ENVIROATLAS

EDUCATIONAL CURRICULUM

INTRODUCTION TO ECOSYSTEM SERVICES

A SUITE OF 6 MINI-LESSONS DESIGNED FOR STUDENTS IN GRADES 4-6

Created by

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PREFACE

The following suite of six mini-lesson plans was created as part of a larger curriculum of activities for educational use to introduce students to *EnviroAtlas* and the concepts of watersheds, pollution, connections between the environment and human health, greenways, and using maps in decision-making. **These lesson plans specifically address the concept of ecosystem services.** Additional lesson plan modules are available that address a variety of other related topics for a range of grade-levels and ages.

There is also an **Educational Overview** document that outlines some of the tools in *EnviroAtlas* for educators who wish to design their own lesson plans around the available *EnviroAtlas* tools. We encourage you to look over that Educational Overview document so that you can use *EnviroAtlas* to best meet your needs. All Educational materials can be found here: https://www.epa.gov/enviroatlas/enviroatlas-educational-materials

For questions regarding this document and supplemental materials, please contact the *EnviroAtlas* Team at EnviroAtlas@epa.gov.

While this document has been reviewed and approved by the U.S. Environmental Protection Agency, its contents do not necessarily reflect the views and policies of the Agency.

ACKNOWLEDGMENTS

These educational materials were developed through the efforts of multiple contributors. At the time of publication, 797 participants, of whom 750 were students, had participated in these specific Ecosystem Services activities.

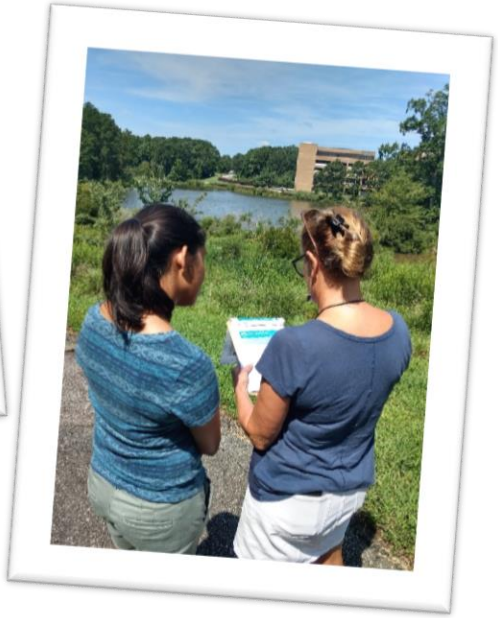
Thanks to our classroom teachers and their students for carrying out and reviewing these *EnviroAtlas* Lesson Plans:

Exploring Your Watershed (2017)

- Jennifer Carson, K-5 ESL teacher, Grady A. Brown Elementary School
- Jennifer Cypra, K-5 AIG/STEM teacher, Grady A. Brown Elementary School
- Amy Beckett, 4th grade teacher, Holt Elementary School
- Kacey James, 5th grade teacher, Holt Elementary School
- Jane White, 5th grade teacher, Bethesda Elementary School

We learned much from these pilot tests and utilized the teachers' feedback to adjust and edit the Lesson Plans.

Thanks also to Molly Windsor, US EPA Contractor, for assisting with graphics on the "Services that Stick" lesson plan.



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EnviroAtlas
people health nature economy

Lesson Plan

www.epa.gov/enviroatlas

Learning Ecosystem Services with EnviroAtlas

A set of 6 mini-lessons that explore the concept of ecosystem services.
Lessons can be done with or without internet.

Suggested Grades: 4-6

Suggested Topics: water quality, air quality, recreation, engagement with nature, human health, ecosystem services, ecosystems

Key Concept: Ecosystem goods and services provide the benefits that humans receive from nature.

Time Considerations:
All 6 lessons are designed to be completed in 30-45 mins.

Materials: *(vary by lesson)*
***BINGO, Healthy Environment, Healthy You, Ecosystem Services Assessment*:** handouts, clipboards
***Buckets of Benefits*:** handouts
(optional: items)
***Services that Stick*:** handouts, crayons, glue, scissors
Webquest: handouts, computer, internet access

NGSS Standards *(State Standards in back)*: 4-ESS3-2, 3-5-ESS1-2, 5-ESS3-1, MS-LS2-1, MS-LS2-2, MS-LS2-5, MS-ESS3-4. NGSS SEP: 1, 7, 8.

Learning Objectives

By the end of these lessons, students will be able to:

- Identify ecosystem services in various ecosystems.
- Explain what ecosystem services are and how humans benefit from them.
- Point out the impacts of ecosystem services on their local environments and personal lives.
- Consider and discuss the impacts of ecosystem services on their daily lives and on human populations.
- Consider ways to engage with ecosystems and nature to improve their personal lives.

Key Words/Vocabulary

aesthetics	agroecosystems	air quality
anxiety	asthma	coasts
coastal wetlands	deserts	economy
ecosystems	ecosystem services	engagement
forests	habitat	happiness
oceans	pollinator	physical activity
respiratory symptoms	stress	

Summary

This module follows the **BSCS 5E model** to promote student discovery and learning about the interconnectedness of humans and the ecosystems that they live in or near.

These six classroom-ready lessons leverage a web-based mapping tool called ***EnviroAtlas,*** developed by the Environmental Protection Agency (EPA) and its partners.

EnviroAtlas is an easy-to-use mapping tool designed for citizens, students, and professionals to assess the status of local and regional environments, the ecosystem services that they provide, and the benefits that humans receive from them.

ECOSYSTEM

All living and nonliving things in an area, as well as the interactions among them.

ECOSYSTEM SERVICES

Ecosystem goods and services, often shortened to ecosystem services (ES), provide the benefits that humans receive from nature. They underpin almost every aspect of human well-being, including our health, security, and economy.

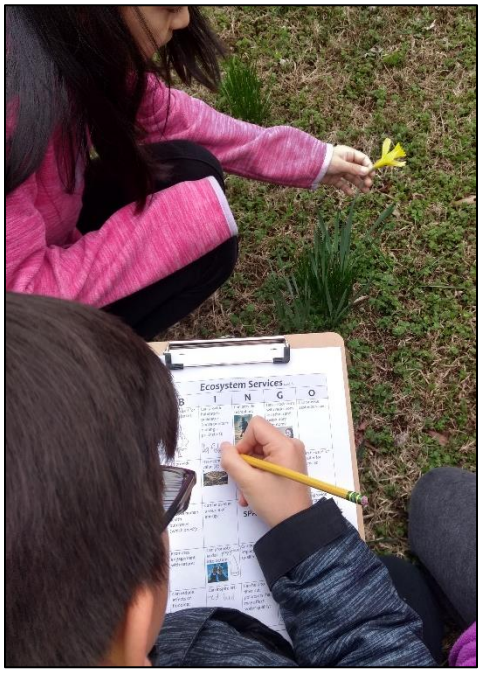

Figure 1. Students participating outdoors in the "Ecosystem Services BINGO" lesson, pointing out a potential link to pollination.

