Colorado Teacher-Authored Instructional Unit Sample

Science
6th Grade

Unit Title: Changing Environments

INSTRUCTIONAL UNIT AUTHORS

Colorado Springs School District 11
Christopher Cruz
Rose Tinucci

Ellicott School District
Diana Ford
Michael Webb
Corey Zukie

Hanover School District
Kimberly Barre

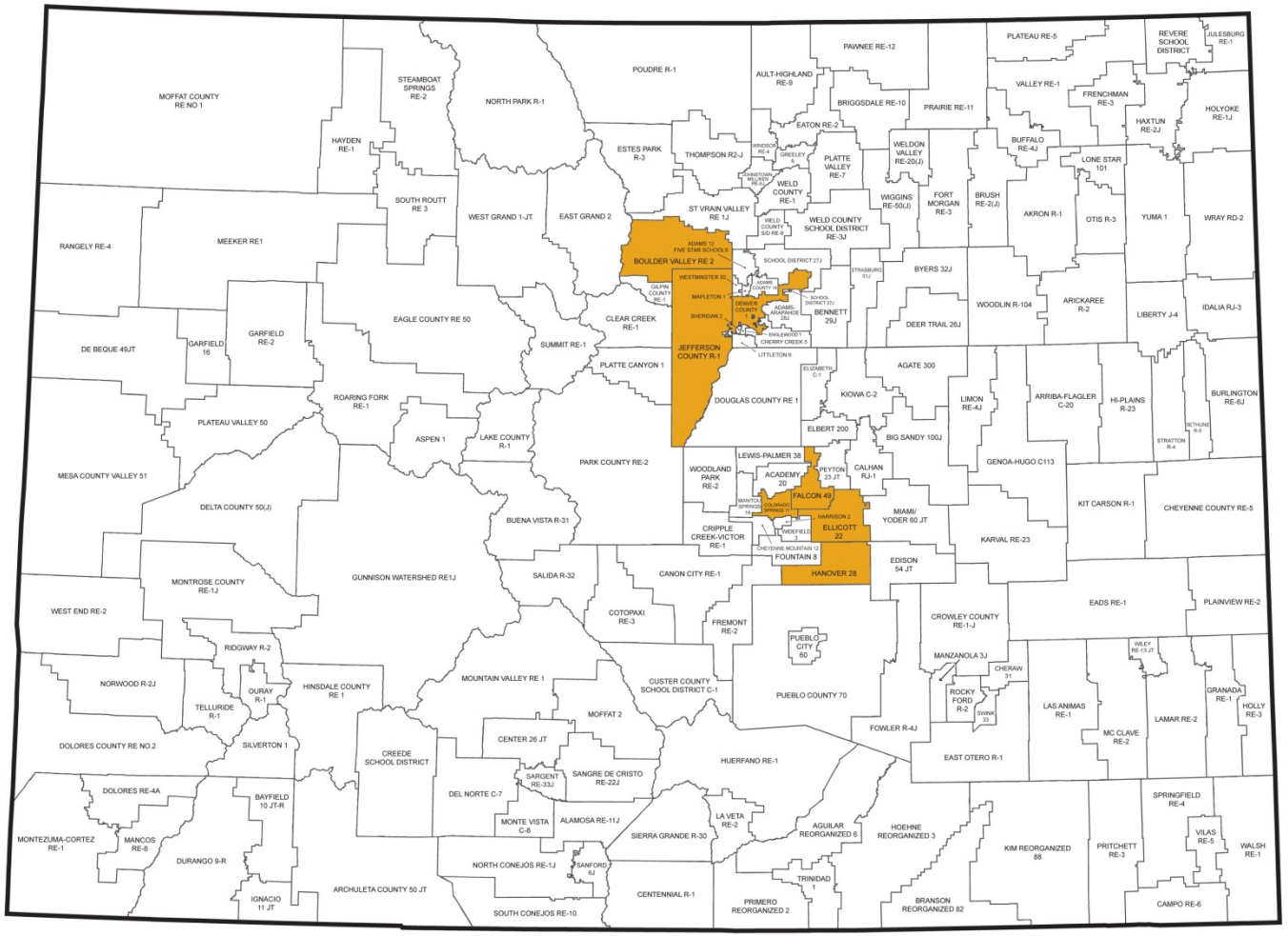
BASED ON A CURRICULUM OVERVIEW SAMPLE AUTHORED BY

Boulder Valley School District
Samantha Messier

Denver County School District
Ryan Sparzak

Falcon School District
Lura Moore

Jefferson County School District
Dawn Jones



This unit was authored by a team of Colorado educators. The template provided one example of unit design that enabled teacher-authors to organize possible learning experiences, resources, differentiation, and assessments. The unit is intended to support teachers, schools, and districts as they make their own local decisions around the best instructional plans and practices for all students.

