ECOSYSTEMS AND SOIL HEALTH

An educator toolkit of lessons and videos for a 3rd-5th grade audience.

COMPILED BY NEW YORK AGRICULTURE IN THE CLASSROOM

In partnership with the New York Beef Council.

New York Agriculture in the Classroom

NEW YORK BEEF COUNCIL

Funded by Beef Farmers & Ranchers

Ecosystems and Soil Health

Introduction:
In this agricultural focused phenomenon-based inquiry, learners will engage with the following concepts:

- Importance of balanced ecosystems
- Understanding of the food and fiber systems
- How ecosystems are intertwined
- Biodiversity
- Soil health
- The effects of positive and negative human engagement on ecosystems
- Ruminants compared to monogastric organisms
- Flow of energy and nutrients
- Properties of soil
- Art with soil

As students participate in Part 1 of the experience, they will get a broad understanding of ecosystems and biodiversity while learning about humans' impact on the land.

In Part 2 of the experience students will learn how humans can regenerate ecosystems which might have been negatively impacted or increase the productivity of less productive land while engaging with a real-life agriculturalist. Students will also be challenged to put what they have learned to practice.

Classroom Application:

The lessons in the experience are developed as a progression with the culminating experience challenging students to plan and advocate for the development of their own managed ecosystem or student garden.

The progression of lessons is developed in a way so that teachers can engage with concepts lesson by lesson, in groups of lessons, or by focusing on concept groupings.

Lessons 1-5 focus on the larger concepts of ecosystem, ecosystem health, and biodiversity. Lessons 6-10 helps students to develop the sense of conservation and stewardship with a focus on soil and ecosystem health.

Each lesson is designed with a short informative piece allowing background knowledge of the concepts in the lesson. If a teacher would like to engage in a single lesson or group of lessons, it is suggested that students read through all the short informative pieces allowing for a more knowledgeable engagement with a single lesson or group of lessons.

The toolkit is designed for a 3rd-5th grade audience.

Matrix Map

Click on the corresponding numbers to move directly to the lesson information.

	Lesson	Description	Time
Part 1: Environments, Ecosystems, and Human Interaction			
1	To Keep Soil in its Place	Students will be able to demonstrate rain drop splash (splash erosion) and determine its impact on bare soil, ultimately being able to visually identify types of erosion.	90 Minutes
2	Managed and Natural Ecosystems	Students will compare the differences between natural and managed ecosystems and describe ways in which farmers can protect agricultural ecosystems.	2 hours
3	My Farm Web	Students use the visual representation of a web to explore the role of agriculture in their daily lives and understand how most of the necessities of life can be traced back to the farm.	1 hour
4	Caring for the Land	Students will explain why people have different opinions regarding soil management and identify cause and effect relationships relating to agriculture and the environment.	1 hour
5	From Boom to Bust	Students will examine the modern and historical importance of soil erosion in Utah and on the Great Plains during the Dust Bowl.	1 hour
Part 2: Living Soil: One Solution			
6	The Remarkable Ruminant	Students will follow the farm to fork process of producing beef, learn how cattle and other ruminants convert grass into nutrient-rich foods such as milk and meat, discover ways cattle recycle food waste, and identify careers in the beef cattle industry.	3 hours
7	At Home on the Range	Students will learn about rangelands by participating in a hands-on activity of growing their own grass to represent a beef farm.	1 hour
8	Properties of Soil	Students will discover that different soils have different characteristics, examine different types of soil, investigate soil components, and observe how air space allows soils to hold and transmit water.	90 minutes
9	Exploring Texture in the Garden	Students will explore living and nonliving things, determine how nonliving resources help sustain plant life, and experiment with visual arts techniques through an examination of texture in the natural world. Activities in this lesson include collecting and categorizing items from the natural environment, creating seed and soil mosaics, making clay imprints, and coloring cloth with plant materials.	3.5 hours
10	How Does Your Garden Grow?	Students synthesize what they know about soils, plants, and the environment to plan a garden, present their plans, and explain why they made the decisions that they did.	45 minutes, plus time to complete project

Phenomena

Lesson 1

The top layer of soil or topsoil is extremely important in the natural world. This layer is essential for plants and animals as it holds much of the nutrients, water, and microorganisms that support plants and animals. As humans utilize different land areas, the loss of topsoil from erosion must be considered and prevented. Different human activities can increase the degradation of the soil causing it to be carried away through tributaries and rivers into the ocean.

This is not a unique problem to the United States; loss of valuable topsoil is a global issue. Throughout the world there has been an increase of similar losses of topsoil. In highly sensitive ecosystems, this phenomenon can lead to desertification and a drying out of what was once a temperate climate. Rebuilding these soils can take decades if not longer.

Fortunately, researchers, agriculturalists, conservations, environmentalists, and everyday citizens have been working on identifying ways to reverse these trends. These individuals are creating new ways to look at growing the food and fiber systems that are needed by the over 7 billion people on Earth. Sometimes, solutions can be found by looking back at the history of how civilizations grew food and fiber. Other times, answers can be found in the natural world and its natural ecosystems and cycles.

In this agricultural focused phenomena-based inquiry, students will engage with a real farmer who is farming in a "new old way". He has found that he can reverse negative trends of soil depletion and enrich poor soil by understanding the importance and science behind "living soils". What is living soil and where does it come from? To answer this, students will ride along and learn about the world's environments and ecosystems, managed and natural ecosystems, livestock, and benefits of generational knowledge, and how it helps to produce high quality food for people while creating a healthier environment.

