of Nebraska.

**Now You See It, Now You Don’t:**

The activity, as written, is designed for middle school classrooms. Modifications will be provided for both upper elementary and high school standards-based classrooms.

Modifying curriculum that is appropriate for other grade levels is rather easy if you focus on appropriate state and national standards. It is essential that teachers identify student expectations at the specific grade level. Elucidating student expectations enables the teacher to focus instruction on attainment of essential conceptual understandings.

**Overarching Themes for Now You See It, Now You Don’t**

**Extra-Terrestrial Adventure**

Middle School

**Estimated Time:**

This is an interdisciplinary lesson that would be best taught by a team of science, math and language art teachers for 3 class periods or more.

**Materials/Supplies:**

Computers with web access

Calculators

Hobby scraps

Clay

Cardboard

Yarn

Discarded eyes

Pipe cleaners

Toothpicks

Clothespins

And other craft materials

**Conceptual Background:**

In this interdisciplinary lesson, teachers will use their knowledge of ratios, proportions, large numbers, and the relationship of rate and change to explore the requirements for life on other planets, moons, and celestial bodies. Students will write and communicate orally, justify choices, and perform web searches to explore the role of creativity in science.

**Mathematics Standards:**

MA 6.1.1.b Compare and order positive and negative integers

MA 6.1.1.d Represent large numbers using exponential notation

MA 7.1.1.c Represent large numbers using scientific notation

MA 7.1.3.a Compute accurately with integers

MA 8.1.3.e Solve problems using ratios and proportions

MA 6.1.4.a Use appropriate estimation methods to check the reasonableness of solutions for problems involving positive rational numbers

MA 7.1.4.a Use estimation methods to check the reasonableness of solutions for problems involving integers and positive rational numbers

MA 8.1.4.a Use estimation methods to check the reasonableness of solutions for problems involving rational numbers

**Science Standards:**

SC 8.1.1.g Evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information

SC 8.1.1.h Share information, procedures, results, and conclusions with appropriate audiences

SC 8.1.1.i Analyze and provide appropriate critique of scientific investigations

SC 8.1.1.j Use appropriate mathematics in all aspects of scientific inquiry

SC 8.1.2.a Recognize science is an ongoing process and the scientific community accepts and uses explanations until they encounter new experimental evidence not matching existing explanations

SC 8.1.2.b Describe how scientific discoveries influence and change society

SC 8.1.2.c Recognize scientists from various cultures have made many contributions to explain the natural world.

SC 8.1.3.g Describe how science and technology are reciprocal

SC 8.2.2.d Recognize that everything on or around Earth is pulled towards Earth’s center by gravitational force

SC 8.3.1.c Recognize specialized cells perform specialized functions in multicellular organisms

SC 8.3.1.e Describe how plants and animals respond to environmental stimuli

SC 8.3.3.b Compare the roles of producers, consumers, and decomposers in an ecosystem

SC 8.3.3.c Recognize that producers transform sunlight into chemical energy through photosynthesis

SC 8.3.3.f Identify symbiotic relationships among organisms

SC 8.3.3.g Identify positive and negative effects of natural and human activity on an ecosystem

SC 8.3.4.b Recognize the extinction of a species is caused by the inability to adapt to an environmental change

SC 8.4.1.a Describe the components of the solar system

SC 8.4.1.c Describe the effects of gravity on Earth and the effect of gravity on objects in the solar system

SC 8.4.3.a Describe how energy from the Sun influences the atmosphere and provides energy for plant growth

**Language Arts Standards:**

LA 5-7.3.2.a Apply listening skills needed for multiple situations and modalities

LA 5-7.3.2.b Listen and ask probing questions to elicit information

LA 5-7.3.2.c Listen to analyze, and evaluate message, purpose, and perspective of information being communicated

LA 6-8.4.1.a Select and use multiple resources to generate and answer questions and establish validity of information

LA 6-8 4.1.b Demonstrate ethical and legal use of information by citing sources suing a prescribed format

LA 6-8.4.1.e While reading, listening, and viewing, evaluate the message for bias, commercialism and commercialism and hidden agendas

LA 6-8.2.2.a Write in a selected genre considering purpose

LA 6-8.2.2.c Write considering typical characteristics of the selected genre

LA 6-8.3.1.a Communicate ideas and information in a manner appropriate for the purpose and setting

LA 6-8.1.6.a Explain how author’s purpose and perspective affect the meaning and reliability of the text.

LA 6-8.1.6.b Identify and analyze elements of narrative text

**Purpose/Objective:**

To research life on other planets by creating a model of an organism that could survive on a celestial body in our solar system.