These lesson plans are designed for 4th and 5th grade students. They can also be adapted for students in 3rd grade or middle school and even high school.

Centered on ecosystem services, these EnviroAtlas educational materials encourage a systems approach to thinking about the world. By learning through this approach with cross-cutting concepts, students can gain a more holistic view of study topics and see real-world applications of specific science disciplines while also learning how to use freely available online tools.

The lessons in this package increase in rigor in the order that they appear. While they are designed to be completed in sequential order, they can be taught independently. The first lesson listed, "*Ecosystem Services BINGO*" can be done with 3rd grade students, and the last lesson listed, "*Buckets of Benefits,*" could be used in middle school or even high school classrooms.

More information about how to use *EnviroAtlas* in the classroom can be found here: https://www.epa.gov/enviroatlas/enviroatlas-educational-materials

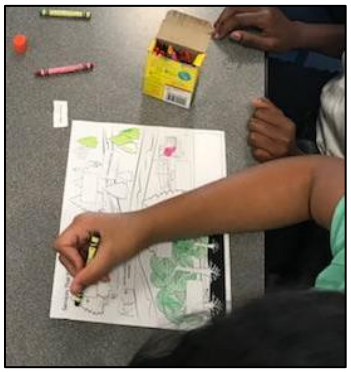

Figure 2. Students completing the "Services that Stick" activity.

At-a-glance Summary

Teaching Strategies	Student/teacher actions
Engage	***Ecosystem Services* BINGO:** Engage students with an outdoors excursion in a natural area near your school. Students explore their environment and search for items in nature to match their BINGO cards.
Explore	***"Healthy Environment, Healthy You" journaling activity:*** Students explore the concepts and impacts of ecosystem services by completing a journaling activity about the health impacts of aesthetics & engagement with nature. **Webquest activity:** Using computers, students explore *EnviroAtlas Interactive Map* in search of national map layers that reflect ecosystem services with human health benefits. **Ecosystem Services Assessment:** Students explore an outdoor ecosystem and examine it for place-based evidence of ecosystem services.
Explain	***"Services that Stick":*** Students engage in a cut & paste activity to identify ecosystem services in various ecosystems. Afterwards, students explain the ecosystem services to the class.
Elaborate	***"Buckets of Benefits":*** Students elaborate on the concept of ecosystem services by engaging with hands-on objects meant to represent them. The students describe how the objects relate to ecosystem services by writing analogies.
Evaluate	**All lessons contain their own Handouts that can be used as Formal Assessments at the end of each lesson.**
Extend* **optional*	Students can explore the *Eco-Health Relationship Browser*; more *Extension Ideas* can be found in the Resources portion of the lesson.

Notes for all 6 Ecosystem Services Lessons

Time Considerations

5E Stage	Part of Lesson	Suggested Time
Engage	*Ecosystem Services* BINGO	15-20 minutes
Explore	"Healthy Environment, Healthy You" EnviroAtlas Webquest Ecosystem Services Assessment	10-60 minutes 20-30 minutes 15-20 minutes
Explain	*"Services that Stick"*	30-40 minutes
Elaborate	*"Buckets of Benefits"*	20-45 minutes
Evaluate	***Handouts: 10-30 minutes; could be homework if out of time***	

Teacher Preparation

General Background Information:

Students should have a basic understanding of ecosystem concepts:

- Students should be able to name a few ecosystems, including the following: coasts, wetlands, meadow, field, rivers, forests, mountains, urban (cities), and agro-ecosystems (farmlands).
- Students should have a basic understanding of some ecosystem concepts (e.g., streams provide habitat for some animals, humans create pollution, etc.).
- Students should have a basic understanding of how their local environment is an ecosystem.

Extension option for all six lessons

Students can extend their learning by exploring the EnviroAtlas Eco-Health Relationship Browser (https://www.epa.gov/enviroatlas/enviroatlas-eco-health-relationship-browser).

The Eco-Health Relationship Browser illustrates scientific evidence for linkages between human health and ecosystem services.

There is also a free lesson plan available online for grades 4-12 that leverages the Eco-Health Relationship Browser. Check it out here: https://www.epa.gov/enviroatlas/connecting-ecosystems-and-human-health

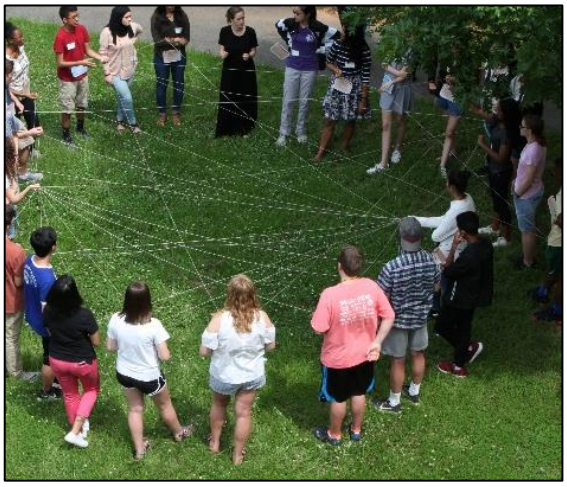

Figure 3. Students participate in the "Connecting Ecosystems and Human Health" activity that leverages the Eco-Health Relationship Browser.