To develop an understanding of this phenomena, have students learn what is needed to keep soil in its place.

To Keep Soil in its Place Lesson		
Interest Approach		
Students will identify the cause and effect of erosion in particularly how it effects bare soils.		
Activities		
Activity 1	The effects of water on bare soil	30 minutes
Activity 2	Identify different types of erosion and their causing factors	30 minutes
Activity 3	Students will engineer different solutions for preventing erosion	30 minutes

Vocabulary

Atmosphere- layers of gas that surrounds the Earth
Best Practices- procedures or ways of doing things that have best results compared to other procedures or ways of doing things
Biodiversity- the diverse types of living things in a habitat or ecosystem
Biosphere- the area on of the Earth where living things exist
Fertilizing- to enrich by providing nutrients
Fibrous- thick, stringy; roughage
Forage plants- grasses and legumes that livestock and animals feed on
Grazing- process in which animals are allowed to freely roam and feed
Grazing Plan- plan used to allow for livestock to feed in a certain area for a determined amount of time which is determined by weather, time of year, type of plants, and density of forage plants
Hydrosphere- the portions of water found above, below, and on the Earth
Lithosphere- the crust and outer mantel of the earth
Living soil- soil rich with organic material, decomposers, bacteria, and other microorganisms
Managed ecosystem- ecosystems that have been converted from their natural state and are utilized by humans for purposes such as housing, industry, agriculture, etc…
Monogastric- living organisms that have a single chambered stomach
Natural ecosystem- ecosystem which are in their natural state; untouched by humans
Overgrazing- process of degradation of soils and plant life by the over feeding of animals
Paddock- a small field used for grazing
Regenerative agriculture- the agricultural practices focused on enriching and restoring the biodiversity of an ecosystem
Ruminant- living organisms which have four chambered stomachs
Symbiotic relationship- relationship in which two or more living organisms benefit each other through their existence in an ecosystem
Weed suppression- chemical and mechanical practices used to slow the growth or prevent the growth of undesired plants

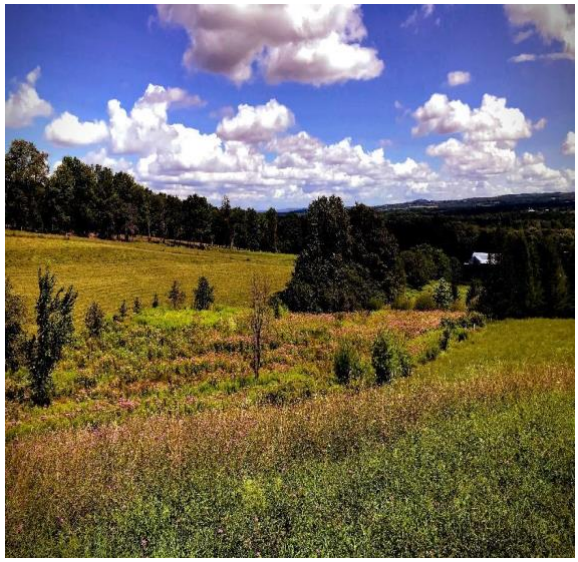
I Heard the Herd

Rotational Grazing and Soil Health

Lesson 2

Soil (**lithosphere**-the ground below us), water (**hydrosphere**-the water around us), and climate (**atmosphere**-air above us) are the most important factors that must be considered in agriculture. Nutrients, minerals, and energy are continuously held and cycled through each sphere.

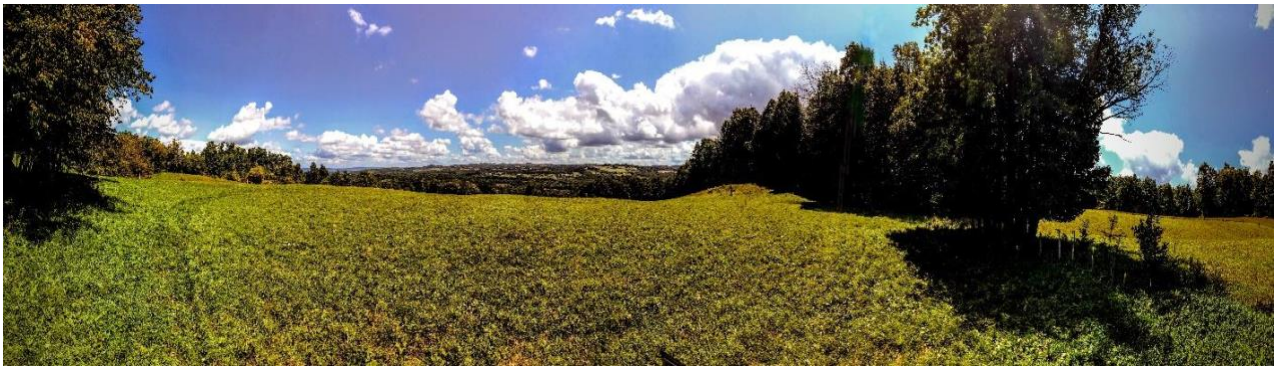
Plants, animals, and humans (**biosphere**-where plants and animals live) utilize this flow of energy and nutrients to grow and sustain life. When plants, animals, and humans die, the nutrients and energy that they used and stored are reintroduced into the cycle. The interdependence of the energy and nutrient cycle within all four spheres and all things inside these spheres in any given place is called an ecosystem.