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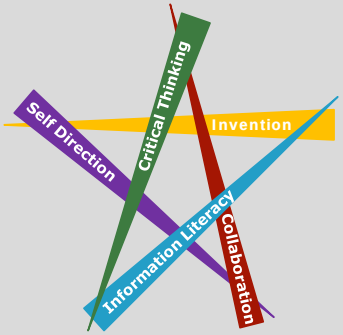
Colorado's District Sample Curriculum Project

Colorado Teacher-Authored Sample Instructional Unit

Content Area	Science	Grade Level	6th Grade
Course Name/Course Code			

Standard	Grade Level Expectations (GLE)	GLE Code
1. Physical Science	1. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles	SC09-GR.6-S.1-GLE.1
	2. Atoms may stick together in well-defined molecules or be packed together in large arrangements. Different arrangements of atoms into groups compose all substances.	SC09-GR.6-S.1-GLE.2
	3. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model	SC09-GR.6-S.1-GLE.3
	4. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density	SC09-GR.6-S.1-GLE.4
2. Life Science	1. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species	SC09-GR.6-S.2-GLE.1
	2. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem	SC09-GR.6-S.2-GLE.2
3. Earth Systems Science	1. Complex interrelationships exist between Earth's structure and natural processes that over time are both constructive and destructive	SC09-GR.6-S.3-GLE.1
	2. Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere	SC09-GR.6-S.3-GLE.2
	3. Earth's natural resources provide the foundation for human society's physical needs. Many natural resources are nonrenewable on human timescales, while others can be renewed or recycled	SC09-GR.6-S.3-GLE.3

Colorado 21st Century Skills



Critical Thinking and Reasoning: *Thinking Deeply, Thinking Differently*

Information Literacy: *Untangling the Web*

Collaboration: *Working Together, Learning Together*

Self-Direction: *Own Your Learning*

Invention: *Creating Solutions*

Reading & Writing Standards for Literacy in Science and Technical Subjects 6 - 12

Reading Standards

- Key Ideas & Details
- Craft And Structure
- Integration of Knowledge and Ideas
- Range of Reading and Levels of Text Complexity

Writing Standards

- Text Types & Purposes
- Production and Distribution of Writing
- Research to Construct and Present Knowledge
- Range of Writing

Unit Titles	Length of Unit/Contact Hours	Unit Number/Sequence
Changing Environments	4-6 weeks	1

Unit Title	Changing Environments	**Length of Unit**	4-6 weeks
Focusing Lens(es)	Change Interaction	**Standards and Grade Level Expectations Addressed in this Unit**	SC09-GR.6-S.2-GLE.1 SC09-GR.6-S.2-GLE.2 SC09-GR.6-S.3-GLE.1
Inquiry Questions (Engaging-Debatable):	• How do changes in one (population) affect balance in an ecosystem? • How would life / ecosystems be different if Earth's surface did not change?		
Unit Strands	Earth Science, Life Science		
Concepts	Change, equilibrium/stability, ecosystems, environment, population, energy, matter, flow, cycle, surface features, constructive/destructive forces, interaction, patterns		

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
The interactions among organisms in an ecosystem facilitate the flow of energy and cycling of matter and follow predictable patterns. (SC09-GR.6-S.2-GLE.2-EO.c; IQ.2; N.3)	What biotic and abiotic factors comprise ecosystems? (SC09-GR.6-S.2-GLE.1-EO.c) What are ways that we can describe and measure populations and ecosystems? (SC09-GR.6-S.2-GLE.1-EO.a) How does a food web show the flow of energy through an ecosystem? patterns (SC09-GR.6-S.2-GLE.2-EO.b) What "jobs" do organisms do to facilitate the flow of energy and cycling of matter? patterns (SC09-GR.6-S.2-GLE.2-EO.c; IQ.2)	How do biotic and abiotic factors interact in an ecosystem? (SC09-GR.6-S.2-GLE.1-EO.c) Why are there generally more producers than consumers in an ecosystem? (SC09-GR.6-S.2-GLE.1-EO.c) How does the flow of energy compare and contrast with the cycling of matter? patterns (SC09-GR.6-S.2-GLE.2-EO.c)
The interaction between Earth's constructive and destructive forces explains both the pattern and changes in surface features on Earth. (SC09-GR.6-S.3-GLE.1-EO.a; IQ. 2; RA.1)	What constructive and destructive forces affect Earth's surface features? How does Earth's surface change over time? (SC09-GR.6-S.3-GLE.1-EO.b,c; IQ.2; RA.2; N.2)	How do forces inside the Earth and on the surface build, destroy, and change Earth's crust? (SC09-GR.6-S.3-GLE.1-EO.a; IQ. 1; RA.1) How do changes in Earth's surface alter the nonliving environment of ecosystems? (SC09-GR.6-S.3-GLE.1-EO.b; RA.1)
Changes in the environment can determine the survival of populations and the stability of ecosystems. (SC09-GR.6-S.2-GLE.1-EO.a; IQ.1)	What types of environmental changes can occur? (SC09-GR.6-S.2-GLE.1-EO.a) What is meant by "equilibrium" of an ecosystem? (SC09-GR.6-S.2-GLE.1-EO.c; IQ.2)	How do environmental changes explain why populations decrease or increase? (SC09-GR.6-S.2-GLE.1-EO.a) How do environmental changes affect the survival of individual organisms, populations and species? (SC09-GR.6-S.2-GLE.1-EO.a)