**Procedure:**

1. Students listen to a tape of “One-Eyed, One-Horned Flying Purple People Eater” or a 5-10 minute clip of E.T The Extra-Terrestrial.
2. The teacher uses some form of class display (white board, overhead, flip chart, etc) to record student generated reactions, thoughts, and comments.
3. The teacher should introduce listening skills. (LA 5-7.3.2.a) (LA 5-7.3.2.b) (LA 5-7.3.2.c) These skills can be practiced by students listening to the 1938 radio drama “War of the Worlds” by Orson Wells.
4. The teacher facilitates a discussion that includes the problems of “just” listening to the story, what is the story being told, is it believable, how do you think people listening to the radio reacted; do you think a movie would be a better media to communicate this story? (LA 6-8.4.1.e)
5. Ask students if they think there is life beyond Earth. What are some of the factors to be considered when responding to this question? **Hint:** think about temperature, atmospheric gases such as water, oxygen and ozone, sunlight, gravity, etc. Randomly select groups to perform a web search on a specific planet, moon, or other celestial body. (SC 8.4.1.a) (LA 6-8.4.1.a) Cite all resources. (LA 6-8 4.1.b) A possible resource is <http://www.bbc.co.uk/science/space/solarsystem/>
6. Students will use the information to create an organism that can survive on their specific celestial body. They will need to think about the characteristics of their celestial body, what it means to be alive, and the adaptations needed to survive in this environment.(SC 8.1.1.g) (SC 8.3.1.e) (SC 8.4.1.c)
7. Students will write a rationale for the special features needed for their organisms to survive in their specific environment. (LA 6-8.2.2.a) (LA 6-8.2.2.c) (SC 8.3.1.c)
8. Students present their organism and justify their design to the class. (SC 8.1.1.h) (SC 8.1.1.i) (LA 6-8.3.1.a)
9. Identify the factors affecting the possibility of life on other planets and moons. How might these be overcome?
10. The teacher facilitates a discussion of the nature of science and the use of imagination to generate new knowledge. The idea of traveling to outer space was discussed as early as 1620 by J. Kepler. In his book *Sumnium* he discusses a voyage to the moon and lunar characteristics he expected to see (craters, valleys, mountains, and describes characteristics needed for its inhabitants to survive on the moon). For Kepler’s translated book and commentary by Edward Rosen see: <http://johanneskepler.info/index.php?option=com_content&view=article&id=43&Itemid=47>. Galileo’s astronomical observations in the early 1600s confirmed Kepler’s prediction of the existence of craters and mountains on the moon. What are some of the major contributions of Galileo to the science of astronomy? (SC 8.1.2.a) Students should discuss the benefits of the space program. What is it like living in space? <http://spaceflight.nasa.gov/living/index.html> What have we learned? What are some of the innovative technologies that have been developed? What products have been produced? (SC 8.1.2.b) (SC 8.1.2.c) Does the cost justify the benefits? Should funding be provided to continue the space program?
11. Discuss the role of satellites, telescopes, and probes in learning about space. The following website provides updated information regarding the Voyager program. <http://voyager.jpl.nasa.gov/> (SC 8.1.3.g)
12. Kepler even suggests that for the voyage to the moon to be successful, the flight should begin when the sun is behind the Earth or at a point directly opposite take-off. Kepler also knew that since the Earth and the moon are in motion, the shortest route would not be a straight line. Describe the shape of a rocket’s orbit of the moon. Identify some of the factors that are considered when determining a launch date. <http://www.nasa.gov/missions/highlights/schedule101.html> is a helpful website. (SC 8.2.2.d)
13. Race cars can go 180 miles per hour, a jet can travel at 660 miles per hour, and the space shuttle orbits at 17,500 miles per hour. A) Convert the race car, jet, and space shuttle rates to miles per second and then determine how many times faster the space shuttle is than a race car. How many times faster is the shuttle than a jet? (MA 8.1.3.e) B) Choose one of these modes of transportation and calculate the time required to travel to your celestial body. **Hint:** You will need to research the distance from your celestial body to Earth. Use the average distance of perihelion (closest) and aphelion (farthest). (MA 6.1.4.a) (MA 7.1.4.a) (MA 8.1.4.a) C) Light travels at 186,000 miles per second. If you traveled at the speed of light speed, how many times faster would you travel compared to your selected mode of transportation in B). **Hint:** converting to scientific notation will the large numbers more manageable. (MA 6.1.1.d) (MA 7.1.1.c) (SC 8.1.1.j)
14. Extension: Students can determine the shortest travel distances to several stars by accessing <http://spacemath.gsfc.nasa.gov/weekly/5Page29.pdf> **Hint:** Understanding light years will assist students in understanding large distances. (MA 6.1.1.d) (MA 7.1.1.c) (MA 8.1.3.e)
15. Extension: An online game is available at <http://pbskids.org/cyberchase/games/negativenumbers/index.html> that involves the movement of a Space Coupe to destroy invading virus pods. The game requires students to use positive and negative numbers as well as scale. (MA 6.1.1.b) (MA 7.1.3.a)
16. The teacher can facilitate a discussion on the impact of natural and human activity on an ecosystem. (SC 8.3.3.g) Specifically the movie Wall-E, and others listed in number 14, demonstrates the importance of producers and relationships necessary to maintain balance in ecosystems. (SC 8.3.3.b) (SC 8.3.3.c) (SC 8.3.3.f) (SC 8.4.3.a)
17. The teacher can also facilitate a discussion on science fiction and the link(s) to reality. Think about some of these movies: Planet of the Apes (1970), Soylent Green (1973), E.T. The Extra-Terrestrial (1982), Pod People (1983), Waterworld (1995), Independence Day (1996), GATTACA (1997), I, Robot (2004), Wall-E (2008), and Inception (2010). Identify the facts or reality used by the author to create a powerful movie. What are some of the changes to life as we know it that has been predicted by science fiction? (SC 8.3.4.b) Explore the role of imagination in creating science fiction. (LA 6-8.1.6.a) (LA 6-8.1.6.b) Have students reflect on the Steven Spielberg quote “You have many years ahead of you to create the dreams that we can’t even imagine”. <http://www.brainyquote.com/quotes/authors/s/steven_spielberg.html>
18. An optional activity for high school students to use the orbit calculator to explore velocity, force, and gravity found at <http://exploration.grc.nasa.gov/education/rocket/rktrflght.html>
19. Students should also explore rockets. Middle school students would enjoy creating bottle rockets. This website tells you how to build a “Water-Powered Bottle Rocket” Using a Two 2-Liter Soda Bottles <http://tclauset.org/21_BtlRockets/BTL.html>