Bishopp Family Farm paddock. (NYAITC)

As farms are first developed, agriculturalists change the ecosystem from a **natural ecosystem** to a **managed ecosystem**. Developing land for agricultural use is necessary to feed, cloth, and house the over 7 billion people that live on Earth. The first lesson identifies the difference between a managed and natural ecosystem.

Managed and Natural Ecosystems Lesson		
Interest Approach		
Students will identify the difference between biotic and abiotic and understand how each are important parts of managed and natural ecosystems.		
Activities		
Activity 1	What is an Ecosystem? - Compare and contrast different types of ecosystems.	1 hour
Activity 2	Comparing Natural and Managed Ecosystems - Analyze and categorize different types of ecosystems building on new knowledge.	30 minutes
Activity 3	Farm Food Chains - Identify consumers, producers, and apex predators that would be found in different ecosystems. Work in groups to create and present different unique ecosystem-based food chains.	30 minutes

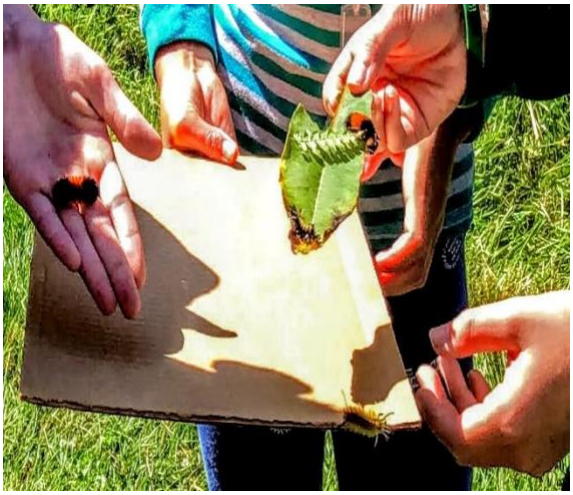


Bishopp Family Farm paddock.
(NYAITC)

Lesson 3

Although natural ecosystems have been converted to managed ecosystems, this is very important for human existence. We are dependent on agriculturalists to produce the food and fiber that we use each day. Without their work in the fields, forests, and on the water, we would have to spend our days searching, foraging, hunting, and growing the food and fiber that we need. In this lesson, you will engage with an agricultural food web to get a better understanding on where food and fiber comes from.

My Farm Web Lesson		
Interest Approach		
Students will work to define, “What is agriculture?”.		
Activity		
Activity 1	Concept Picture Web- Develop a knowledge of the production chains of the food and fiber networks.	30 minutes
Activity 2	Concept Word Web- Work in groups to build and share a word web around different food and fiber sectors.	30 minutes



Students examining biodiversity. (NYAITC)

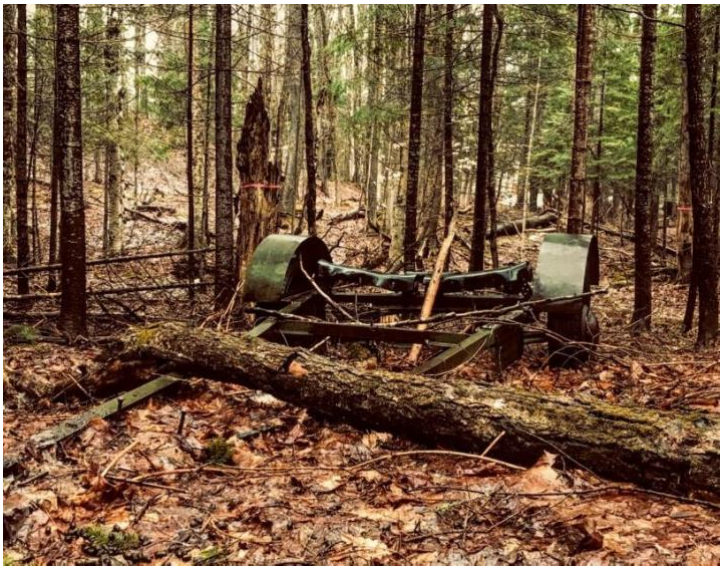
Lesson 4

Ecosystems can be very diverse and unique. This is called **biodiversity**. When humans change natural ecosystems to build things like cities, roads, amusement parks, schools, and farms the biodiversity of that area is changed. Sometimes this change can be irreversible.

Often, professionals like ecologists, engineers, city planners, developers, researchers, farmers, and other professionals work together to change the land in ways that create as little impact to an ecosystem as possible. Lesson three shares how agriculturalists and environmentalists are two groups that can be seen as conflicting but often work together to care for the land.

Caring for the Land Lesson		
Interest Approach		
Students will hold a class discussion to form an opinion on if farmers can be environmentalists.		
Activity		
Activity 1	Farmers, Environmentalists, Environmental Activist- Compare and contrast the differences and similarities and identify how they can support each other.	1 hour

Lesson 5



Old industry remains in a New York State forest. (NYAITC)