Key Vocabulary

aesthetics: The branch of philosophy dealing with such notions as the beautiful, the ugly, the sublime, the comic, etc., as applicable to the natural world and the judgments of such notions.

agroecosystem: An ecosystem that has been modified by humans for the primary purpose of producing food, fiber, or other agricultural products. It typically includes environmental features such as hedgerows and ponds, which support ecosystem services including habitat provision and pollination.

air quality: The natural production and maintenance of clean air is important for overall human health and well-being. As industry, urbanization, and use of motor vehicles have increased, so too has the concentration of pollutants in the atmosphere.

anxiety: Excessive and unrealistic worry about everyday tasks which interferes with normal functioning. Several types of anxiety disorders exist.

asthma: A chronic disease of the airways that makes breathing difficult. Inflammation of the air passages results in a temporary narrowing of the airways that carry oxygen to the lungs.

coastal wetlands: Wetland types found in coastal watersheds include salt marshes, bottomland hardwood swamps, mangrove swamps, and shrubby depressions known in the southeastern United States as "pocosins." Wetlands can be tidal or non-tidal, and freshwater or saltwater.

economy: The management of the environmental, man-made, and human resources in a community, nation, etc., especially with a view to productivity, including jobs.

ecosystem: A system, or a group of interconnected elements, formed by the interaction of a community of organisms with their environment.

ecosystem services: Also known as ecosystem goods and services, these are natural elements, functions, and processes that support life on earth. Examples include fish and game species, the production of oxygen, the breakdown and recycling of many waste materials, and the creation and retention of healthy soils. These and many more ecosystem services provide the benefits that humans receive from nature. They underpin almost every aspect of human well-being, including our health, security, and economy.

engagement: The act of engaging or the state of being involved.

food chain: a linear sequence of organisms through which nutrients and energy pass as one organism eats another.

pollinator: An animal that moves pollen from the male anther to the female stigma of a flower.

physical activity: Any bodily movement produced by skeletal muscles which requires energy expenditure.

respiratory symptoms: Coughing or wheezing. Can be associated with serious illnesses.

stress: A normal feeling that can manifest as a result of an event or thought that makes people frustrated, upset or nervous.

urban ecosystem: A dynamic system that contains both built and natural elements. Man-made infrastructure typically covers a large proportion of the land surface and/or people live in high densities.

wetlands: Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

APPENDICES

APPENDIX 1: Bibliography

Bibliography

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All the information in the "*Healthy Environment, Healthy You*" activity can be found in the EnviroAtlas Eco-Health Relationship Browser and the corresponding bibliography.

- EnviroAtlas Eco-Health Relationship Browser: https://www.epa.gov/enviroatlas/enviroatlas-eco-health-relationship-browser

APPENDIX 2: Educational Standards

Resources: State Science Educational Standards *(on following pages)*

Alignment of this Lesson Module to State Science Educational Standards—4th grade

Alignment of this Lesson Module to State Science Educational Standards—5th grade

Alignment of this Lesson Module to State Science Educational Standards—6th grade

STATE EDUCATIONAL STANDARDS

4th GRADE, ALL 50 STATES & DC

These Standards have been collected from individual State websites (1/2017). They have been connected to themes that are available in an EPA tool called *EnviroAtlas*.

State (last updated on this chart, Standards adoption year)	**4th grade Science Educational Standards that apply to the *EnviroAtlas* "Exploring Your Watershed" module**
AL (1/2017, 2015)	**16.** Describe patterns of Earth's features on land and in the ocean using data from maps (e.g., topographic maps of Earth's land and ocean floor; maps of locations of mountains, continental boundaries, volcanoes, and earthquakes).
AK (1/2017, 2012)	[4] SC3.2 identifying a simple food chain of familiar plants and animals, diagramming how energy flows through it; describing the effects of removing one link.
AZ (1/2017, 2005)	**Strand 3, Concept 1: PO 1**. Describe how natural events and human activities have positive and negative impacts on environments (e.g., fire, floods, pollution, dams). **PO 2.** Evaluate the consequences of environmental occurrences that happen either rapidly (e.g., fire, flood, tornado) or over a long period of time (e.g., drought, melting ice caps, the greenhouse effect, erosion). **Strand 3, Concept 3: PO 3.** Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment. **PO 4.** Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes).
AR (1/2017, 2005)	**ESS.8.4.2** Analyze the impact of using natural resources. **ESS.8.4.5** Evaluate the impact of Arkansas' natural resources on the economy, including but not limited to • farming • timber • tourism • hunting • fishing ESS.8.4.6 Evaluate human use of Arkansas' natural resources on the environment, including but not limited to • mining • clear cutting • dredging.
CA (1/2017, 2009)	**4-ESS2-2.** Analyze and interpret data from maps to describe patterns of Earth's features. **4-ESS3-1.** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. **4-ESS3-2.** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. **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. **3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

	NGSS Science & Engineering Practices (APPENDIX F): 1. Asking questions (for science) and defining problems (for engineering). 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information.
CO (1/2017, 2009)	Standard 2, Life Science, Concept 3: There is interaction and interdependence between and among living and nonliving components of ecosystems
CT (1/2017, 2015)	NGSS (see CA above).
DC (1/2017, 2013)	NGSS (see CA above).
DE (1/2017, 2013)	NGSS (see CA above).
FL (1/2017, 2014)	**SC.4.L.17.4**. Recognize ways plants and animals, including humans, can impact the environment. A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs. B. Both human activities and natural events can have major impacts on the environment.
GA (1/2017, new standards up 2017-2018)	**S4L1**. Obtain, evaluate, and communicate information about the roles of organisms and the flow of energy within an ecosystem. c. Design a scenario to demonstrate the effect of a change on an ecosystem. (Clarification statement: Include living and non-living factors in the scenario.)
HI (1/2017, 2005)	None.
ID (1/2017, 2016)	None.
IL (1/2017, 2011)	NGSS (see CA above).
IN (1/2017, 2016)	**4.ESS.4** Develop solutions that could be implemented to reduce the impact of humans on the natural environment and the natural environment on humans. **3-5.E.2** Construct and compare multiple plausible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
IA (1/2017, 2016)	**4-ESS2-2.** Analyze and interpret data from maps to describe patterns of Earth's features. **4-ESS3-2.** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
KS (1/2017, 2013)	NGSS (see CA above).

KY (1/2017, 2013)	**4-ESS2-2.** Analyze and interpret data from **maps** to describe patterns of Earth's features. **4-ESS3-2.** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
LA (1/2017, 2016)	**72.** Predict and describe consequences of the removal of one component in a balanced ecosystem (e.g., consumer, herbivores, nonliving component) (SE-E-A2)
ME (1/2017, 2013)	NGSS (see CA above).
MD (1/2017, 2013)	NGSS (see CA above).
MA (1/2017, 2016)	None.
MI (1/2017, 2015)	NGSS (see CA above).
MN (1/2017, 2009)	**4.1.2.2.2.** Engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product.
MS (1/2017, 2010)	**4d.** Describe how human activities have decreased the capacity of the environment to support some life forms. (DOK 2) • Reducing the amount of forest cover • Increasing the amount of chemicals released into the atmosphere • Farming intensively
MO (1/2017, 2015)	**72.** Predict and describe consequences of the removal of one component in a balanced ecosystem (e.g., consumer, herbivores, nonliving component) (SE-E-A2)
MT (1, 2017, 2016)	**1.1** develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied): (a) asking questions about objects, events, and organisms in the environment, (b) planning and conducting simple investigations **1.6** identify how observations of nature form an essential base of knowledge among the Montana American Indians **5.2** describe a scientific or technological innovation that impacts communities, cultures, and societies **5.3** simulate scientific collaboration by sharing and communicating ideas to identify and describe problems **5.4** use scientific knowledge to make inferences and propose solutions for simple environmental problems
NE (1/2017, 2010)	**5.3.3** Students will describe relationships within an ecosystem. **5.3.3.d** Recognize all organisms cause changes, some beneficial and some detrimental, in the environment where they live.