**Teaching Strategies:**

These activities are highly interactive and require participation of all students. The teacher acts as a facilitator. An excellent teacher resource can be found at PBS Teachers, Hunt for Alien Earths, Source: NOVA scienceNOW <http://www.pbs.org/teachers/connect/resources/7091/preview/>

**Possible Assessment Ideas:**

1. Completion of the model
2. Journal about the survival of their ET.
3. Create a food chain and food web for the ET in its unique environment.
4. Complete the fact or fiction quiz at this website: <http://planetquest.jpl.nasa.gov/gallery/PQquiz.html>

LAY OF THE LAND

[**http://geology.com/satellite/nebraska-satellite-image.shtml**](http://geology.com/satellite/nebraska-satellite-image.shtml)

Middle School

**Estimated Time:**

Two or three class periods depending on the activities selected from the list below.

**Materials/Supplies:**

Nebraska Maps

Computers

Rulers

Calculator

**Conceptual Background:**

In the following series of activities students develop their mapping skills as well as their number sense while investigating the ecology and topography of Nebraska. The activities support the standards below.

**Mathematics Standards:**

MA 6.1.3.a Multiply and divide rational numbers

MA 7.1.3.c Solve problems involving percent of numberse

MA 8.1.3.a Compute accurately with rational numbers

MA 8.1.3.e Solve problems involving ratios and proportions

MA 6.1.4.a Use appropriate estimation methods to check the reasonableness of solutions for problems involving positive rational numbers

MA 7.1.4.a Use estimation methods to check the reasonableness of solutions for problems involving integers and positive rational numbers

MA 8.1.4.a Use estimation methods to check the reasonableness of solutions for problems involving rational numbers

MA 6.2.2.a Identify the ordered pair of a plotted point in the coordinate plane

MA 7.2.2.a Plot the location of an ordered pair in the coordinate plane

**Science Standards:**

SC 8.1.1.h Share information, procedures, results, and conclusions with appropriate audiences

SC 8.1.3.g Describe how science and technology are reciprocal

SC 8.3.3.d Determine the biotic and abiotic factors that impact the number of organisms an ecosystem can support

SC 8.3.3.g Identify positive and negative effects of natural and human activity on an ecosystem

SC 8.4.2.e Compare and contrast constructive and destructive forces that impact Earth’s surface

SC 8.4.3.b Identify factors that influence daily and seasonal changes on Earth

SC 8.4.4.b Describe how environmental conditions have changed through use of the fossil record

**Language Arts Standards:**

LA 6-8.3.1.a Communicate ideas and information in a manner appropriate for the purpose and setting

LA 6-8.3.3.b Interact and collaborate with others in learning situations by contributing questions, information, opinions, and ideas using a variety of media and formats

LA 6-8.4.1.a Select and use multiple resources to answer questions and support conclusions using valid information

**Purpose/Objective:**

To develop the mathematical skills necessary to read and interpret maps which reveal the variety of topography found in the state of Nebraska.