A general understanding of ecosystems and environmental change allows scientists to predict and model potential impacts on populations of organisms. (SC09-GR.6-S.2-GLE.1-EO.b, d; N.1)	How do models help scientists to predict future events? (SC09-GR.6-S.2-GLE.1-EO.d; RA.1; N.3)	How might future environmental changes affect the survival of individual organisms, populations and species? (SC09-GR.6-S.2-GLE.1-EO.d; N.3) and (SC09-GR.6-S.3-GLE.1-EO.ac, N.2)

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
• The difference between biotic and abiotic (SC09-GR.6-S.2-GLE.1-EO.c) • The reasons why there are generally more producers than consumers in an ecosystem (SC09-GR.6-S.2-GLE.1-EO.c) • How food webs help us visualize the flow of energy through and ecosystem (SC09-GR.6-S.2-GLE.2-EO.b) • Matter cycles within ecosystems (SC09-GR.6-S.2-GLE.2-EO.c; IQ.1) • Earth's surface is constantly changing (SC09-GR.6-S.3-GLE.1-EO.c; IQ.1) • Examples of how forces inside the Earth contribute to changes in the surface of Earth's crust (SC09-GR.6-S.3-GLE.1-EO.a; IQ.1) • The constructive and destructive forces brought about by changes to the Earth's surface (SC09-GR.6-S.3-GLE.1-EO.a; IQ.1) • How environmental conditions affect the survival of individual organisms, populations and entire species (SC09-GR.6-S.2-GLE.1-EO.d; N.3) and (SC09-GR.6-S.3-GLE.1-EO.ac, N.2)	• Develop, communicate and justify an evidence-based explanation about why there generally are more producers than consumers in an ecosystem (SC09-GR.6-S.2-GLE.2-EO.a) • Design a food web diagram to show the flow of energy through an ecosystem (SC09-GR.6-S.2-GLE.2-EO.b) • Compare and contrast the flow of energy with the cycling of matter in ecosystems (SC09-GR.6-S.2-GLE.2-EO.c) • Gather, analyze and communicate an evidence-based explanation for the complex interaction between Earth's constructive and destructive forces (SC09-GR.6-S.3-GLE.1-EO.a) • Gather, analyze and communicate evidence from text and other sources that explains the formation of surface features (SC09-GR.6-S.3-GLE.1-EO.b) • Use or create a computer simulation for planets' changing surface (SC09-GR.6-S.3-GLE.1-EO.c) • Practice the collaborative inquiry process that scientists use to identify local evidence of constructive and destructive forces (SC09-GR.6-S.3-GLE.1; N.1) • Create and compare models of natural processes that affect structures (SC09-GR.6-S.3-GLE.1; N.2) • Interpret and analyze data about changes in environmental conditions (SC09-GR.6-S.2-GLE.1-EO.a) • Develop, communicate, and justify and evidence-based explanation about how ecosystems interact (SC09-GR.6-S.2-GLE.1-EO.b) • Model equilibrium in an ecosystem (SC09-GR.6-S.2-GLE.1-EO.c) • Examine, evaluate, question, and ethically use information from a variety of sources to investigate how environmental conditions affect survival (SC09-GR.6-S.2-GLE.1-EO.d)

Critical Language: includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline.
EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*

A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*Ecosystems change over time as populations interact with each other and the changing environment.*
Academic Vocabulary:	Analyze, interpret, evidence, interactions
Technical Vocabulary:	Weathering, erosion, deposition, constructive forces, destructive forces, ecosystem, population, species, crust, survival, equilibrium, producers, consumers, food web, food chain

