Correlations

of the

Project WILD Online Course Activities

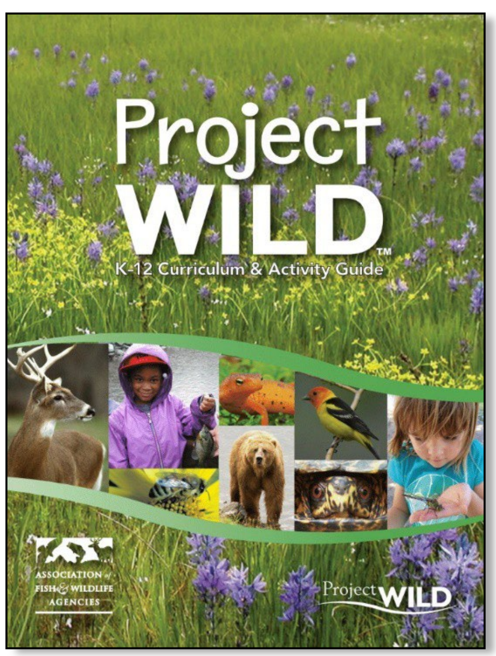
to

Next Generation Science Standards

and the

Framework for K-12 Science Education

2023



Project WILD Activity Correlations

Introduction

Purpose:

The *Project WILD K-12 Curriculum & Activity Guide* (WILD) is interdisciplinary, offering activities that focus on everything from mathematics to social studies, but Project WILD is especially relevant to science, specifically the K-12 science classroom. Most states have now adopted *The Next Generation Science Standards* (NGSS) or standards based on *A Framework for K-12 Education.* The foundations for both are three dimensions of science: Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts. Project WILD provides phenomenon-based experiences and activities that are three-dimensional, supporting the standards teachers must work to help their students achieve. Now more than ever, Project WILD can be viewed as a tool to help teachers get students outside while engaging in standards-based teaching and learning. This document was developed in 2023 as a companion for the Project WILD online course to highlight the three-dimensionality and phenomenon-based aspects of the six science-focused activities included from the *Project WILD K-12 Curriculum & Activity Guide* (note that the activity "Natural Dilemmas," a social studies activity included in the online course, does not correlate to the NGSS).

NGSS & the Framework:

The NGSS are national K–12 science content standards. They set the expectations for what students should know and be able to do at the end of instruction. The NGSS were developed by states to improve science education for all students by providing a set of research-based, up-to-date K–12 science standards. These benchmarks give local educators the flexibility to design classroom learning experiences that stimulate students' interests in science and prepare them for college, careers, and citizenship.

Learn more about how Achieve coordinated the work of twenty-six Lead State Partners and collaborated with critical partners, including the National Research Council, the National Science Teachers Association, and the American Association for the Advancement of Science, to develop the NGSS based on the NRC's K-12 Framework for Science Education.

Terms to Know

DCI: Disciplinary Core Idea | SEP: Science and Engineering Practice | CCC: Crosscutting Concept

PE: Performance Expectation

Phenomenon-Based & The Untethered Dimensions:

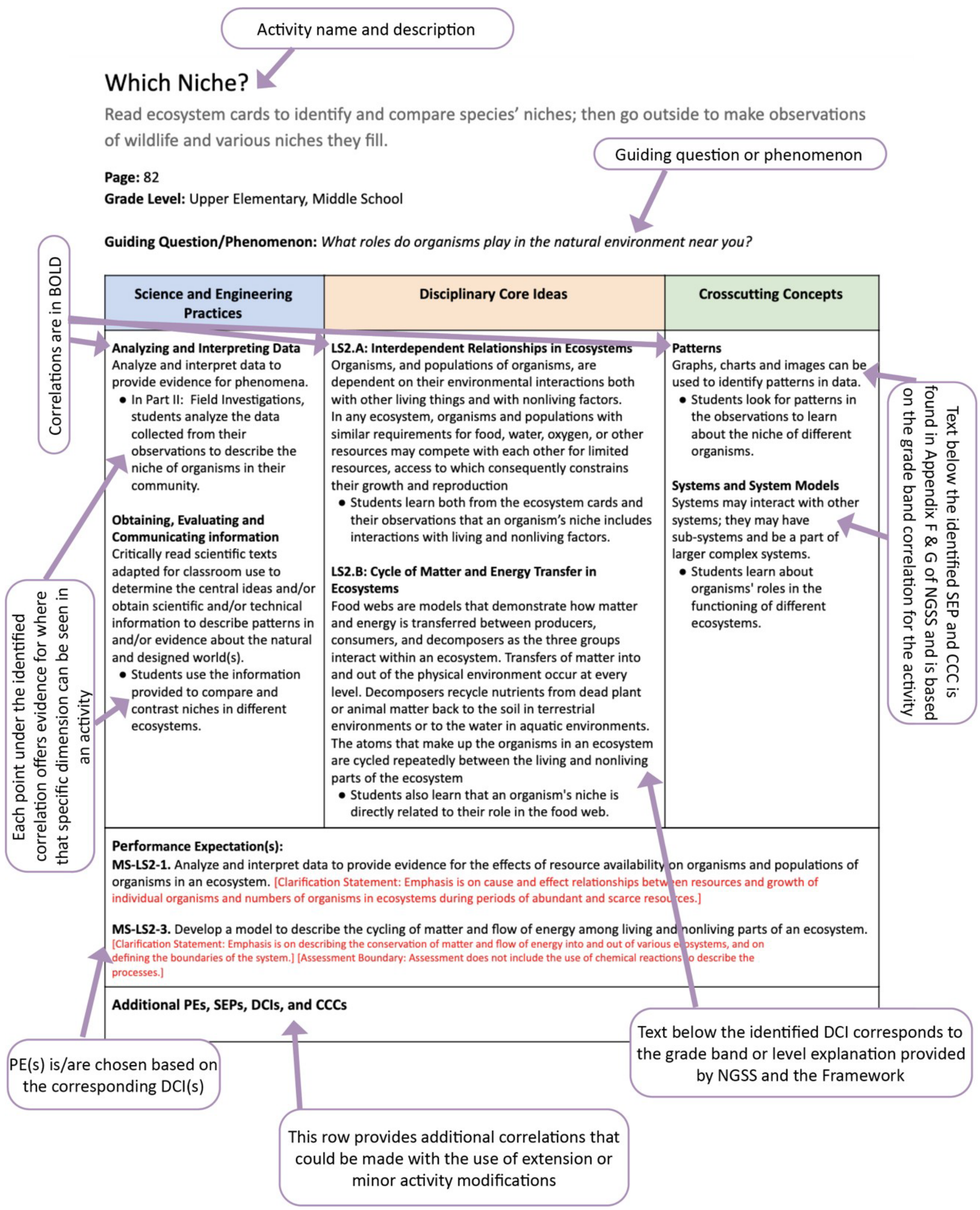
According to NGSS, natural phenomena are observable events that occur in the universe and that we can use our science knowledge to explain or predict. Framing the phenomenon at the crux of the activity for each correlation is a "Guiding Question." This question or phenomenon is meant to drive the instruction and allow students to use SEPs to explain or predict and CCCs to make sense of that phenomenon.

The actual "standard" in NGSS is the three-dimensional Performance Expectation (PE). The PEs are not the focus of these correlations because any single standard (or PE) cannot be effectively taught in one lesson or activity. Consequently, the approach for developing these correlations is known as "untethered," where the appropriate DCI from the Performance Expectation is used but is not necessarily the stated SEPs or CCCs. Rather, the SEPs and CCCs actually used by students in the activity are specified in the correlations.

The Correlation Document:

Each correlation document begins with basic details about the activity and a guiding question/phenomenon. The guiding question is meant to serve teachers with an idea for how the experience can be based on and driven by phenomena. Teachers are encouraged to adapt the guiding question to make it as relevant to students and their environment as possible.

The actual correlations can be found in the table on each document. The correlations are broken down by the three-dimensions and three columns: SEPs, DCIs, and CCCs. The bold words in each column signify the specific correlation(s). In most instances, there are multiple correlations for each dimension. Each correlation has a bullet providing evidence of the specified dimension from the activity. The Performance Expectation (the actual standard) supported by the learning experience is in the row below the three columns. As stated above, however, we have used the untethered approach as recommended by Nextgenscience for connecting the SEPs and CCCs. Both the SEP and the CCC text below the bolded correlations are found in the NGSS progressions, [Appendix F]() and [Appendix G]() respectively. These progressions show how each SEP or CCC relates directly to an activity's specified grade band. Some activities can be easily modified to support additional correlations. Notes about these additional correlations, where applicable, have been made in the last row of the table. Below is a diagram to help with understanding each correlation page.