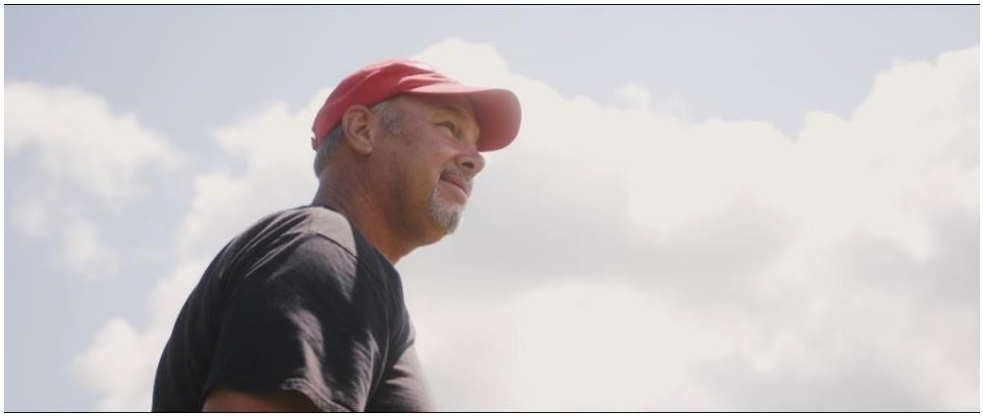
Humans have not always respected and protected the land like they should. We can look all around us to see evidence of that. Sometimes, humans had very little regard for the land, not worrying about how they were impacting the environment. They knowingly stripped, polluted, and destroyed valuable ecosystems for their natural resources.

More often, individuals did not know the impact they were having on the land. Individuals harvested natural resources for their families and communities. They were unaware that the way they were using the land would cause it harm and it was not until later, when the land was unusable, did they realize their mistake.

When one ecosystem is affected, the ecosystems around it are also affected. This can cause a domino effect where one small problem can become a much larger problem.

In American history, the Great Dust Bowl was a catastrophic agricultural event. The lesson *From Boom to Bust* will give evidence for the cause and effect of the disaster, the impact it had on America as a nation, and the lessons which have been learned from this era.

From Boom to Bust Lesson		
Interest Approach		
Students will engage with different media sources to develop an understanding of the negative effects of soil erosion which lead to the Great Dust Bowl.		
Activities		
Activity 1	Soil Stories-Use pictures from the "Great Dust Bowl" to create a group narrative about climate impact.	30 minutes
Activity 2	What's Your Soil Story? - Work in groups to find local examples of erosion, infer what might have caused the erosion, and compare and contrast if local erosion could cause the same impacts as "The Great Dust Bowl".	30 minutes



Troy Bishopp
(Black Mountain Visuals)

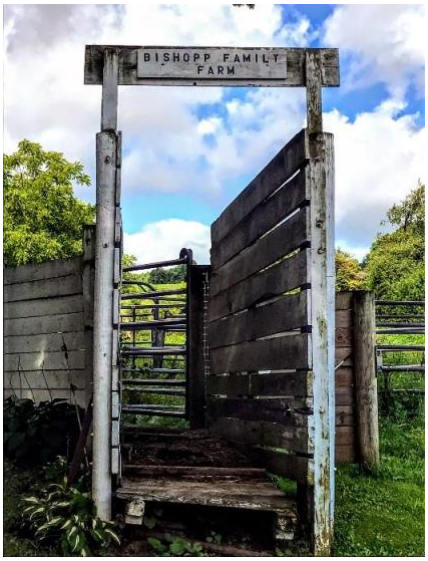
Lesson 6

With the development of technology and a better understanding of how Earth's systems work, humans have become much more aware of our impact on our planet. Fortunately, agriculturalists, environmentalists, agronomists, conservationists, researchers, and everyday citizens have learned from many of the land management mistakes that were made in the past.

With the help of many different groups, modern day agriculturalists have created different and updated ways of producing food and fiber with **best practices**.

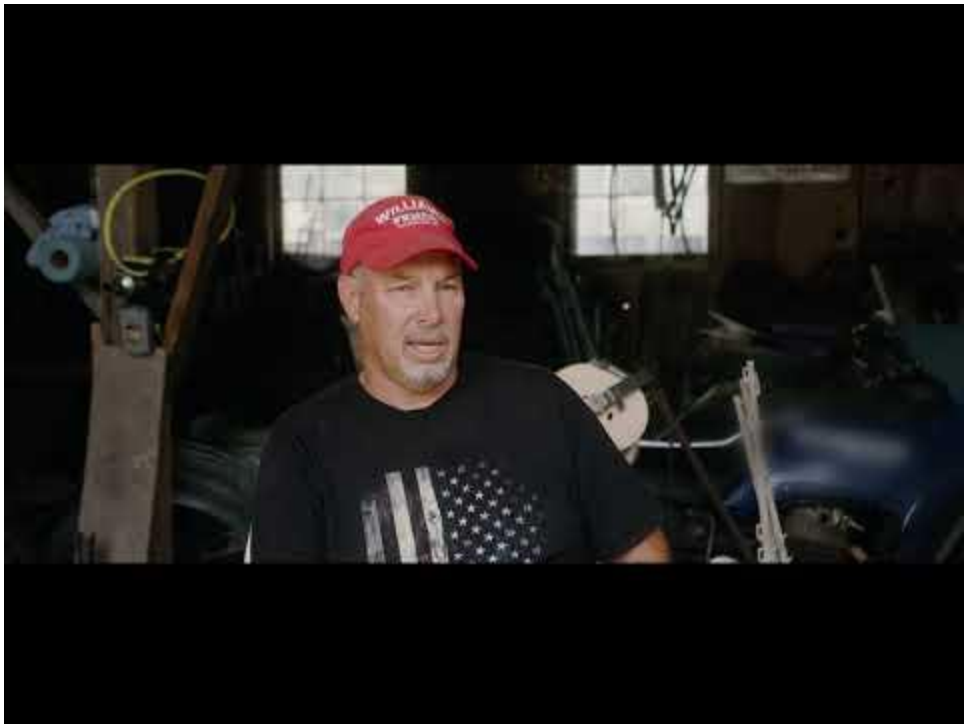
These new ideas and procedures for growing food and fiber help agriculturalists to produce more on less land with less impact on the land they are using. More often, with the use of best practices, agriculturalists have improved the ecosystems around them.