Unit Description:	This unit begins with an introduction of organisms and the flow of energy within an ecosystem. The unit then progresses to environmental changes such as constructive and destructive forces that affect the ecosystem, and the relationship between changes within the environment and how an organisms' population will be altered. The unit will focus on the relationship between a changing environment and how the organisms' population changes while attempting to achieve stability, and eventually equilibrium. The unit culminates in a performance assessment where the students are predicting how changes in an environment may (or may not) affect future populations within that environment.
Considerations:	This unit was written with the intent of being taught after the "Water, Water, Everywhere" unit.
Unit Generalizations	
Key Generalization:	Changes in the environment can determine the survival of populations and the stability of ecosystems.
Supporting Generalizations:	The interactions among organisms in an ecosystem facilitate the flow of energy and cycling of matter and follow predictable patterns.
	The interaction between Earth's constructive and destructive forces explains both the pattern and changes in surface features on Earth.
	A general understanding of ecosystems and environmental change allows scientists to predict and model potential impacts on populations of organisms.

Performance Assessment: *The capstone/summative assessment for this unit.*	
Claims: (Key generalization(s) to be mastered and demonstrated through the capstone assessment.)	Changes in the environment can determine the survival of populations and the stability of ecosystems.
Stimulus Material: (Engaging scenario that includes role, audience, goal/outcome and explicitly connects the key generalization)	You are an environmentalist who will analyze a community in which a constructive or destructive force has affected a nearby population of organisms. You must choose a median (Power Point, creating a diorama, making a poster…) and illustrate the environmental change that has occurred (Earthquake, melted glacier that creates a Kettle lake, flood that destroyed an area….) and explain the impact on the organisms' population in a community. You will report your findings and impact study to the community.
Product/Evidence: (Expected product from students)	Power Point, poster or diorama that shows a constructive or destructive force that has impacted an area. Included in the product should be a population of an organism that has been impacted by the environmental change with an explanation of how the population has changed due to the impact of the environmental change.
Differentiation: (Multiple modes for student expression)	The teacher may provide students with multiple examples of constructive and deconstructive forces. The teacher may give students a list of animals to choose from based on the ecosystem. The teacher may allow students to present their materials verbally. To extend this work, students will make predictions of the impact on the population, for a specified duration of time, based on their current evidence of population changes OR students will provide a prediction of how the community will try to reach equilibrium.

Texts for independent reading or for class read aloud to support the content	
Informational/Non-Fiction	**Fiction**
Ecosystems– Rice, W.B. [lexile level 420] *Ecosystems*-- Van Voorst, J.M. [lexile level 900] *Matter*- Manolis, K. [lexile level 560] *Earth's Shifting Surface*- Snedden, M. [lexile level 880] *Erosion: Changing Earth's Surface*- Koontz, R.M. [lexile level 780] *Galapagos Islands: Nature's Delicate Balance at Risk* - Tagliaferro, L. [lexile level 1200]	*Dangerous Earth*– Rooney, A. [lexile level 600] *The Earth Cries Out: Forensic Chemistry and Environmental Science* - McIntosh, K. [lexile level 900]

Ongoing Discipline-Specific Learning Experiences				
1.	Description:	Working like a scientist: Using the scientific method	Teacher Resources:	http://www.brainpopjr.com/science/scienceskills/scientificmethod/grownups.weml (Near middle of page teacher resources page with activities) http://undsci.berkeley.edu/teaching/misconceptions.php (A list of common misconceptions about the nature of science) http://undsci.berkeley.edu/teaching/ (Tips for introducing and teaching scientific method and experimentation) http://www.livescience.com/6727-invisible-gorilla-test-shows-notice.html (Video in which most people fail to observe large "gorilla" moving across room) http://www.shodor.org/succeed-1.0/forensic/teacher/lessons/observation.html (Lesson plan devoted to developing observation skills) http://blogs.loc.gov/teachers/2011/06/look-again-challenging-students-to-develop-close-observation-skills/ (Library of Congress brief of tools for helping students develop observation skills)
			Student Resources:	http://www.brainpopjr.com/science/scienceskills/scientificmethod/grownups.weml (At top of page student link for movie and activities about scientific method) http://www.glencoe.com/sites/common_assets/science/virtual_labs/E16/E16.html (Virtual lab to practice use of scientific method and experimentation) http://www.brainpop.com/science/scientificinquiry/scientificmethod/preview.weml (Movie and quiz for scientific method/inquiry) http://lifehacker.com/5960811/how-to-develop-sherlock-holmes+like-powers-of-observation-and-deduction (Explanation of tools to increase observation skills with hook related to Sherlock Holmes)
	Skills:	Practice and collaborate using the inquiry process Make predictions, report and share findings (graph, data table, etc.)	Assessment:	Students are assessed within the learning experiences