Adaptation Artistry

Design and construct your own bird and describe your creation's adaptations and habitats.

Page: 206
Grade Level: Upper Elementary, Middle School

Guiding Question/Phenomenon: *The birds resting and feeding outside the classroom window look very different from birds on the seashore, or those that live in the tropics or polar regions. Why are there so many variations in beaks, feet, legs, wings, and coloration?*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Develop models to describe phenomena. ● Students develop a model to represent the adaptations (trait variations) of the bird they design to live in a particular habitat. **Constructing Explanations and Designing Solutions** Use evidence (e.g. observations, patterns) to support an explanation Use evidence (observations, patterns) to construct an explanation. ● Students use evidence represented by their bird's designed characteristics to explain how it could live successfully in the selected habitat the students created for it.	**LS1.A: Structure and Function** Animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ● Students assign specialized functions to the structures they assign to their designed bird **LS3.B: Variations of Traits** Different organisms vary in how they look and function because they have different inherited information. The environment also affects the traits that an organism develops. ● Students explain how inherited information and/or environmental factors influence how the bird looks and acts. **LS4.B: Natural Selection** Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. ● Students explain how the structures assigned to their bird gives it advantages to survive and thrive in their habitat.	**Cause and Effect** Cause and effect relationships are routinely identified. ● Students explain how inherited or environmentally influenced traits have caused their birds to be able to survive and thrive in their habitats. **Systems and System Models** A system can be described in terms of its components and their interactions. ● Students describe how each structure (subsystem) works with the other structures of the bird (system) to ensure its success in its habitat (ecosystem).

Performance Expectation(s):

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. [Clarification Statement: Examples of cause and effect relationships could plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

Additional PEs, SEPs, DCIs, and CCCs

N/A

Bottleneck Genes

Using a bottle, colored beads, and environmental scenario cards, investigate how genetic diversity within a population affects a species' ability to adapt and survive.

Page: 268
Grade Level: Middle School, High School

Guiding Question/Phenomenon: *How does genetic diversity contribute to the health of an endangered species in your area?*

<table>
<tr><th>Science and Engineering Practices</th><th>Disciplinary Core Ideas</th><th>Crosscutting Concepts</th></tr>
<tr>
<td>Developing and Using Models
Use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.
● Students use a model of a black-footed ferret population to determine the effects of genetic diversity on their ability to survive under different environmental conditions.

Using Mathematics and Computational Thinking
Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
● Students mathematically describe the genetic diversity of a black ferret population and use that ratio to predict the black ferret's success in various environmental scenarios.</td>
<td>LS4.B: Natural Selection
The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
● Students use a model of a black-footed ferret population to determine if the traits of that population will positively affect survival under different environmental conditions.</td>
<td>Stability and Change
Much of science deals with constructing explanations of how things change and how they remain stable.
● Students explore how genetic variability relates to stable populations in different environmental scenarios.</td>
</tr>
<tr><td colspan="3">Performance Expectation(s):
HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]</td></tr>
<tr><td colspan="3">Additional PEs, SEPs, DCIs, and CCCs
This activity also correlates well with the same SEPs and CCCs at the middle grades level.

The online course includes a Khan Academy video that also covers these DCIs, PE, and CCC:

LS3.A: Inheritance of Traits Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.

LS3.B: Variation of Traits In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.

LS4.C: Adaptation Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new</td></tr>
</table>

environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

Scale, Proportion, and Quantity: Patterns observable at one scale may not be observable or exist at other scales.

Oh Deer!

Students become deer and habitat components in a physical activity that demonstrates population fluctuations, carrying capacity, and limiting factors.