**Procedure:**

1. In pairs, have students use map coordinates to locate the following places on a state map. (MA 6.2.2.a) (MA 7.2.2.a)
	1. Agate Fossil Beds National Monument
	2. Fort Niobrara National Wildlife Refuge
	3. Ashfall Fossil Beds State Historical Park
	4. Gavins Point Dam
	5. Oglala National Grassland
	6. Chimney Rock
	7. Courthouse Rock
	8. Jail Rock
	9. DeSoto National Wildlife Refuge
	10. Indian Cave State Park
	11. Locate and name the nearby the town of three national forest in Nebraska
	12. Find 5 wildlife refuges
	13. What is the highest point in Nebraska (Panorama Point, 5424 feet)
	14. Where are most of the lakes in Nebraska located?
2. The teacher facilitates a class discussion and pooling of answers. Be sure to discuss “what findings surprised the students.” (LA 6-8.3.1.a)
3. The teacher introduces the concept that maps are made to scale. The official state map of Nebraska published by the Department of Roads [www.nebraskatransportation.org](http://www.nebraskatransportation.org) has a graphic scale bar that represents distances on the map in miles. (MA 8.1.3.e)
4. In pairs, students select a location from #1 above. Determine the route and distance to travel to this location by car. Next, use the graphic scale bar to determine the distance if a bird was flying directly to this location. What is the difference in distance? (MA 8.1.3.a) (MA 8.1.3.e)
5. Estimate the time to travel to your destination. (MA 6.1.4.a) (MA 7.1.4.a) (MA 8.1.4.a) What factors might influence your travel time?
6. Estimate the cost of the trip based on current gasoline prices. (MA 6.1.4.a) (MA 7.1.4.a) (MA 8.1.4.a) **Hint:** How many miles are you traveling? How many miles per gallon does your vehicle get? ( MA 6.1.3.a) (MA 8.1.3.a)
7. In pairs, students plan an overnight camping trip at Chadron State Park. Plan the route to get there by car, however, students cannot take the Interstate. Record the route and the number of miles. Calculate the cost of the roundtrip using the current price of gasoline and your vehicle’s miles per gallon. (MA 8.1.3.e)
8. Use Google Earth to discover the latitude, longitude and elevation of Chadron State Park. What landforms can you find on Google Earth that are not present on the map? (SC 8.1.3.g) (LA 6-8.4.1.a)
9. There are six topographic areas in Nebraska according to the official Nebraska Map. Students in groups of 4 should identify the biotic and abiotic factors of their assigned topographic area and research the answers to the following questions: (SC 8.3.3.d)
	1. How does the presence or absence of water affect the vegetation in the 6 topographic areas?
	2. What type of animals probably live in each of the 6 topographic areas?
	3. How are the land cover and soil characteristics of the topographic areas related?
10. Report out to the class. (SC 8.1.1.h) (LA 6-8.3.3.b)
11. Compare and contrast the biotic and abiotic factors of the 6 areas. What similarities and differences are apparent? (SC 8.3.3.d)
12. Are the biotic and abiotic factors in these 6 topographic areas typical for this latitude, longitude, and elevation? Provide a written rationale. (SC 8.3.3.d)
13. The satellite images used for Google Earth may be several years old. If an image was acquired today, in what ways would it be different from your old one?
14. Identify evidence that the Earth’s crust has changed in Nebraska. **Hint:** What natural changes could alter the topographic areas of Nebraska? Think about erosion, weathering, etc. (SC 8.4.2.e)
15. What human interactions may have altered the topographic areas of Nebraska in the last 50 years? 100 years? (SC 8.3.3.g)
16. Explain why Chadron State Park has a drier climate than eastern Nebraska. (SC 8.4.3.b)

**Additional Activities (Extensions)**

1. Students could plan the meals for the 2 day camping trip at Chadron State Park. They could research the cost of food for 4 people and determine the daily calorie intake for each person. (MA 6.1.3.a) (MA 8.1.3.a) The percentage of carbohydrates, proteins, and fats could be calculated. (MA 7.1.3.c) They could also estimate the number of calories used to hike, ride bike, swim, shoot a few hoops, etc. Is the number greater or lesser than the calories present in the meal plan? Adjust the meal plan or the activity level so that the amount of calories consumed equals the amount of calories expended. Justify your adjustments. (MA 6.1.3.a) (MA 8.1.3.a)
2. Use a contour map to learn about the shape of the land in Nebraska. Where are the plains? Where are the steep slopes? Find additional natural and man-made features such as waterways, bridges, etc. Explain how the shape of the land impacts lands use. Free online topographical maps are available at: <http://www.anyplaceamerica.com/topographic_maps/nebraska/lancaster_county/1776_bicentennial_prairie_marker_historical_marker/215-9982/>
3. The 2 fossil beds located in Nebraska could be further explored to explain how environmental conditions have changed. (SC 8.4.4.b)
4. Investigate migration patterns of ducks and geese through Nebraska. The Project Beak activity entitled “Where in the World” allows students to map the migration of two long-billed curlews as they travel through Nebraska. The activity can be found at: <http://www.projectbeak.org/teacher/activities.htm>

Students can build a model to demonstrate how the global positioning system (GPS) works. Access directions for this activity at <http://spaceplace.nasa.gov/teachers/jason_gps.pdf> You can go to [http://gpshome.ssc.nasa.gov](http://gpshome.ssc.nasa.gove) and learn how GPS is used all over the world. There are several activities involving the use of GPS at the Digital Library for Earth Science Education <http://www.dlese.org/new_dlese/> including an animated tutorial located at <http://www.trimble.com/gps/index.shtml> **Now You See It, Now You Don’t**

Middle School *(Modifications for upper elementary and high school located at the end of this document)*

**Estimated time:**

3 or 4 class periods

On the first day students develop a working definition of species and populations. In following days students research a specific ecosystem and present their findings to the class. Several optional activities and websites are provided to facilitate the creation of a unit of study.