NV (1/2017, 2014)	NGSS (see CA above).
NH (1/2017, 2016)	**S:SPS1:4:1.7** Ask questions about objects, organisms and events in their local environment. **S:SPS1:4:1.8** Pose questions to investigate and practical problems to solve. **S:SPS2:4:2.1** Demonstrate that if something consists of many parts, the parts usually influence one another. **S:SPS2:4:4.2** Understand that some changes are so slow or so fast that they are hard to see. **S:SPS3:4:1.1** Be able to complete an assigned task when given a specific role in a group. **S:SPS3:4:1.2** Communicate ideas to others. **S:SPS3:4:1.3** Give specific feedback about work of others. **S:SPS3:4:2.1** Demonstrate a basic conservation action such as recycling or a schoolyard habitat project. **S:SPS3:4:2.2** Develop questions based upon their observations about the natural world and design a simple investigation. **S:SPS3:4:2.3** Develop questions that help them learn about the environment; and design and conduct simple investigations. **S:SPS3:4:2.4** Locate and collect information about the environment and environmental and natural resources topics. **S:SPS3:4:2.5** Use reliable information to answer questions. **S:SPS3:4:2.6** Organize information to search for relationships and patterns concerning the environment and environmental topics. **S:SPS3:4:2.7** Identify and investigate issues in their local environments and communities. **S:SPS4:4:1.1** Access information from a variety of media sources (e.g., Internet, CD-ROM programs, print resources). **S:SPS4:4:1.3** Analyze and compare data from a variety of age-appropriate sources such as newspapers and websites. **S:SPS4:4:2.1** Use a variety of tools and formats (oral presentations, journals, and multimedia presentations) to summarize and communicate the results of observations. **S:SPS4:4:6.1** Plan and conduct a scientific investigation in group settings.
NJ (1/2017, 2013)	NGSS (see CA above).
NM (1/2017, 2009)	**Strand II: Content of Science Standard II (Life Science):** Understand the properties, structures, and processes of living things and the interdependence of living things and their environments.

	Strand III: Science and Society Standard I: K-4 Benchmark I: 1. Know that science has identified substances called pollutants that get into the environment and can be harmful to living things.
NY (1/2017, 2015)	NGSS (see CA above).
NC (1/2017, 2011)	**4.L.1.1.** Give examples of changes in an organism's environment that are beneficial to it and some that are harmful. **4.L.1.3.** Explain how humans can adapt their behavior to live in changing habitats (e.g. recycling wastes, establishing rain gardens, planting trees and shrubs to prevent flooding and erosion).
ND (1/2017, 2014)	**4.6.1.** Evaluate the effects of technology on people and the environment (e.g., new construction, oil drilling, electric cars). **4.7.1.** Identify consequences of natural and human induced environmental changes (e.g., erosion, tsunami, deforestation). **4.7.2.** Identify ways in which science and technology have greatly improved human lives (e.g., food quality and quantity, transportation, health, sanitation, communication).
OH (1/2017, 2014)	**Ohio State Science Standards are not numbered or coded in any way:** Earth's surface has specific characteristics and landforms that can be identified.
OK (1/2017, 2014)	**4-ESS2-2** Analyze and interpret data from **maps** to describe patterns of Earth's features. **4-ESS3-1** Obtain and combine information to describe that energy and fuels are derived from renewable and non-renewable resources and how their uses affect the environment. **4-ESS3-2** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
OR (1/2017, 2014)	NGSS (see CA above).
PA (1/2017, 2002)	**3.3.4.A4** Recognize Earth's different water resources, including both fresh and saltwater. **3.4.4.B1** Describe how **technology** affects humans in various ways. **3.4.4.B2** Explain how the use of **technology** affects the environment in good and bad ways.
RI (1/2017, 2013)	NGSS (see CA above).
SC (1/2017, 2014)	**4.S.1A.1** Ask questions that can be (1) answered using scientific investigations or (2) used to refine models, explanations, or designs. **4.S.1A.4** Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation or graphing) to (1) reveal patterns and construct meaning or (2) support explanations, claims, or designs.

	4.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams. **4.S.1A.8** Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
SD (1/2017, 2015)	**4-ESS2-2** Analyze and interpret data from maps to describe patterns of Earth's features. **4-ESS3-1** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. **4-ESS3-2** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
TN (1/2017, 2009)	**GLE 0407.Inq.1** Explore different scientific phenomena by asking questions, making logical predictions, planning investigations, and recording data. **GLE 0407.T/E.5** Apply a creative design strategy to solve a particular problem generated by societal needs and wants. **GLE 0407.2.1** Analyze the effects of changes in the environment on the stability of an ecosystem. **GLE 0407.7.2** Evaluate how some earth materials can be used to solve human problems and enhance the quality of life.
TX (1/2017, 2014)	**112.15.a4(A).** Within the natural environment, students know that earth materials have properties that are constantly changing due to Earth's forces. The students learn that the natural world consists of resources, including renewable and nonrenewable, and their responsibility to conserve our natural resources for future generations. **112.15b9(B).** Describe the flow of energy through food webs, beginning with the Sun, and predict how changes in the ecosystem affect the food web such as a fire in a forest.
UT (1/2017, 3-6: 2002)	**Standard 5, Objective 1:** Describe the physical characteristics of Utah's wetlands, forests, and deserts. **Standard 5, Objective 2:** Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.
VT (1/2017, 2013)	NGSS (see CA above).
VA (1/2017, 2016)	**4.1.** The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