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Grade Level: Upper Elementary, Middle School, High School

Guiding Question/Phenomenon: *What factors affect deer populations?*

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concepts
Developing and Using Models Use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. ● Students participate in a simulation to model the fluctuation in deer population based on a variety of factors. Identify limitations of models (3-5). ● Students discuss what is realistic and unrealistic about the simulation, examining the limitations of the model. **Using Mathematics and Computational Thinking** Use mathematical and/or computational representations of phenomena to support explanations. ● Students develop graphical representations of the fluctuation in deer population based on the simulation.	**LS2.A: Interdependent Relationships in Ecosystems** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) or species in any given ecosystem. ● Students discuss carrying capacity for deer populations based on the simulation and the factors that contribute to the carrying capacity of an ecosystem.	**Patterns** Mathematical representations are needed to identify some patterns. ● Students look for patterns in the graphical representations to identify fluctuations in deer populations .

Performance Expectation(s):
HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent including boundaries, resources, climate and competition. Examples of mathematical comparisons could include graphs, charts, histograms, or population changes from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

Additional PEs, SEPs, DCIs, and CCCs
The online course includes “Oh Deer 5-dice,” a version of “Oh Deer!” adapted for online instruction. The SEPs below apply to that version, in addition to the SEPs above.

Analyzing and Interpreting Data
Analyze and interpret data to provide evidence for phenomena.
- Students record the number of deer that survive each round to determine the approximate carrying capacity of the habitat.

Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.
- Based on data from the previous round(s), students make suggestions for survival threshold numbers (number of points required for a deer to survive) that will result in a sustainable population of deer over several rounds, without the population dropping too low for the deer to be unable to reproduce.

Using Mathematics and Computational Thinking

Create algorithms (a series of ordered steps) to solve a problem.

- In the first variation, students create an algorithm that will set survival thresholds to produce a sustainable population of deer over several rounds.

Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.

- In the first variation, students create and test an algorithm to adjust the survival threshold for deer each round.

Constructing Explanations and Designing Solutions

Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. Construct an explanation using models or representations.

- Students define limiting factors and use examples from the model to explain how various factors impact the size of the deer population.

Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.

- In the first variation, students create an algorithm to adjust the survival threshold for deer each round.

Sustainability: Then, Now, Later

Explore the concept of sustainability through an active simulation, then analyze first-person narratives reflecting the lifestyles of various time periods.

Page: 491
Grade Level: Middle School

Guiding Question/Phenomenon: *What is sustainability and how do my choices affect it?*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Develop and/or use a model to predict and/or describe phenomena. ● Students participate in a game that models the use of natural resources and the idea of sustainability. **Obtaining, Evaluating and Communicating Information** Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). ● Students read different scenarios to compare and contrast sustainability over different time factors.	**ESS3.A Natural Resources** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, freshwater, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. ● Students participate in a game that parallels the use of natural resources and sustainability. They discuss renewable vs. nonrenewable, develop lists of such resources they use in daily life, and how resources may be overused in a non-sustainable way. **ESS3.C: Human Impacts on Earth Systems** The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. ● Students obtain information about how the use of natural resources has changed over time and the impact of those changes on sustainability.	**Cause and Effect** Cause and effect relationships might be used to predict phenomena in natural or designed systems. ● Students discuss the use of renewable and nonrenewable resources and the effect of overuse. **Stability and Change** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. ● Students explore how natural resource use has changed over time and the effects of those uses on ecosystems and human systems.

Performance Expectation(s):

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

Additional PEs, SEPs, DCIs, and CCCs

Which Niche?

Read ecosystem cards to identify and compare species' niches; then go outside to make observations of wildlife and various niches they fill.

Page: 82
Grade Level: Upper Elementary, Middle School

Guiding Question/Phenomenon: *What roles do organisms play in the natural environment near you?*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyze and interpret data to provide evidence for phenomena. ● In Part II: Field Investigations, students analyze the data collected from their observations to describe the niche of organisms in their community. **Obtaining, Evaluating and Communicating information** Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). ● Students use the information provided to compare and contrast niches in different ecosystems.	**LS2.A: Interdependent Relationships in Ecosystems** Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction ● Students learn both from the ecosystem cards and their observations that an organism's niche includes interactions with living and nonliving factors. **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem ● Students also learn that an organism's niche is directly related to their role in the food web.	**Patterns** Graphs, charts and images can be used to identify patterns in data. ● Students look for patterns in the observations to learn about the niche of different organisms. **Systems and System Models** Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. ● Students learn about organisms' roles in the functioning of different ecosystems.

Performance Expectation(s):

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. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

Additional PEs, SEPs, DCIs, and CCCs