A great example of a farmer who uses best practices on his farm is Troy Bishopp of Bishopp Family Farm.



Squeeze chute on Bishopp Family Farm.
(NYAITC)

Click the image below to watch a video introducing Troy Bishopp,
owner of Bishopp Family Farm.

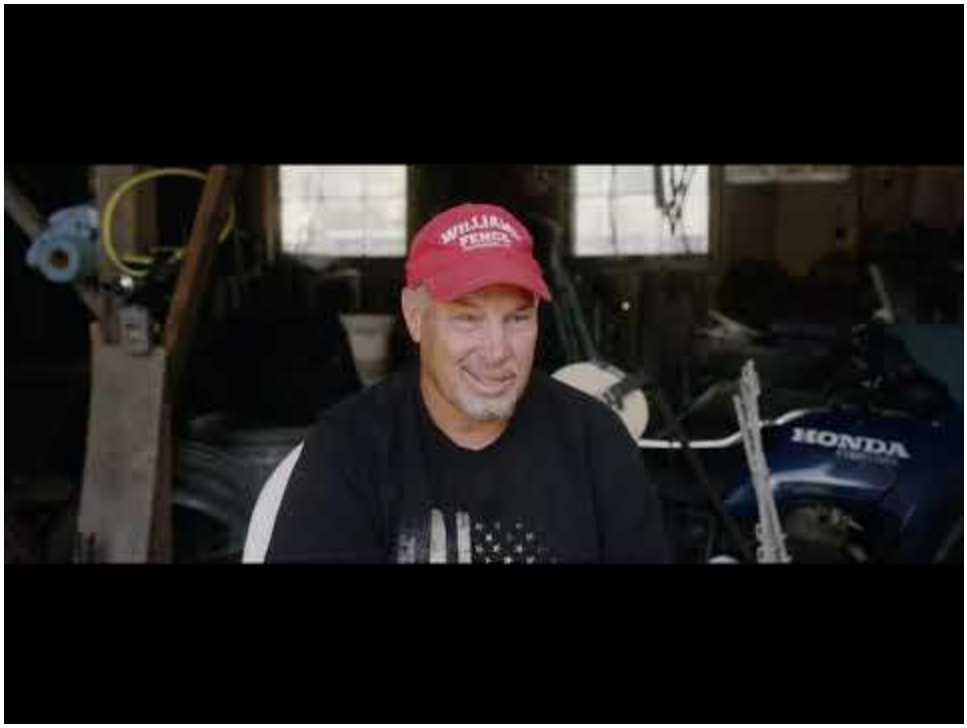


As Troy mentioned, he is a 5th generation beef farmer, conservationist, and “orchestra director”. Troy produces high-quality grass-fed beef. To be able to produce this product, Troy must consider the soil, water, and climate on his farm and how they are interrelated. He must consider how the choices he makes in his managed ecosystem, his farm, affects the natural ecosystem that surrounds him.

Looking down on Town of Deansboro from Bishopp Family Farm.
(Black Mountain Visuals)

One tool Troy uses is his herd of cattle. Troy’s cattle are **ruminants** or animals that have a four-chambered stomach. Unlike **monogastric** animals which have one-chamber stomachs, ruminants can process a broad array of **forage plants** or different types of grasses and legumes. Forage plants are plants that other animals cannot process for nutrients and energy as they are too **fibrous**.

Click the image below to hear Troy Bishopp explain the process of rumination and how he uses his cattle to enhance the micro- and macro-ecosystems on his farm.



Bishopp Family Farm herd of cattle.
(Black Mountain Visuals)

Lesson six will help to identify what a ruminant is, how they process grasses for nutrients and energy, how they become a source of nutrient rich food for humans, and how they can benefit their ecosystems.

The Remarkable Ruminant Lesson		
Interest Approach		
Students explore how livestock animals like sheep, goats, and cattle that have a unique digestive system allowing them to break down the cellulose in plants and how cattle recycle and conserve resources while producing nutrient-rich food.		
Activities		
Activity 1	Beef from Farm to Fork - Learn about the beef lifecycle and write a summary of the beef lifecycle using new vocabulary.	1 hour
Activity 2	The Remarkable Ruminant - Understand the increasing population growth of the Earth, the need for humans to utilize resources for food and fiber, and how ruminant organisms are different than monogastric organisms.	1 hour
Activity 3	Find beneficial solutions for different food waste scenarios and create a knowledge of how ruminants are a protein source and can benefit the land.	30 minutes
Activity 4	Identify potential careers relating to livestock.	30 minutes

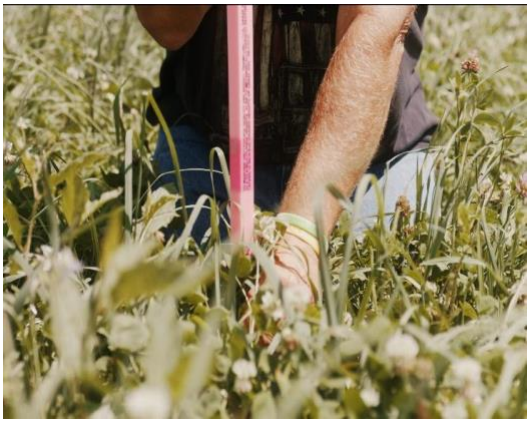
Lesson 7

Troy follows a **grazing plan** that allows his herd to **graze** the land section by section also known as a **paddock**. Troy developed his grazing plan through his generational knowledge of the land, input from scientists and conservationists, and through ongoing research. We will learn more about this from Troy and Brian Reaser (Tioga County Soil and Water Conservation District's Agricultural Environmental Management Specialist) in a later video.