	a) distinctions are made among observations, conclusions, inferences, and predictions; *b) objects or events are classified and arranged according to characteristics or properties;* *e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;* *h)* ***hypotheses are developed*** *as cause and effect relationships;* *k) data are communicated with simple graphs, pictures,* ***written statements****, and numbers;* *l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and* *m) current applications are used to reinforce science concepts.* **4.5b,d,f.** The student will investigate and understand how plants and animals, including humans, in an ecosystem interact with one another and with the nonliving components in the ecosystem. Key concepts include *b) organization of populations, communities, and ecosystems and how they interrelate;* *d) habitats and niches; and* *f) influences of human activity on ecosystems.* **4.9a-d.** The student will investigate and understand important Virginia natural resources. Key concepts include *a) watersheds and water resources;* *b) animals and plants;* *c) minerals, rocks, ores, and energy sources; and* *d) forests, soil, and land.*
WA (1/2017, 2009)	NGSS (see CA above).
WV (1/2017, 2016)	NGSS (see CA above).
WI (1/2017, 2012)	By the end of **grade four**, students will: **A.4.1** When conducting science investigations, ask and answer questions that will help decide the general areas of science being addressed **A.4.2** When faced with a science-related problem, decide what evidence, models, or explanations previously studied can be used to better understand what is happening now **A.4.3** When investigating a science-related problem, decide what data can be collected to determine the most useful explanations **A.4.4** When studying science-related problems, decide which of the science themes are important **A.4.5** When studying a science-related problem, decide what changes over time are occurring or have occurred **C.4.1** Use the vocabulary of the unifying themes to ask questions about objects, organisms, and events being studied

	C.4.2 Use the science content being learned to ask questions, plan investigations, make observations, make predictions, and offer explanations **C.4.3** Select multiple sources of information to help answer questions selected for classroom investigations **C.4.4** Use simple science equipment safely and effectively, including rulers, balances, graduated cylinders, hand lenses, thermometers, and computers, to collect data relevant to questions and investigations **C.4.5** Use data they have collected to develop explanations and answer questions generated by investigations **C.4.6** Communicate the results of their investigations in ways their audiences will understand by using charts, graphs, drawings, written descriptions, and various other means, to display their answers **C.4.7** Support their conclusions with logical arguments **C.4.8** Ask additional questions that might help focus or further an investigation **F.4.1** Discover how each organism meets its basic needs for water, nutrients, protection, and energy in order to survive **F.4.4** Using the science themes, develop explanations for the connections among living and non-living things in various environments **H.4.2** Using the science themes, identify local and state issues that are helped by science and technology and explain how science and technology can also cause a problem. **H.4.3** Show how science has contributed to meeting personal needs, including hygiene, nutrition, exercise, safety, and health care **H.4.4** Develop a list of issues that citizens must make decisions about and describe a strategy for becoming informed about the science behind these issues
WY (1/2017, 2016)	**4-ESS2-2.** Analyze and interpret data from maps to describe patterns of Earth's features. **4-ESS3-1.** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. **4-ESS3-2.** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. **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. **3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

STATE EDUCATIONAL STANDARDS

5th GRADE, ALL 50 STATES & DC

These Standards have been collected from individual State websites (1/2017). They have been connected to themes that are available in an EPA tool called *EnviroAtlas*.

State (last updated on this chart, Standards adoption year)	**5th Grade Science Educational Standards that apply to the *EnviroAtlas* "Exploring Your Watershed" Module**
AL (1/2017, 2015)	**14.** Use a model to represent how any two systems, specifically the atmosphere, biosphere, geosphere, and/or hydrosphere, interact and support life (e.g., influence of the ocean on ecosystems, landform shape, and climate; influence of the atmosphere on landforms and ecosystems through weather and climate; influence of mountain ranges on winds and clouds in the atmosphere). **16.** Collect and organize scientific ideas that individuals and communities can use to protect Earth's natural resources and its environment (e.g., terracing land to prevent soil erosion, utilizing no-till farming to improve soil fertility, regulating emissions from factories and automobiles to reduce air pollution, recycling to reduce overuse of landfill areas).
AK (1/2017, 2012)	**[5] SE1.1** identifying a community problem or issue and describing the information needed to develop a scientific solution (L)
AZ (1/2017, 2005)	**Strand 3, Concept 1: PO 1.** Explain the impacts of natural hazards on habitats (e.g., global warming, floods, asteroid or large meteor impacts). **PO 2.** Propose a solution, resource, or product that addresses a specific human, animal, or habitat need. **PO 3.** Evaluate the possible strengths and weaknesses of a proposed solution to a specific problem relevant to human, animal, or habitat needs.
AR (1/2017, 2005)	**LS.4.5.4** Evaluate food webs under conditions of stress: • overgrazing • overpopulation • natural disaster • introduction of nonnative species • human impact/urban development **LS.4.5.16** Evaluate positive and negative human effects on ecosystems
CA (1/2017, 2009)	**5-ESS2-1.** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. **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. **3–5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

	NGSS Science & Engineering Practices (APPENDIX F): 1. Asking questions (for science) and defining problems (for engineering). 2. Developing and using models. 8. Obtaining, evaluating, and communicating information.
CO (1/2017, 2009)	None.
CT (1/2017, 2015)	NGSS (see CA above).
DC (1/2017, 2013)	NGSS (see CA above).
DE (1/2017, 2013)	NGSS (see CA above).
FL (1/2017, 2014)	**SC.5.N.1.1.** Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
GA (1/2017, new standards up 2017-2018)	None.
HI (1/2017, 2005)	None.
ID (1/2017, 2016)	**5.S.5.1.1.** Identify issues for environmental studies. **5.S.5.2.1.** Describe how science and technology are part of a student's life. **5.S.5.2.2.** List examples of science and technology.
IL (1/2017, 2011)	NGSS (see CA above).
IN (1/2017, 2016)	**5.ESS.3** Investigate ways individual communities within the United States protect the Earth's resources and environment. **5.ESS.4** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
IA (1/2017, 2016)	**5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
KS (1/2017, 2013)	NGSS (see CA above).

KY (1/2017, 2013)	**5-ESS2-1.** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. **ESS3.C:** Human Impacts on Earth Systems • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)
LA (1/2017, 2016)	**Physical Science:** 26. Identify and describe ecosystems of local importance (LS-M-C3) **Science and the Environment:** 49. Identify and give examples of pollutants found in water, air, and soil (SE-M-A3) 50. Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-MA4)
ME (1/2017, 2013)	NGSS (see CA above).
MD (1/2017, 2013)	NGSS (see CA above).
MA (1/2017, 2016)	**5-ESS3-1.** Obtain and combine information about ways communities reduce human impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.
MI (1/2017, 2015)	NGSS (see CA above).
MN (1/2017, 2009)	**5.4.2.1.1.** Natural systems have many components that interact to maintain the living system **5.4.2.1.2.** Natural systems have many parts that interact to maintain the living system **5.4.4.1.1.** Humans change environments in ways that can be either beneficial or harmful to themselves and other organisms.
MS (1/2017, 2010)	**4d.** Describe changes caused by humans on the environment and natural resources and cite evidence from research of ways to conserve natural resources in the United States, including (but not limited to) Mississippi. Examples of Mississippi efforts include the following: (DOK 2) • Associated Physics of America, a private company located in Greenwood Mississippi, develops ways to convert a variety of agricultural products into efficient, environment-friendly and cost-effective energy sources. • The Natural Resource Enterprises (NRE) Program of the Department of Wildlife and Fisheries and the Cooperative Extension Service at MSU educate landowners in the Southeast about sustainable natural resource enterprises and compatible habitat management practices.