**Materials/Supplies:**

Small, multi-colored chips or small, colored candies or cereals

Grid paper

Colored pencils

Rulers

Dice (rolling cubes)

Computers

**Conceptual Background:**

The activity, as written, is designed for middle school classrooms. Modifications will be provided for both upper elementary and high school standards-based classrooms.

Modifying curriculum that is appropriate for other grade levels is rather easy if you focus on appropriate state and national standards. It is essential that teachers identify student expectations at the specific grade level. Elucidating student expectations enables the teacher to focus instruction on attainment of essential conceptual understandings.

**Mathematics Standards:**

MA 6.2.2.a Identify the ordered pair of a plotted point in the coordinate plane

MA 6.3.1.c Identify relationships as increasing, decreasing, or constant

MA 6.3.2.b Represent a variety of quantitative relationships using symbols and words

MA 6.4.1.b Compare and interpret data sets and their graphical representations

MA 6.4.2.a Make predictions based on data and create questions to further investigate

MA 7.4.1.a Analyze data sets and interpret their graphical representations

MA 8.3.1.a Represent and analyze a variety of patterns with tables, graphs, words, and algebraic equations

MA 8.3.2.a Model contextualized problems using various representations

MA 8.4.1.b Compare characteristics between sets of data or within a given set of data

the quality of the predictions

MA 8.4.2.a Evaluate predictions to formulate new questions and plan new studies

**Science Standards:**

SC 8.1.1.f Record and represent data appropriately and review for quality, accuracy, and relevancy

SC 8.1.1.g Evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information

SC 8.1.1.h Share information, procedures, results, and conclusions with appropriate audiences

SC 8.1.1.j Use appropriate mathematics in all aspects of scientific inquiry

SC 8.1.2.a Recognize science is an ongoing process and the scientific community accepts and uses explanations until they encounter new experimental evidence not matching existing explanations

SC 8.3.3.a Diagram and explain the flow of energy through a simple food web

SC 8.3.3.b Compare the roles of producers, consumers, and decomposers in an ecosystem

SC 8.3.3.d Determine the biotic and abiotic factors that impact the number of organisms an ecosystem can support

SC 8.3.3.e Recognize a population is all the individuals of a species at a given place and time

SC 8.3.3.f Identify symbiotic relationships among organisms

SC 8.3.3.g Identify positive and negative effects of natural and human activity on an ecosystem

SC 8.3.4.a Describe how an inherited characteristic enables an organism to improve its survival rate

SC 8.3.4.b Recognize the extinction of a species is caused by the inability to adapt to an environmental change

SC 8.4.2.g Describe the water cycle

SC 8.4.3.a Describe how energy from the Sun influences the atmosphere and provides energy for plant growth

SC 8.4.3.c Describe atmospheric movements that influence weather and climate

**Language Arts Standards:**

LA 8.1.5.e Determine meaning using print and digital reference materials

LA 6-8.1.6.a Analyze the meaning, reliability, and validity of the text considering author’s purpose, perspective

LA 8.1.6.b Identify and analyze elements of narrative text

LA 8.1.6.c Analyze author’s use of literary devices

LA 6-8.1.6.d Summarize, analyze, and synthesize informational text using main and supporting details

LA 6-8.1.6.g Apply knowledge of text features to locate information and gain meaning from a text

LA 8.1.6.f Analyze and evaluate information from text features

LA 7-8.1.6.j Generate and/or answer literal, inferential, critical, and interpretive questions, analyzing and synthesizing prior knowledge, information from the text and additional sources, to support answers

LA 8.1.6.k Select text for a particular purpose

LA 8.1.6.n Make complex or abstract inferences or predictions by synthesizing information while previewing and reading text

LA 8.2.2.b Write considering typical characteristics of the selected genre

LA 6-8.2.2.c Write considering typical characteristics of the selected genre

LA 6-8.2.2.e Analyze models and examples (own and others) of various genres in order to create a similar piece

LA 6-8.3.1.a Communicate ideas and information in a manner appropriate for the purpose and setting

LA 8.3.1.b Demonstrate and adjust speaking techniques for a variety of purposes and situations

LA 6-8.3.1.c Utilize available media to enhance communication

LA 6-8.3.2.a Demonstrate listening skills needed for multiple situations and modalities

LA 6-8.3.2.b Listen and ask questions

LA 6-8.3.2.c Listen to analyze, and evaluate message, purpose, and perspective of information being communicated

LA 6-8.3.3.b Apply conversation strategies

LA 6-8.3.3.c Interact and collaborate with others in learning situations by contributing questions, information, opinions, and ideas using a variety of media and formats

LA 6-8.4.1.a Select and use multiple resources to generate and answer questions and establish validity of information

LA 6-8.4.1.b Demonstrate ethical and legal use of information by citing sources using prescribed formats and tools

LA 6-8.4.1.c Practice safe and ethical behaviors when communicating and interacting with others

LA 6-8.4.1.f Gather and share information and opinions as a result of communication with others

**Purpose/objective:**

To explore ecosystems and the influence of habitat destruction, adaptation, and global warming on diversity. Data analysis, critical thinking skills, communication skills, research skills, and the use of technology to collect data are emphasized in the following series of activities.