Troy's Grazing Plan
(Black Mountain Visuals)

If he follows his grazing plan, Troy's herd is only in a paddock for a short time. Due to the quick rotation of cattle in a single grazing area, cattle will only have enough time to eat the nutrient rich top portions of the plant before they are moved.

If livestock are allowed to remain in one area without being moved, they will eat all the forage plants in that area down to the soil level. This is called **overgrazing**. Overgrazing can lead to negative ecosystem impacts such as runoff, erosion, and loss of valuable topsoil in which plants grow.



Troy measuring forage height.
(Black Mountain Visuals)

Troy has a developed plan that he follows, and his herd is moved frequently. This allows forage plants to grow denser and have more developed roots systems. This is much like mowing a yard in the summer. The more developed root systems help stabilize the soils in Troy's paddocks as well as absorb water and hold more nutrients in the soil. In the seventh lesson, you will learn about the importance that livestock play in creating a healthy environment and how they benefit the natural ecosystem found in the Utah grasslands.

At Home on the Range Lesson		
Interest Approach		
Students will understand how ruminants thrive in certain ecosystems and, due to their ability to digest different forage, can benefit the land.		
Activities		
Activity 1	Start a farm. Learn about grasslands and planting grass.	30 minutes
Activity 2	Learn about the concepts of grazing and overgrazing. Identify the effects both have on the land.	30 minutes

Lesson 8

Manure in the field.
(Black Mountain Visuals)

As seen in the grasslands of Utah, herd animals that graze play a vital role in a healthy ecosystem. At one time extremely large herds of bison or buffalo roamed these areas and were nearly hunted to extinction. This caused there to be a hole in the ecosystem with the grasslands declining in health.

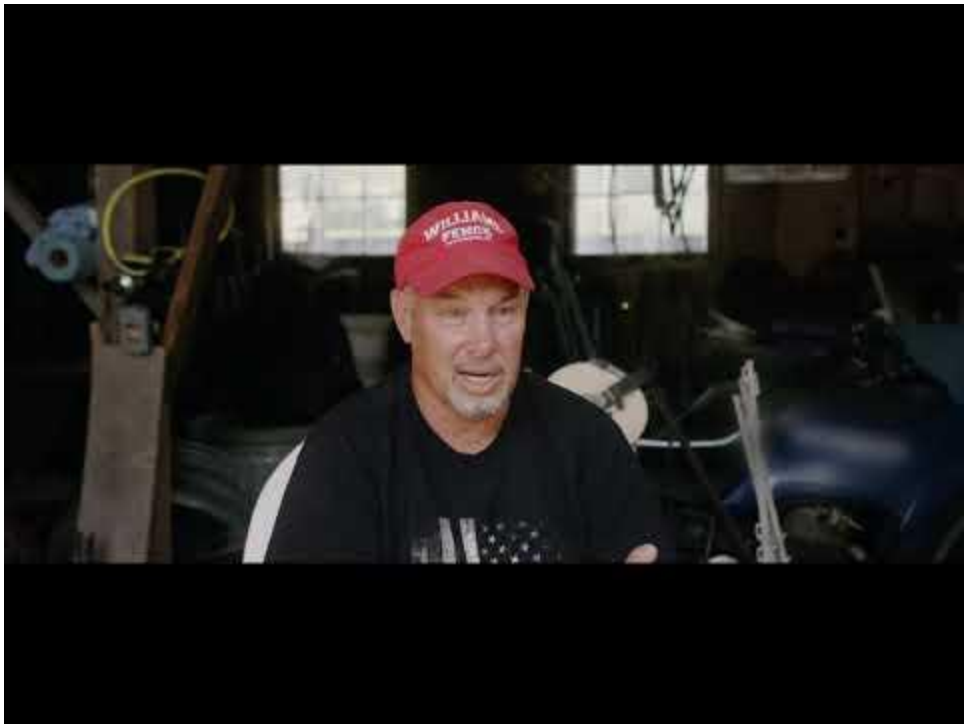
As shared in the previous lesson, livestock have been introduced to the Utah grasslands and play the same role that the bison once did as livestock carry out similar functions to the bison. Just like the bison, the livestock eat the grasses they move across the prairie. The waste from the livestock fertilizes the plants as they graze. This is called a **symbiotic relationship** or a relationship in which two or more organisms benefit each other.

This is very important for the biodiversity of an ecosystem and creates the web of organisms that depend on each other. The forage plants feed the livestock and the livestock waste provides nutrients for forage plants. The waste also helps to establish healthy bacteria and microorganisms in the soil and provides food for decomposers to break down. Decomposer waste helps to return vital nutrients and minerals to the soil for plants to use. These organisms not only feed the soil but aerate soils keeping them from becoming compacted. This microecosystem is essential for creating healthy "**living soils"** .

To be able to produce an ongoing successful harvest, Troy must carefully forecast, research, enhance, and conserve his ecosystem. Troy does this by practicing a technique called **regenerative agriculture**. In regenerative agriculture, agriculturalists use farming and grazing techniques to revive ecosystems that can become depleted or destroyed from use over time.