2.	Description:	Thinking like a scientist: Become a critical consumer of information	Teacher Resources:	http://www.phschool.com/eteach/language_arts/2002_12/essay.html (Strategies to help develop reading comprehension skills) http://www.readingrockets.org/article/3479/ (7 tips with resources to help students' reading comprehension)
			Student Resources:	http://www.brainpop.com/english/studyandreadingskills/readingskills/ (Reading comprehension movie and quiz) http://www.brainpop.com/english/writing/mainidea/ (Main idea movie and quiz) http://www.brainpop.com/math/dataanalysis/graphs/preview.weml (Analyzing graphs movie and quiz)
	Skills:	Gather, analyze, and communicate evidence from text Determine reliable versus non reliable sources of information Identify key points and themes Identify faults in research methods, logic, and statistical findings Scrutinize credibility of sources Evaluating bias Evaluating scientific claims	Assessment:	Students are assessed within the learning experiences

Prior Knowledge and Experiences

Students must have a basic understanding of survival, how and what a prediction is, Earth's features, population, what constructive and destructive mean in general, and the difference between living and non-living.

Vertical Articulation: The last time students have seen concepts related to this unit was in 4th, 2nd, and PK.

Learning Experience # 1

The teacher may provide various lab experiences (e.g., stream table) demonstrating changes to the Earth's surface so that students can identify and differentiate between constructive and destructive forces.

Generalization Connection(s):	The interaction between Earth's constructive and destructive forces explains both the pattern and changes in surface features on Earth.	
Teacher Resources:	https://teacherweb.com/LA/.../**Constructive-and-Destructive-Forces**.ppt (Power point over constructive and destructive forces) **http://tinyurl.com/ogbdzxf** (Power point over constructive and destructive forces) http://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/the-forces-that-change-the-face-of-earth (Forces info) http://www.geo.arizona.edu/sites/www.geo.arizona.edu/files/Stream%20Table1.pdf (Lab resource/example)	
Student Resources:	https://www.youtube.com/watch?v=WWc5UeYvYZA (Stream erosion/deposition lab) https://www.youtube.com/watch?v=7juhX0TunNg (Stream transport, erosions, and deposition lab) https://www.youtube.com/watch?v=YZHmLlwXlil (Review video) https://www.youtube.com/watch?v=wUaswZHk6ps (Time-lapse of Fluvial deposits) https://sites.google.com/a/ssd2.org/forces-of-earth-1/gravaty(Constructive and destructive forces: (mountains, volcanoes, gravity, glaciers, water, erosion, wind)	
Assessment:	The student will illustrate and label constructive and destructive forces created by the effects of water as well as create a timeline that represents the constructive and destructive forces at different time intervals.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide a word bank.	The student will only illustrate the before and after effects of the water.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide different variables (e.g., slope, flow).	The student may compare and contrast the effects of the different variables (e.g. slope and flow) on erosion as well as predict future impacts on the environments.
Critical Content:	• Erosion • Weathering • Alluvial • Deposition • Constructive • Destructive • Fluvial	
Key Skills:	• Create a simulation of Earth's changing surface • Analyze constructive and deconstructive features • Understand a sequence a events on a timeline	
Critical Language:	Erosion, weathering, deposition, deposit, constructive forces, destructive forces, fluvial, alluvial	

Learning Experience # 2		
The teacher may provide various videos and other forms of media on the Earth's surface so that students can identify the difference between constructive and destructive forces.		
Generalization Connection(s):	The interaction between Earth's constructive and destructive forces explains both the pattern and changes in surface features on Earth. (SC09-GR.6-S.3-GLE.1-EO.a;IQ. 2; RA.1)	
Teacher Resources:	http://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/the-forces-that-change-the-face-of-earth (forces info) https://teacherweb.com/LA/.../Constructive-and-Destructive-Forces.ppt (Power point over constructive and destructive forces) http://tinyurl.com/ogbdzxf (Power point over constructive and destructive forces) http://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/the-forces-that-change-the-face-of-earth (Forces info)	
Student Resources:	http://www.youtube.com/watch?v=qEbYpts0Onw&feature=related (land slide video) http://www.youtube.com/watch?v=pCMMwQmUjHI&feature=related (mass movement video) http://www.youtube.com/watch?v=CyY3bCV8K-M&feature=related (Mudslide video) http://www.youtube.com/watch?v=d5LxT7UGdxY&feature=related (Stalactites video) http://www.youtube.com/watch?v=fIbwo3NB8lk (waterfall video) http://www.youtube.com/watch?v=oZH9yqaixVc (Turbulence video) http://www.youtube.com/watch?v=mgnzSTY5zRg (Glacier video) http://www.youtube.com/watch?v=7nS_aR8XX_U (Waves video) http://www.youtube.com/watch?v=FGqz3qklCck (Beach video) http://www.youtube.com/watch?v=Xo_yZGVB5Jg (Long shore drift video) http://www.youtube.com/watch?v=_-SYlshnkN8 (Deflation video) http://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/the-forces-that-change-the-face-of-earth (forces info)	
Assessment:	The students will identify (list on paper or white boards) different constructive and destructive forces from real life videos and images.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide a word bank.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide resources (Internet sites or reliable reference books) for students to identify real life examples on their own.	The student may provide video clips or photographs from their community that identifies different forms of weathering and erosion in their communities.
Critical Content:	• Erosion • Weathering • Deposition • Constructive • Destructive	