	• The Engineer Research and Development Center of the Vicksburg District of the U.S. Army Corps of Engineers provides quality engineering and other professional products and services to develop and manage the Nation's water resources, reduce flood damage, and protect the environment.
MO (1/2017, 2015)	**5-ESS3-1.** Obtain and combine information about ways communities reduce human impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.
MT (1/2017, 2016)	Benchmarks at end of 4th grade, 8th grade, and upon graduation from high school *(see above for 4th grade)*
NE (1/2017, 2010)	**5.3.3** Students will describe relationships within an ecosystem. **5.3.3.d** Recognize all organisms cause changes, some beneficial and some detrimental, in the environment where they live.
NV (1/2017, 2014)	NGSS (see CA above).
NH (1/2017, 2016)	Separated into GSEs (Grade Span Expectations), 5-6 (so, "By the end of Grade 6, all students will…"
NJ (1/2017, 2013)	NGSS (see CA above).
NM (1/2017, 2009)	**Strand II: Content of Science Standard II (Life Science): 5-8 Benchmark I: 4.** Describe how human activity impacts the environment.
NY (1/2017, 2015)	NGSS (see CA above).
NC (1/2017, 2011)	**5.L.2.1.** Compare the characteristics of several common ecosystems, including estuaries and salt marshes, oceans, lakes and ponds, forests, and grasslands. **5.L.2.3.** Infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem.
ND (1/2017, 2014)	**5.1.2.** Explain how changes alter the balance within a system (e.g., the effects of limited resources on populations, global climate change, flood, drought) **5.7.2.** Explain ways humans benefit from Earth's resources (e.g., air, water, soil, food, fuel, building materials)
OH (1/2017, 2014)	**Ohio State Science Standards are not numbered or coded in any way:** Organisms perform a variety of roles in an ecosystem.
OK (1/2017, 2014)	**5-LS2-2.** Use models to explain factors that upset the stability of local ecosystems. **5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
OR	NGSS (see CA above).

(1/2017, 2014)	
PA (1/2017, 2002)	**3.4.5.B2** Describe how waste may be appropriately recycled or disposed of to prevent unnecessary harm to the environment.
RI (1/2017, 2013)	NGSS (see CA above).
SC (1/2017, 2014)	**5.S.1A.1** Ask questions used to (1) generate hypotheses for scientific investigations or (2) refine models, explanations, or designs. **5.S.1A.2** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others. **5.S.1A.8** Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support hypotheses, explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language. **5.E.3A.1 Construct explanations of how different landforms and surface features result from the location and movement of water on Earth's surface through watersheds (drainage basins) and rivers.** **5.E.3B.3** Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth. **5.L.4B.4** Construct scientific arguments to explain how limiting factors (including food, water, space, and shelter) or a newly introduced organism can affect an ecosystem.
SD (1/2017, 2015)	**5-ESS3-1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
TN (1/2017, 2009)	**GLE 0507.2.3** Establish the connections between human activities and natural disasters and their impact on the environment.
TX (1/2017, 2014)	**112.16.b9A.** Observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements. **112.16.b9C.** Predict the effects of changes in ecosystems caused by living organisms, including humans, such as the overpopulation of grazers or the building of highways.
UT (1/2017, K-2: 2010, 3-6: 2002, 7-8: 2003, 9-12: 2003, Earth Science: 2012)	None.

VT (1/2017, 2013)	NGSS (see CA above).
VA (1/2017, 2016)	**5.7g.** The student will investigate and understand how Earth's surface is constantly changing. Key concepts include: *g) human impact.*
WA (1/2017, 2009)	NGSS (see CA above).
WV (1/2017, 2016)	NGSS (see CA above).
WI (1/2017, 2012)	**A.8.1** Develop their understanding of the science themes by using the themes to frame questions about science-related issues and problems. **A.8.3** Defend explanations and models by collecting and organizing evidence that supports them and critique explanations and models by collecting and organizing evidence that conflicts with them. **A.8.5** Show how models and explanations, based on systems, were changed as new evidence accumulated (the effects of constancy, evolution, change, and measurement should all be part of these explanations). **C.8.1** Identify questions they can investigate using resources and equipment they have available **C.8.2** Identify data and locate sources of information including their own records to answer the questions being investigated **C.8.3** Design and safely conduct investigations that provide reliable quantitative or qualitative data, as appropriate, to answer their questions **C.8.6** State what they have learned from investigations, relating their inferences to scientific knowledge and to data they have collected **C.8.7** Explain their data and conclusions in ways that allow an audience to understand the questions they selected for investigation and the answers they have developed **C.8.8** Use computer software and other technologies to organize, process, and present their data **C.8.10** Discuss the importance of their results and implications of their work with peers, teachers, and other adults **C.8.11** Raise further questions which still need to be answered **F.8.8 Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet** **F.8.9** Explain how some of the changes on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species

	H.8.1 Evaluate the scientific evidence used in various media (for example, television, radio, Internet, popular press, and scientific journals) to address a social issue, using criteria of accuracy, logic, bias, relevance of data, and credibility of sources
WY (1/2017, 2016)	**5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to conserve Earth's resources and environment.

EnviroAtlas
people health nature economy
Lesson Plan Standards
www.epa.gov/enviroatlas

STATE EDUCATIONAL STANDARDS

6TH GRADE, ALL 50 STATES & DC

These Standards have been collected from individual State websites (1/2017). They have been connected to themes that are available in an EPA tool called *EnviroAtlas*.