Troy uses similar techniques seen in the previous lesson to establish healthy soil and water on his 100-acre farm. Using a rotational grazing technique allows for natural **fertilizing** and **weed suppression** of his fields as well as a biodiverse ecosystem. Troy and Brian Reaser of the Tioga Soil and Water Conservation District discuss the process of regenerative farming and Troy's grazing plan.

Click the image below to watch a video describing how rotational grazing benefits the soil and the land.



Troy Bishopp (Bishopp Family Farm) and Brian Reaser (Tioga County Soil and Water).
(Black Mountain Visuals)

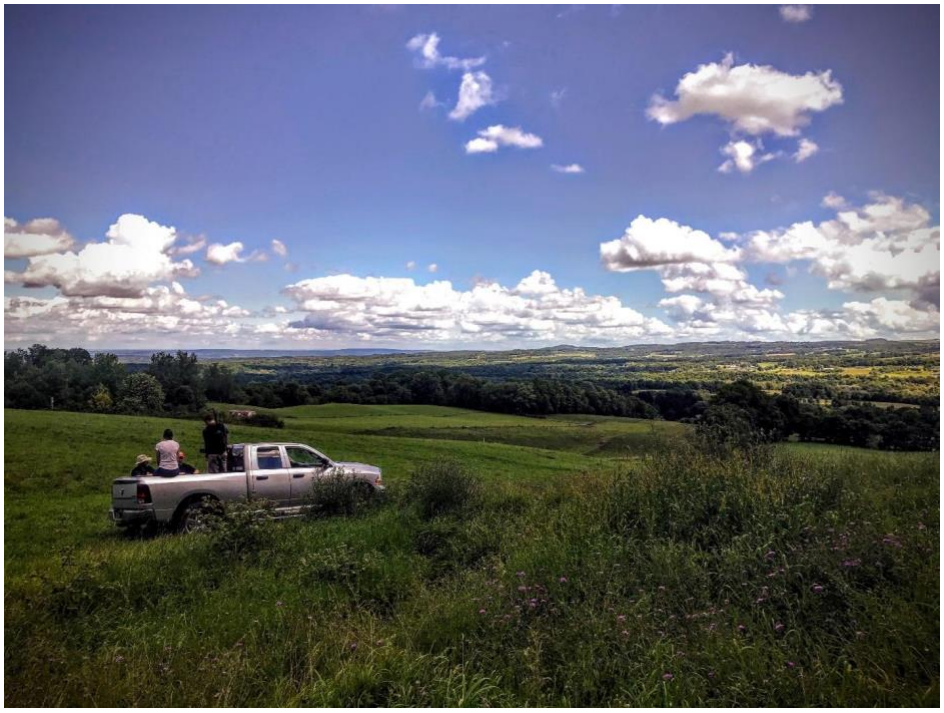
Troy and Brian discussed how the cattle on Bishopp Family Farm benefit the local ecosystem much like in the Utah grasslands. How they are managed plays a unique role in building the soil and the health of his local managed and natural ecosystems. In the eighth lesson, you will learn about the importance of healthy "living" soils.

Properties of Soil Lesson		
Interest Approach		
Students will explore their existing knowledge of soil.		
Activities		
Activity 1	Trail Blazing - Hit the trail, settle, and start a ranch learning about grasslands and planting grass along the way.	1 hour
Activity 2	Grass and Grazing - Learn about the concepts of grazing and over grazing and identify the effects both have on the land.	1 hour
Activity 3	Lasso'n Lingo - Learn the terms using land management terms and creative a narrative with the newly learning vocabulary	1 hour

Lesson 9

To dig into soil and art to engage your creative side, see the following lesson.

Exploring Texture in the Garden Lesson		
Interest Approach		
Students will read books and explore natural items to learn about living and nonliving things and explore ways to observe and classify objects in the natural environment.		
Activities		
Activity 1	Mosaics - Create a mosaic using biotic and abiotic samples collected by students.	2 hours
Activity 2	Garden Imprinting - Create imprints by using and classifying biotic and abiotic samples.	1 hour
Activity 3	Garden Colors - Create prints using colored oils and dyes from biotic samples.	30 minutes



Looking over the Mohawk Valley from Bishopp Family Farm.
(NYAITC)

Lesson 10

There are many factors that must be considered when an agriculturist grows a product. These practices not only support healthy soils but also benefit the plants, animals, people, water, and air. With the use of best practices, research, and wise management farmers can fill the food and fiber needs of humans as well as ensure that the Earth's ecosystems remain healthy.

Now that you have a stronger understanding of the importance of soil, agriculture, ecosystems, and practices that are used to protect and generate healthier ecosystems, you are now ready to start thinking about designing your own agricultural focused managed ecosystem.

How Does Your Garden Grow?		
Interest Approach		
Students will explore their existing knowledge about gardens.		
Activity		
Activity 1	Planning a Garden- Apply concepts of natural and managed ecosystems, living soils, and needs for production to create a conceptual school garden.	45 minutes, plus time to complete the project

To learn more about soil health and to engage with other agricultural technologies farmers use, consider the Journey 2050 challenge.