Key Skills:	● Identify forms of real life weathering and erosion
Critical Language:	Erosion, weathering, deposition, deposit, constructive forces, destructive forces

Learning Experience # 3		
The teacher may introduce abiotic and biotic factors of an ecosystem so that students can identify and explain the difference between the two in a given environment.		
Generalization Connection(s):	The interactions among organisms in an ecosystem facilitate the flow of energy and cycling of matter and follow predictable patterns.	
Teacher Resources:	http://study.com/academy/lesson/abiotic-factors-of-an-ecosystem-definition-examples-quiz.html (text explanation, includes quizzes) http://study.com/academy/lesson/what-is-biotic-definition-factors-examples.html (text explanation, includes quizzes) http://www.slideshare.net/lurganbeach/ecosystems-biotic-and-abiotic-factors-8840280 (slide show)	
Student Resources:	http://biology.tutorvista.com/ecology/abiotic-factors.html (image of abiotic features) http://katiegrasch-ecology.weebly.com/abioticbiotic-factors.html (image of biotic and abiotic features) http://www2.ccsd.ws/sbfaculty/team8e/jecole/Science/abiotic_vs_.htm (real-life examples of abiotic and biotic factors)	
Assessment:	Students will construct a visual representation of an ecosystem labeling and describing biotic and abiotic factors within that environment. Students will come up with: ● Multiple biotic factors ● Multiple abiotic factors ● Scientific explanation of how each of these each factors may affect the environment	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide a ecosystem. The teacher may provide an explanation of how some of the factors affect the environment.	The student may identify 4 biotic and abiotic factors instead of 8.
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide opportunities to work as a class to create communities adjacent to each other and inner flow between the communities.	The student may provide evidence of how energy is transferred throughout the environment, focusing on the biotic factors.
Critical Content:	● Energy flow within an ecosystem ● Population ● Community ● Autotrophs ● Heterotrophs	

	• Producer • Consumers • Biotic • Abiotic
Key Skills:	• Identify biotic and abiotic factors in an environment • How they interact
Critical Language:	Population, community, producers, consumers, autotrophs, heterotrophs, biotic, abiotic

Learning Experience # 4		
The teacher may model the random sampling and capture-mark and release so that the students can demonstrate the method of counting a population in order to describe change over time.		
Generalization Connection(s):	The interactions among organisms in an ecosystem facilitate the flow of energy and cycling of matter and follow predictable patterns.	
Teacher Resources:	http://www.cals.ncsu.edu/course/fw353/Estimate.htm (estimating animal populations) https://www.boundless.com/biology/textbooks/boundless-biology-textbook/population-and-community-ecology-45/population-demography-249/population-size-and-density-925-12181/ (population sampling) http://www.radford.edu/~jkell/mark_rec103.pdf (mark, capture and release method) http://www.nsta.org/publications/news/story.aspx?id=49386 (lab sample) http://www.biologycorner.com/lesson-plans/ecology/ (Various resources and links)	
Student Resources:	https://www.youtube.com/watch?v=7nr9rQpm2A4 (methods of counting wild animals) thttp://study.com/academy/lesson/populations-density-survivorship-and-life-histories.html (population density video) http://www.biologycorner.com/flash/mark_recap.swf (mark and release method simulation)	
Assessment:	Students will perform a lab experiment that demonstrates random sampling and capture-mark and release method of counting a population. The students will report their findings and analysis in a written format that will include a graph and a prediction of future population changes.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide fewer samples for the students to count as well as a pre-formatted graph.	The student may complete fewer number of counts during the laboratory experience and use a pre-formatted graph to report their findings. The student may electronically complete the written section of the report.

Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may inter-mix species so that students have to sort and count intermixed populations.	The student may use a double graph to report their findings.
Critical Content:	• Random sampling • Capture- mark and release method of counting a population	
Key Skills:	• Graphing • Accurate data collection methods • Lab procedure • Making a prediction based on evidence	
Critical Language:	Random sampling, capture-, mark and release method of counting a population, hypothesis, conclusion, prediction,	

Learning Experience # 5	
The teacher may provide different examples, and forms of media, demonstrating how a food chain (developing into a food web) displays the flow of energy within an ecosystem so that students can identify the flow of energy through organisms in an ecosystem.	
Generalization Connection(s):	The interactions among organisms in an ecosystem facilitate the flow of energy and cycling of matter and follow predictable patterns. (SC09-GR.6-S.2-GLE.2-EO.c; IQ.2; N.3)
Teacher Resources:	http://education.nationalgeographic.com/encyclopedia/food-web/ (explanation of trophic levels and food webs) http://www.nature.com/scitable/knowledge/library/food-web-concept-and-applications-84077181 (Food web and trophic level readings) http://www.biologycorner.com/lesson-plans/ecology/ (Various resources and links) http://www.mpsaz.org/rmhs/staff/aeullman/class1/assignments/files/mountain_lion_jack_rabbit_population_activity.pdf (predator-prey simulation)
Student Resources:	http://kids.britannica.com/comptons/art-90132/The-amount-of-energy-at-each-trophic-level-decreases-as (Trophic Level explanation) http://legacy.owensboro.kctcs.edu/gcaplan/eco/Note%20Withgott/ECO%20NOTE%20K%20Species%20Interaction.htm (Higher level thinking ecology definitions) http://www.uic.edu/classes/bios/bios101/x311_files/textmostly/slide19.html (food web image) http://files5.pdesas.org/12719500419102004003801602021424502009207125124 9/Download.ashx?hash=2.2 (10% law visual) http://www.enchantedlearning.com/subjects/foodchain/ (food chain/web reading)
Assessment:	Students will create a food web (e.g., flow chart) and illustrate the transfer of energy. Students must justify, using scientific evidence, where the energy is transferred to and from.

Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide an outline of a food web for the students to fill in. The teacher may provide an energy flow chart.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	Teacher may provide resources for further research opportunities, such as more complex food webs (e.g. deep sea food webs)	Students can provide evidence of how food webs from different ecosystems interact and affect each other.
Critical Content:	● Food web, food chain, primary producer, primary consumer, secondary consumer, tertiary consumer, autotroph, heterotroph, transfer of energy, trophic levels, 10% rule	
Key Skills:	● Labeling the transfer of energy providing evidence as to where energy is transferred/lost	
Critical Language:	Food web, food chain, primary producer, primary consumer, secondary consumer, tertiary consumer, autotroph, heterotroph, transfer of energy, 10% rule	

Learning Experience # 6	
The teacher may provide a case study of the interaction amongst two populations (e.g., wolf and deer population) so that students can analyze data to explain the relationship between these organisms.	
Generalization Connection(s):	The interactions among organisms in an ecosystem facilitate the flow of energy and cycling of matter and follow predictable patterns. A general understanding of ecosystems and environmental change allows scientists to predict and model potential impacts on populations of organisms.
Teacher Resources:	http://www.biologycorner.com/worksheets/predator_prey_graphing.html (Example of worksheet) http://regentsprep.org/regents/biology/units/ecology/index.cfm (Unit resources) http://www.biologycorner.com/lesson-plans/ecology/ (Various resources and links) http://www.mpsaz.org/rmhs/staff/aeullman/class1/assignments/files/mountain_lion_jack_rabbit_population_activity.pdf (Predator-prey relationship simulation)
Student Resources:	http://necsi.edu/projects/evolution/co-evolution/pred-prey/co-evolution_predator.html (Predator-Prey relationship info) http://www.birdday.org/2014materials/PredatorPrey.pdf (predator/prey game)

	http://www.wolfquest.org/pdfs/Predator-Prey%20Tag.pdf (game) http://srel.uga.edu/outreach/kidsdoscience/kidsdoscience-predator-game.htm (game)	
Assessment:	Students will complete a graph analyzing the relationship between the wolf and deer populations in a given environment. Based on the graph and data students will: ● Explain why they think population may have changed. ● Predict what will happen to each population in the future. ● Calculate the population change.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide a completed graph for the students to analyze.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	N/A	Students will research other communities that have reached balance in nature/equilibrium. Students will research why some ecologists wish to discredit the theory of "balance of nature".
Critical Content:	• Equilibrium • Balance of nature • Predator • Prey • Negative feedback • Population change	
Key Skills:	• Analyze the interaction between two populations within an ecosystem	
Critical Language:	Equilibrium, balance of nature, predator theory, prey, negative feedback, population change	