**Procedure:**

1. Have students work in pairs or groups of three to draw a 6 by 6 grid with 1” squares and number them. Use x, y coordinate system to appropriately label the grid. (MA 6.2.2.a)
2. Give each pair or group of three students a small cup (1/3 to /2 cup) of small, multi-colored chips.
3. Randomly pour the chips onto the grid.
4. Remove all chips that fall outside the grid.
5. How many different colors of chips are present on the grid? Each different color represents a species in this activity. How many chips of each color are present? The result is the population of each species. (SC 8.3.3.e)
6. Construct a histogram with the number of chips on the y axis. The x axis will represent the species. Each time you throw the dice you will need to create a new histogram to record the results. You will have a group of bars for each throw of the dice. (MA 8.3.1.a) (MA 8.3.2.a) (SC 8.1.1.f)
7. To begin, roll two different colored dice (one color assigned to the x axis and the other color assigned to the y-axis) to determine which square will be cleared of chips. (MA 6.2.2.a) Remove all chips in that square representing the rolled ordered pair (x,y). **Remember** to create your histogram before the next roll.
8. Take a minute to think about which colored chip will be eliminated first. Estimate which colored chip will become extinct first. (MA 6.4.2.a) (MA 8.4.2.a) Write a justification for your prediction.
9. Continue rolling the die until one species (color of chip) becomes extinct.

Predict the order in which the various species (color of chips) will become threatened or endangered. (MA 6.4.2.a) (MA 8.4.2.a)