State (last updated on this chart, Standards adoption year)	**6th Grade Science Educational Standards that apply to the *EnviroAtlas* "Exploring Your Watershed" Module**
AL (1/2017, 2015)	14. Analyze and interpret data (e.g., tables, graphs, maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; rates of human activities) to describe how various human activities (e.g., use of fossil fuels, creation of urban heat islands, agricultural practices) and natural processes (e.g., solar radiation, greenhouse effect, volcanic activity) may cause changes in local and global temperatures over time. 16. Implement scientific principles to design processes for monitoring and minimizing human impact on the environment (e.g., water usage, including withdrawal of water from streams and aquifers or construction of dams and levees; land usage, including urban development, agriculture, or removal of wetlands; pollution of air, water, and land).
AK (1/2017, 2012)	The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by [6] SA3.1 gathering data to build a knowledge base that contributes to the development of questions about the local environment (e.g., moose browsing, trail usage, river erosion) (L)
AZ (1/2017, 2005)	**Concept 2:** Science and Technology in Society. Develop viable solutions to a need or problem. PO 1. Propose viable methods of responding to an identified need or problem. PO 2. Compare possible solutions to best address an identified need or problem. PO 3. Design and construct a solution to an identified need or problem using simple classroom materials. PO 4. Describe a technological discovery that influences science. **Concept 3:** Populations of Organisms in an Ecosystem. Analyze the relationships among various organisms and their environment. PO 1. Explain that sunlight is the major source of energy for most ecosystems. PO 2. Describe how the following environmental conditions affect the quality of life: • water quality • climate • population density • smog
AR (1/2017, 2005)	None.
CA (1/2017, 2009)	**MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

	MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. **MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. **NGSS Science & Engineering Practices (APPENDIX F):** 1. Asking questions (for science) and defining problems (for engineering). 2. Developing and using models. 8. Obtaining, evaluating, and communicating information.
CO (1/2017, 2009)	3. Earth Systems Science, 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
CT (1/2017, 2015)	NGSS (see CA above).
DC (1/2017, 2013)	NGSS (see CA above).
DE (1/2017, 2013)	NGSS (see CA above).
FL (1/2017, 2014)	SC.6.N.1.1 Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

GA (1/2017, new standards up 2017-2018)	None.
HI (1/2017, 2005)	None.
ID (1/2017, 2016)	Goal 5.1: Understand Common Environmental Quality Issues, Both Natural and Human Induced 6.S.5.1.1 Identify issues for environmental studies. (626.01.a) Goal 5.2: Understand the Relationship between Science and Technology 6.S.5.2.1 Describe how science and technology are part of our society. (625.01.a) 6.S.5.2.2 Describe how science and technology are interrelated. (625.01.b)
IL (1/2017, 2011)	NGSS (see CA above).
IN (1/2017, 2016)	6.LS.5 Research invasive species and discuss their impact on ecosystems.
IA (1/2017, 2016)	NGSS (see CA above).
KS (1/2017, 2013)	NGSS (see CA above).
KY (1/2017, 2013)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (08-LS2-4) 08-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. LS2.C: Ecosystem Dynamics, Functioning, and Resilience Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (08-LS2-5) LS4.D: Biodiversity and Humans Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to 08-LS2-5) ETS1.B: Developing Possible Solutions There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to 08-LS2-5) 08-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
LA (1/2017, 2016)	**Science and the Environment** 45. Describe methods for sustaining renewable resources (SE-M-A6) 46. Identify ways people can reuse, recycle, and reduce the use of resources to improve and protect the quality of life (SE-M-A6) 47. Illustrate how various

	technologies influence resource use in an ecosystem (e.g., forestry management, soil conservation, fishery improvement) (SE-M-A8)
ME (1/2017, 2013)	NGSS (see CA above).
MD (1/2017, 2013)	NGSS (see CA above).
MA (1/2017, 2016)	6.MS-ETS1-6(MA). Communicate a design solution to an intended user, including design features and limitations of the solution
MI (1/2017, 2015)	NGSS (see CA above).
MN (1/2017, 2009)	6.1.2.2.1. Engineering design is the process of devising products, processes and systems that address a need, capitalize on an opportunity, or solve a specific problem.
MS (1/2017, 2010)	4d. Summarize the causes and effects of pollution on people and the environment (e.g., air pollution, ground pollution, chemical pollution) and justify how and why pollution should be minimized. (DOK 1)
MO (1/2017, 2015)	6.MS-ETS1-6(MA). Communicate a design solution to an intended user, including design features and limitations of the solution
MT (1/2017, 2016)	Benchmarks at end of 4th grade, 8th grade, and upon graduation from high school
NE (1/2017, 2010)	8.1.1.g Evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information. 8.3.3.g Identify positive and negative effects of natural and human activity on an ecosystem
NV (1/2017, 2014)	NGSS (see CA above).
NH (1/2017, 2016)	S:SPS1:6:1.2 Plan observations based on a given purpose. S:SPS1:6:1.8 Ask questions about relationships between and among observations. S:SPS2:6:2.1 Recognize that thinking about things as systems means looking for how every part relates to others. S:SPS2:6:4.1 Understand that things change in steady, repetitive, or irregular ways, or sometimes in more than one way at the same time; often the best way to tell which kinds of change are happening is to make a table or graph of measurements. S:SPS2:6:4.2 Discover how a system may stay the same because nothing is happening or because things are happening that exactly balance each other out.

	S:SPS3:6:1.1 Work effectively within a cooperative group setting, accepting and executing assigned roles and responsibilities. S:SPS3:6:1.2 Work collectively within a group toward a common goal. S:SPS3:6:1.3 Demonstrate respect of one another's abilities and contributions to the group. S:SPS3:6:2.1 Develop, focus and explain questions about the environment and do environmental investigations. S:SPS3:6:2.2 Design environmental investigations to answer particular questions. S:SPS3:6:2.3 Explore evidence that human-caused changes have consequences for the immediate environment as well as for other places and future times. S:SPS3:6:2.4 Explore how humans shape and control the environment while creating knowledge and developing new technologies. S:SPS3:6:2.5 Investigate environmental and resource management issues at scales that range from local to national to global.
NJ (1/2017, 2013)	NGSS (see CA above).
NM (1/2017, 2009)	None.
NY (1/2017, 2015)	NGSS (see CA above).
NC (1/2017, 2011)	6.E.2.4. Conclude that the good health of humans requires: monitoring the lithosphere, maintaining soil quality and stewardship.
ND (1/2017, 2014)	6.2.4. Use appropriate tools and techniques to gather and analyze data. 6.6.2. Design a product or solution to a problem given constraints (e.g., limits of time, costs, materials and environmental factors) 6.6.3. Explain the relationship between science and technology 6.7.2. Explain how recycling and conservation affect populations, resources, and the environment
OH (1/2017, 2014)	Ohio State Science Standards are not numbered or coded in any way: Living systems at all levels of organization demonstrate the complementary nature of structure and function.
OK (1/2017, 2014)	**MS-LS2-1** Students who demonstrate understanding can: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **MS-LS2-2** Students who demonstrate understanding can: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **MS-LS2-4** Students who demonstrate understanding can: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