Next Generation Learning Standards	
Lesson	**Standard Alignment**
To Keep Soil in its Place	**ELA** R4: Determine the meaning of words, phrases, figurative language, academic, and content-specific words and analyze their effect on meaning, tone, or mood. R7: Analyze how visual and multimedia elements contribute to meaning of literary and informational texts **Science** ESS2-1Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. **Social Studies** 3.3b People make adaptations and modifications to the environment. Advancements in science, technology, and industry can bring about modifications to the environment and can have unintended consequences on the environment. People have attempted to take actions to protect the environment. 5.4c The physical environment influences human population distribution, land use, and other forms of economic activity.
Managed and Natural Ecosystems	**ELA** R1: Locate and refer to relevant details and evidence when explaining what a text says explicitly/implicitly and make logical inferences 5R8: Explain how claims in a text are supported by relevant reasons and evidence, identifying which reasons and evidence support which claims. SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively and build on those of others. L6: Acquire and accurately use general academic and content-specific words and phrases, including those that signal contrast, addition, and other logical relationships **Science** LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS4.D: Biodiversity and Humans ESS2.A: Earth Materials and Systems ESS2.D: Weather and Climate ESS3.B: Natural Hazards **Social Studies** 3.9 Communities meet their needs and wants in a variety of ways, forming the basis for their economy. 5.2b Complex societies and civilizations adapted to and modified their environment to meet the needs of their people
My Farm Web	**ELA** SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively and build on those of others. W1: Write an argument to support claims with clear reasons and relevant evidence. **Science** 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. **Social Studies**

	3.10b World communities have needs, wants, and limited resources. To meet their needs and wants, communities trade with others. Technological developments in transportation and communication have influenced trade.
Caring for the Land	**ELA+** R1: Locate and refer to relevant details and evidence when explaining what a text says explicitly/implicitly and make logical inferences. R9: Use established criteria to categorize texts and make informed judgements about quality; make connections to other texts, ideas, cultural perspectives, eras and personal experiences L6: Acquire and accurately use general academic and content-specific words and phrases, including those that signal contrast, addition, and other logical relationships **Health (CDC Health Standards)** 8.5.1 Express opinions and give accurate information about health issues. Science LS2.B: Cycles of Matter and Energy Transfer in Ecosystems LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS4.C: Adaptation LS4.D: Biodiversity and Humans Social Studies 3.3 Geographic factors often influence where people settle and form communities. People adapt to and modify their environment in different ways to meet their needs 5.5b. Countries in the Western Hemisphere face a variety of concerns and issues specific to the region
From Boon to Bust	**ELA** R1: Locate and refer to relevant details and evidence when explaining what a text says explicitly/implicitly and make logical inferences. R9: Use established criteria to categorize texts and make informed judgements about quality; make connections to other texts, ideas, cultural perspectives, eras and personal experiences SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively and build on those of others. **Social Studies** 3.3b People make adaptations and modifications to the environment. Advancements in science, technology, and industry can bring about modifications to the environment and can have unintended consequences on the environment. People have attempted to take actions to protect the environment. 8.5b The Great Depression and the Dust Bowl affected American businesses and families
The Remarkable Ruminant	**ELA** R2: Determine a theme or central idea and explain how it is supported by key details; summarize a text. SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively and build on those of others W2: Write informative/explanatory texts to explore a topic and convey ideas and information relevant to the subject W6: Conduct research to answer questions, including self-generated questions, and to build knowledge through investigation of multiple aspects of a topic using multiple sources **Science** LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS3-2 Use evidence (e.g., observations, patterns) to support an explanation LS4.C: Adaptation LS4.D: Biodiversity and Humans LS4-2Use evidence (e.g., observations, patterns) to construct an explanation **Social Studies**

	5.2b Complex societies and civilizations adapted to and modified their environment to meet the needs of their people.
At Home on the Range	**ELA** L6: Acquire and accurately use general academic and content-specific words and phrases, including those that signal contrast, addition, and other logical relationships. **Social Studies** 3.3 Geographic factors often influence where people settle and form communities. People adapt to and modify their environment in different ways to meet their needs. 3.3b People make adaptations and modifications to the environment. Advancements in science, technology, and industry can bring about modifications to the environment and can have unintended consequences on the environment. People have attempted to take actions to protect the environment. 5.2b Complex societies and civilizations adapted to and modified their environment to meet the needs of their people.
Properties of Soil	**Ela** SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively and build on those of others L3: Use knowledge of language and its conventions when writing, speaking, reading, or listening R7: Analyze how visual and multimedia elements contribute to meaning of literary and informational texts **Science** LS1.C: Organization for Matter and Energy Flow in Organisms LS2.A: Interdependent Relationships in Ecosystems LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
Exploring Texture in the Garden	**ELA** L6: Acquire and accurately use general academic and content-specific words and phrases, including those that signal contrast, addition, and other logical relationships **Science** LS1.C: Organization for Matter and Energy Flow in Organisms LS2.A: Interdependent Relationships in Ecosystems LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
How Does Your Garden Grow?	**ELA** R1: Locate and refer to relevant details and evidence when explaining what a text says explicitly/implicitly and make logical inferences. SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively and build on those of others W2: Write informative/explanatory texts to explore a topic and convey ideas and information relevant to the subject. SL4: Report on a topic or text, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support central ideas or themes; speak clearly at an understandable pace and volume appropriate for audience **Social Studies** 3.3b People make adaptations and modifications to the environment. Advancements in science, technology, and industry can bring about modifications to the environment and can have unintended consequences on the environment. People have attempted to take actions to protect the environment. 5.4c The physical environment influences human population distribution, land use, and other forms of economic activity. **Math** Mathematical Practices 1.Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.

	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.

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