Learning Experience # 7	
The teacher may provide examples of constructive or destructive forces and video clips of an area that has changed over time (e.g., Yellowstone from the 1980's to today) so that students can analyze the impact each force has on the environment and synthesize the relationship between forces that shape the Earth and living organisms.	
Generalization Connection(s):	The interaction between Earth's constructive and destructive forces explains both the pattern and changes in surface features on Earth. Changes in the environment can determine the survival of populations and the stability of ecosystems.
Teacher Resources:	https://www.youtube.com/watch?v=ysa5OBhXz-Q (Video about how the wolves in Yellowstone changed the rivers) http://www.biologycorner.com/lesson-plans/ecology/ (Various resources and links)

	https://www.nwf.org/pdf/Lesson%207/LESSON%207_Quantifying%20Land%20Changes%20using%20Landsat.pdf (lesson plans about teaching changes in land forms over time)	
Student Resources:	https://www.youtube.com/watch?v=ysa5OBhXz-Q (Video about how the wolves in Yellowstone changed the rivers) http://educators.brainpop.com/bp-jr-topic/slow-land-changes/ (land changes over time) http://www.nps.gov/fire/wildland-fire/learning-center/panoramic-lookout-photographs/photo-gallery/change-over-time.cfm (pictures of land changes over time)	
Assessment:	The students will create a poster, flip book, or video that demonstrates the impact of constructive and deconstructive forces over time on an environment they choose and its surrounding biotic features.	
Differentiation: (Multiple means for students to access content and multiple modes for student to express understanding.)	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher may provide an environment, and/or constructive and deconstructive force.	N/A
Extensions for depth and complexity:	**Access** (Resources and/or Process)	**Expression** (Products and/or Performance)
	The teacher will provide students with resources to find other examples of changes over time that have occurred in other areas.	Students may reference (compare and contrast) other areas that have undergone changes such as those presented in the class video.
Critical Content:	• Constructive and destructive forces • Population change	
Key Skills:	• Analyzing materials • Sequencing over time	
Critical Language:	Constructive and destructive forces, population change, impact, prediction	

Learning Experience # 8	
The teacher may provide examples of the influence constructive and destructive forces have on an ecosystem so that students can predict how environmental changes will impact an ecosystem.	
Generalization Connection(s):	A general understanding of ecosystems and environmental change allows scientists to predict and model potential impacts on populations of organisms.
Teacher Resources:	https://www.youtube.com/watch?v=ysa5OBhXz-Q (Example video about how the wolves in Yellowstone changed the rivers) http://www.biologycorner.com/lesson-plans/ecology/ (Various resources and links) http://www.rare-maps.com/historic_photo.cfm?gclid=CjwKEAjw5pKtBRCqpfPK5qXatWYSJABi5kTx9KGGsvmXKsw5X0edyXdoTvelkoTD69825mwqFj

<table>
<tr><td></td><td colspan="2">h7FBoCBb7w_wcB (historical photographs of different areas of Colorado from the past)</td></tr>
<tr><td>Student Resources:</td><td colspan="2">https://www.youtube.com/watch?v=ysa5OBhXz-Q (Example video about how the wolves in Yellowstone changed the rivers)
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http://educators.brainpop.com/bp-jr-topic/slow-land-changes/ (land changes over time)
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<tr><td>Assessment:</td><td colspan="2">Students will be provided with an example of an ecosystem and constructive or destructive forces. Students will then:
● Predict the impact on different populations
● Model a future ecosystem justifying claims based off of scientific evidence.</td></tr>
<tr><td rowspan="2">Differentiation:
(Multiple means for students to access content and multiple modes for student to express understanding.)</td><td>Access (Resources and/or Process)</td><td>Expression (Products and/or Performance)</td></tr>
<tr><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="2">Extensions for depth and complexity:</td><td>Access (Resources and/or Process)</td><td>Expression (Products and/or Performance)</td></tr>
<tr><td>Teacher provides weather patterns for students to analyze and predict implications of the environment and ecology.</td><td>Students will evaluate weather patterns and predict how that will shape the environment and influence the ecosystem.</td></tr>
<tr><td>Critical Content:</td><td colspan="2">• Constructive and destructive forces
• Population change
• Impact
• Prediction</td></tr>
<tr><td>Key Skills:</td><td colspan="2">• Predict how environmental changes will influence ecosystems</td></tr>
<tr><td>Critical Language:</td><td colspan="2">Constructive and destructive forces, population change, impact, prediction</td></tr>
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