	MS-LS2-5 Students who demonstrate understanding can: Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **MS-ESS3-3** Students who demonstrate understanding can: Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.
OR (1/2017, 2014)	NGSS (see CA above).
PA (1/2017, 2002)	3.3.6.A1 Recognize and interpret various mapping representations of Earth's common features. 3.4.6.B1 Describe how economic, political, and cultural issues are influenced by the development and use of **technology.**
RI (1/2017, 2013)	NGSS (see CA above).
SC (1/2017, 2014)	**6.S.1A.1** Ask questions to (1) generate hypotheses for scientific investigations, (2) refine models, explanations, or designs, or (3) extend the results of investigations or challenge claims. **6.S.1A.2** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others. **6.S.1A.4** Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1) reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs. **6.S.1A.6** Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams. **6.S.1A.8** Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations. **6.E.2A.3** Construct explanations of the processes involved in the cycling of water through Earth's systems (including transpiration, evaporation, condensation and crystallization, precipitation, and downhill flow of water on land).
SD (1/2017, 2015)	MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

	MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services. MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
TN (1/2017, 2009)	GLE 0607.Inq.5 Communicate scientific understanding using descriptions, explanations, and models. GLE 0607.2.3 Draw conclusions from data about interactions between the biotic and abiotic elements of a particular environment. GLE 0607.2.4 Analyze the environments and the interdependence among organisms found in the world's major biomes.
TX (1/2017, 2014)	112.18a(3) Grade 6 science is interdisciplinary in nature; however, much of the content focus is on physical science. National standards in science are organized as multi-grade blocks such as Grades 5-8 rather than individual grade levels. In order to follow the grade level format used in Texas, the various national standards are found among Grades 6, 7, and 8. Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include change and constancy, patterns, cycles, systems, models, and scale. 112.18b(12)(F) diagram the levels of organization within an ecosystem, including organism, population, community, and ecosystem.
UT (1/2017, K-2: 2010, 3-6: 2002, 7-8: 2003, 9-12: 2003, Earth Science: 2012)	None.
VT (1/2017, 2013)	NGSS (see CA above).
VA (1/2017, 2016)	**6.1a-j.** The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

	a) observations are made involving fine discrimination between similar objects and organisms; b) precise and approximate measurements are recorded; *c) scale models are used to estimate distance, volume, and quantity;* *d) hypotheses are stated in ways that identify the independent and dependent variables;* *e) a method is devised to test the validity of predictions and inferences;* *f) one variable is manipulated over time, using many repeated trials;* *g) data are collected, recorded, analyzed, and reported using metric measurements and tools; h) data are analyzed and communicated through graphical representation;* *i) models and simulations are designed and used to illustrate and explain phenomena and systems; and* *j) current applications are used to reinforce science concepts.* **6.7a-g.** The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include *a) the health of ecosystems and the abiotic factors of a watershed;* *b) the location and structure of Virginia's regional watershed systems;* *c) divides, tributaries, river systems, and river and stream processes;* *d) wetlands;* *e) estuaries;* *f) major conservation, health, and safety issues associated with watersheds; and* *g) water monitoring and analysis using field equipment including hand-held technology.* **6.9** The student will investigate and understand public policy decisions relating to the environment. Key concepts include *a) management of renewable resources;* *b) management of nonrenewable resources;* *c) the mitigation of land-use and environmental hazards through preventive measures; and* *d) cost/benefit tradeoffs in conservation policies.*
WA (1/2017, 2009)	NGSS (see CA above).
WV (1/2017, 2016)	NGSS (see CA above).
WI (1/2017, 2012)	**A.8.1** Develop their understanding of the science themes by using the themes to frame questions about science-related issues and problems.

	A.8.3 Defend explanations and models by collecting and organizing evidence that supports them and critique explanations and models by collecting and organizing evidence that conflicts with them. **A.8.5** Show how models and explanations, based on systems, were changed as new evidence accumulated (the effects of constancy, evolution, change, and measurement should all be part of these explanations). **C.8.1** Identify questions they can investigate using resources and equipment they have available **C.8.2** Identify data and locate sources of information including their own records to answer the questions being investigated **C.8.3** Design and safely conduct investigations that provide reliable quantitative or qualitative data, as appropriate, to answer their questions **C.8.4** Use inferences to help decide possible results of their investigations, use observations to check their inferences **C.8.5** Use accepted scientific knowledge, models, and theories to explain their results and to raise further questions about their investigations **C.8.6** State what they have learned from investigations, relating their inferences to scientific knowledge and to data they have collected **C.8.7** Explain their data and conclusions in ways that allow an audience to understand the questions they selected for investigation and the answers they have developed **C.8.8** Use computer software and other technologies to organize, process, and present their data **C.8.9** Evaluate, explain, and defend the validity of questions, hypotheses, and conclusions to their investigations **C.8.10** Discuss the importance of their results and implications of their work with peers, teachers, and other adults **C.8.11** Raise further questions which still need to be answered **F.8.8** Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet **F.8.9** Explain how some of the changes on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species **F.8.10** Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends. **G.8.2** Explain how current scientific and technological discoveries have an influence on the work people do and how some of these discoveries also lead to new careers

	G.8.3 Illustrate the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life **G.8.4** Propose a design (or re-design) of an applied science model or a machine that will have an impact in the community or elsewhere in the world and show how the design (or re-design) might work, including potential side-effects **G.8.5** Investigate a specific local problem to which there has been a scientific or technological solution, including proposals for alternative courses of action, the choices that were made, reasons for the choices, any new problems created, and subsequent community satisfaction **G.8.6** Use current texts, encyclopedias, source books, computers, experts, the popular press, or other relevant sources to identify examples of how scientific discoveries have resulted in new technology **G.8.7** Show evidence of how science and technology are interdependent, using some examples drawn from personally conducted investigations **H.8.1** Evaluate the scientific evidence used in various media (for example, television, radio, Internet, popular press, and scientific journals) to address a social issue, using criteria of accuracy, logic, bias, relevance of data, and credibility of sources **H.8.2** Present a scientific solution to a problem involving the earth and space, life and environmental, or physical sciences and participate in a consensus-building discussion to arrive at a group decision **H.8.3** Understand the consequences of decisions affecting personal health and safety
WY (1/2017, 2016)	**MS-PS1-3.** Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. **MS-LS2-1.** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **MS-LS2-2.** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **MS-ESS2-4.** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. **MS-ESS3-3**. Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.

	MS-ESS3-4. Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems. **MS-ETS2-2.** Develop a model defining and prioritizing the impacts of human activity on a particular aspect of the environment, identifying positive and negative consequences of the activity, both short and long-term, and investigate and explain how the ethics and integrity of scientists and engineers and respect for individual property rights might constrain future development.