1. Continue rolling the die until all the chips have been eliminated. Was your prediction correct? Use your data to explain how your prediction differs from the results. (SC 8.1.1.g)
2. As a class discuss factors that affect extinction of species. Which of these factors are caused by humans? What is the purpose of the Endangered Species Act? (SC 8.3.4.b)
3. In pairs, research your assigned ecosystem to determine:
4. Where is this ecosystem typically found? Describe the geography.
5. What are the general characteristics of the climate? How does the temperature and precipitation affect or limit life in this ecosystem? Give specific examples.
6. What types of animals are found in this ecosystem? Describe their physical and behavioral adaptations.
7. What types of vegetation is found in this ecosystem? Describe special adaptations of the vegetation that are present to aid in reproduction, dispersal, or otherwise aid plant survival in this ecosystem. (LA 7-8.1.6.j)
8. Ecosystems are characterized by the interactions between living (biotic) and non-living (abiotic) factors. Describe at least five specific interactions including at least one example of symbiosis. Students should focus on the transfer of energy that occurs when one organisms eats another. (SC 8.4.3.a) It is important that students learn the differences between how plants and animals obtain food and thus the energy they need. (SC 8.3.3.b) (SC 8.3.3.f) (SC 8.3.3.d)
9. Construct a food web to illustrate these interactions. .(SC 8.3.3.a)
10. What are some of the problems faced by this ecosystem that may affect its biodiversity? (SC 8.3.3.g) (LA 6-8.1.6.d) (LA 6-8.2.2.c)
11. Communicate what you have learned about ecosystems by creating a YouTube video, poster, power point presentation, or brochure. (SC 8.1.1.h) (LA 6-8.3.1.a) (LA 6-8.3.1.c) (LA 6-8.3.2.a) (LA 6-8.3.2.b) (LA 6-8.3.2.c) (LA 6-8.4.1.b) (LA 6-8.4.1.c) (LA 6-8.4.1.f)
12. As the human population increases, there are increasing demands on the environment. Additional materials, energy, and homes are required to sustain population growth. Of particular concern is the changing of how land is used to meet human needs. The creation of highways, buildings, homes, schools, etc. results in habitat loss for many plants and animals. Some populations may become threatened, endangered or even extinct. Additional information is available at <http://www.epa.gov/espp/coloring/especies.htm> Go to <http://www.worldwildlife.org/home-full.html> and choose an animal species that is endangered. Record answers to the following questions: Describe the habitat of your chosen animal. When did this species become endangered? What are the population trends or survival prediction for this animal? What factors are contributing to the animal’s extinction? What does it eat? How might the extinction of this animal affect the ecosystem? What conservation efforts are being taken? Is the cost of the conservation efforts justified? Explain. (MA 6.3.1.c) (SC 8.3.4.b) (LA 6-8.1.6.a) (LA 7-8.1.6.j) (LA 6-8.4.1.a)
13. Optional: As students either watch a video or read the book The Lorax by Dr. Seuss have them write down all environmental issues they see during the movie. (LA 8.1.6.a) (LA 8.3.2.a)
	1. Divide the students into 3 groups. The groups will present a summary of the book using one of the following points of views: anthropocentric (human needs and wants), biocentric (a balance of human and environmental needs), and ecocentric (the needs or a balance in the ecosystem is most import). Debate the various points of view. (LA 8.1.6.a) (LA 8.1.6.d) (LA 8.2.2.c) (LA 8.3.1.a) (LA 8.3.1.b) (LA 8.3.2.b) (LA 8.3.2.c) (LA 8.3.3.b) (LA 8.3.3.c)
	2. Discuss why the book was written. Do you think Dr. Seuss’ intentions were to entertain, inform, or persuade? Cite specific reasons and examples from the book to back up your position. (LA 8.1.5.e) (LA 8.1.6.d) (LA 8.1.6.j)
	3. Create an advertisement persuading someone to buy a Thneed. Encourage student creativity by encouraging them to create a UTube video, song, pamphlet, or billboard. (LA 8.1.6.k) (LA 8.2.2.b) (LA 8.4.1.c)
	4. Brainstorm the main events in The Lorax. Students can choose of the events to write a front page news article about the event. (LA 8.1.6.d)
	5. Construct a concept map that demonstrates your understanding of The Lorax. Include characters, setting, problem, solution, theme, point of view, and plot. (LA 8.1.6.b) (LA 8.1.6.f)
	6. Reread the last page of the text. Write a paragraph or two to explain happened to the last of the Truffala Tree seeds. (LA 8.1.6.g) (LA 8.1.6.j) (LA 8.1.6.n)
	7. Optional: Examine the use of literary devices such as personification, oxymoron, symbolism. (LA 8.1.6.c)
14. Optional: An interactive activity that demonstrates what happens to two different colored bugs as pollution increases and decreases is available is available at: <http://www.sciencenetlinks.com/interactives/evolution.html> It is a fun way to introduce natural selection and the role industry can play in extinction. (SC 8.3.4.a)
15. Optional: Explore how organisms are tracked and/or counted to monitor population growth or decline. Discuss the use of GPS and how it is used to track bird migration. One activity, “Tracking Sandy and Bailey”, is part of Project Beak and can be accessed at <http://www.projectbeak.org/teacher/activities.htm> (SC 8.1.3.g)
16. Optional: Have students complete “Predicting the Future” activity found at <http://www.projectbeak.org/teacher/activities.htm>. In this activity students analyze data to predict the future population numbers for Whopping Cranes in the United States. (MA 6.3.2.b)
17. Optional: Use a real life issue and role play the perspectives of various interest groups involved in a change in land use. Choose a relevant situation that is happening in your community. Consider the lumber industry, flooding a town or farm to create a water recreation area, converting a farm into a suburban area or mall, etc. (SC 8.3.4.a) (LA 6-7.3.3.b) (LA 6-8.3.3.c)
18. Optional: Explore the effect of global warming on the specific ecosystem in which you live by accessing the NOAA website <http://www.climate.gov/#dataServices>. Students will interpret graphs, determine patterns, and write about their findings. There are multiple activities available and opportunities to connect to language arts, geography and history such as the Dust Bowl of the 1930s at http://serc.carleton.edu/eslabs/drought/index.html. (MA 6.3.1.c) ( MA 6.4.1.b) (MA 7.4.1.a) (MA 8.4.1.b) (SC 8.1.2.a) (SC 8.4.3.c) (LA 6-7.1.6.g) (LA 8.1.6.f) (LA7-8.1.6.j) (LA 6-7.3.3.b) (LA 6-8.3.3.c)
19. Optional: Describe the soil found in this ecosystem and the processes involved in soil development. Describe the relationship between soil type and the type of plants found in an ecosystem? (SC 8.4.2.b)
20. Optional: Diagram and explain the water cycle. Discuss the impact of the water cycle on ecosystems. (SC 8.4.2.g) (LA 6-8.2.2.e)

**Teaching Strategies:**

These activities are highly interactive and require participation of all students. The teacher acts as a facilitator.

**Possible Assessment Ideas:**

1. Completion of the YouTube video, poster, power point presentation, or brochure
2. Construction of graphs.
3. Answers to questions.
4. Assessment Activity: Have students work in pairs to complete this activity. A farmer is trying to control the number of mice in his barn by using pesticide. He put several containers of pesticide in various places inside the barn. He waited one month and did not notice a big difference in the number of mice running around in his barn. He decides that the pesticide is ineffective and disposes the empty pesticide containers. He then purchases two barn cats from the local pet rescue. His land borders on a heavily wooded area, which is protected by law as a wildlife refuge. How might the barn owls in this ecosystem be affected over the next three months by the farmer’s attempt to solve his mouse problem? Adapted from Owls: Top of a Food Chain at <http://www.sciencenetlinks.com/lessons.php?BenchmarkID=5&DocID=90>
5. Create a food chain and food web for unique ecosystem.

**Modifying Curriculum for Various Grade Levels:**

Modifying curriculum that is appropriate for other grade levels is rather easy if you focus on appropriate state and national standards. It is essential that teachers identify student expectations at the specific grade level. Elucidating student expectations enables the teacher to focus instruction on attainment of essential conceptual understandings. Web-sites abound with activities. Another source of “tried and true” environmentally-based activities can be found in *Project Wild*. Select activities that align with teaching goals and are relevant and meaningful to students. As activities are selected, think about how 1) students are involved in their own learning, 2) student progress toward meeting the standards will be connected to prior understandings, and 3) ultimately these understandings will be assessed.

**Modifications for Upper Elementary and High School:**

Most any middle school activity can be modified to teach the standards for the lower and upper grade level. In this specific case, adaptations for grades 3-5 include the use of manipulatives. Students can actually build bar graphs by linking cubes together. The graphs are then compared, conclusions drawn, and additional questions pursued. (MA 5.4.1.a) (MA 5.4.1.b) (MA 5.4.1.c) (MA 5.4.1.e)

The science standards addressed include the **Nature of Science and Technology**. Data collection, analysis, and communication are emphasized as well as the importance of mathematics in scientific inquiry. (SC 5.1.1.e) (SC 5.1.1.f) (SC 5.1.1.g) (SC 5.1.1.i), **Life Science** focuses on living and nonliving components of an ecosystem and their interactions. (SC 5.3.1.a) (SC 5.3.1.b) Optional (SC 5.3.2.b) Students can demonstrate the roles of the various components by creating a food chain and describing their adaptations to specific ecosystems and the impact organisms have on the environment in which they live. (SC 5.3.3.a) (SC 5.3.3.b) (SC 5.3.3.c) (SC 5.3.3.d) (SC 5.3.4.a), and **Earth Science**. The Earth Science Standards explore the characteristics of abiotic factors and how the Earth’s materials are used in ecosystems. (SC 5.4.2.a) (SC 5.4.2.c)

Language Art Standards provide students the opportunities to answer questions, write, communicate ideas, listen, summarize, collaborate with others, cite and evaluate sources and learn from others (LA 5.1.6.k) (LA 5.2.2.c) (LA 5.3.1.a) (LA 5.3.2.a) (LA 5.3.2.b) (LA 5.3.2.c) (LA 5.3.3.b) (LA 5.3.3.c) (LA 5.4.1.a) (LA 5.4.1.b) (LA 5.4.1.c) (LA 5.4.1.e) (LA 5.4.1.f)

Modifications for high school include emphasis on higher thinking skills such as analysis, critical thinking, and problem solving. In mathematics students should focus on interpreting data, comparing and analyzing the rate of change, explaining the role of sample size and transformations, explaining the importance and use of statistics, creating and analyzing scatter plots and discussing sampling methods. (MA 12.3.1.a) (MA 12.3.1.f) (MA 12.4.1.c) (MA 12.4.1.d) (MA 12.4.1.e) (MA 12.4.1.f) (MA 12.4.1.g)

In science, students are applying their knowledge to make detailed qualitative and quantitative observations, analyze and interpret data, synthesize ideas to make and evaluate models, and communicate their study and findings to others. (SC 12.1.1.e) (SC 12.1.1.f) (SC 12.1.1.g) (SC 12.1.1.j) (SC 12.1.1.l)

In addition as ecosystems are critically examine ecosystems the focus should be diversity, balance, cycling of abiotic factors, environmental quality, adaptations, human and natural influences on ecosystems and global climate change. This approach addresses the following high school science standards: (SC 12.3.3.a) (SC 12.3.3.b) (SC 12.3.3.c) (SC 12.3.3.d) (SC 12.3.4.a (SC 12.4.2.a) (SC 12.4.2.c) (SC 12.4.3.d)

Another option is to pursue evolution. The study of evolution would be guided by the following science standards: (SC 12.3.4.b) (SC 12.3.4.c) (SC 12.3.4.d)

Cultivating higher order thinking skills requires students engage in multiple experiences in which they evaluate, summarize, analyze, write, research, read, listen, collaborate, and communicate. Learning mathematics and science is greatly enhanced by incorporating the following Language Arts Standards into the curriculum. The following standards are addressed at the high school level: (LA 12.1.6.a (LA 12.1.6.d)

(LA 12.1.6.f) (LA 12.2.2.b) (LA 12.3.1.c) (LA 12.3.2.a) (LA 12.3.2.b) (LA 12.3.2.c)

(LA 12.3.3.a) (LA 12.3.3.b) (LA 12.4.1.a) (LA 12.4.1.b) (LA 12.4.1.c) (LA 12.4.1.e) (LA 12.4.1.f)

**Overarching skills of communicating, collaborating, graphing, researching, data analysis, critical thinking, and writing**

**Population**

**Habitat**

**Destruction**

**Land Use**

**Weather**

**& Climate**

**Water**

**Cycle**

**Soil**

**Study**

**Global**

**Warming**

**Ecosystem**

**Study**

**Now You See It,**

**Now You Don’t**

**Extinction**

**Adaptation**