**MS.LS2.A: Interdependent Relationships in Ecosystems**

Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

**MS.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. (MS-LS2-5)

**MS.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. (MS-LS2-5)
**MS.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. (MS-LS2-5)

**MS.LS1.B: Growth and Development of Organisms**

Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)

**MS.LS1.B: Growth and Development of Organisms**

Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
**Disciplinary Core Idea**

**MS.LS1.B: Growth and Development of Organisms**

Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

**Disciplinary Core Idea**

**MS.LS1.B: Growth and Development of Organisms**

Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (MS-LS3-2)

**Disciplinary Core Idea**

**MS.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. (MS-LS3-2)
**Disciplinary Core Idea**

**MS.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. (MS-LS3-2)

**Disciplinary Core Idea**

**MS.ESS3.C: Human Impacts on Earth Systems**

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)

**Disciplinary Core Idea**

**MS.ESS3.C: Human Impacts on Earth Systems**

Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3)
Disciplinary Core Idea

**MS.ESS3.C: Human Impacts on Earth Systems**

Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-4)

Performance Expectation

**MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.**

**Clarification Statement:** Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.

**Assessment Boundary:** none

Performance Expectation

**MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.**

**Clarification Statement:** Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.

**Assessment Boundary:** none

* This performance expectation integrates traditional science content with engineering through a practice or disciplinary code idea.
Performance Expectation

**MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.**

**Clarification Statement:** Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.

**Assessment Boundary:** none

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Performance Expectation

**MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.**

**Clarification Statement:** Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.

**Assessment Boundary:** Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.

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Performance Expectation

**MS-LS3-2: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.**

**Clarification Statement:** Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.

**Assessment Boundary:** none
Performance Expectation

**MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

**Clarification Statement:** Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).

**Assessment Boundary:** none

* This performance expectation integrates traditional science content with engineering through a practice or disciplinary code idea.

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Performance Expectation

**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.

**Clarification Statement:** Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.

**Assessment Boundary:** none

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Science and Engineering Practice

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)
Science and Engineering Practice

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

Science and Engineering Practice

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4)

Science and Engineering Practice

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5)
Science and Engineering Practice

**Developing and Using Models**

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

Develop and use a model to describe phenomena. (MS-LS3-2)

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**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Apply scientific ideas or principles to design an object, tool, process or system. (MS-ESS3-3)

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**Engaging in Argument from Evidence**

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

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Crosscutting Concept

**Patterns**

Patterns can be used to identify cause-and-effect relationships. (MS-LS2-2)

Crosscutting Concept

**Stability and Change**

Small changes in one part of a system might cause large changes in another part. (MS-LS2-5)

Crosscutting Concept

**Cause and Effect**

Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4)
Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-5)

Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)

Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
**Crosscutting Concept**

**Cause and Effect**

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-4)

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**Connection to Nature of Science**

**Science Addresses Questions About the Natural and Material World**

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

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**Connection to Engineering, Technology, and Applications of Science**

**Influence of Science, Engineering, and Technology on Society and the Natural World**

The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)
**Science Addresses Questions About the Natural and Material World**

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-ESS3-4)

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**Influence of Science, Engineering, and Technology on Society and the Natural World**

The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3)

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**Influence of Science, Engineering, and Technology on Society and the Natural World**

All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-4)
Reading Informational Text

RI.8.8 - Integration of Knowledge and Ideas
Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced. (MS-LS2-5)

Reading in Science

RST.6-8.1 - Key Ideas and Details
Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-2)

Reading in Science

RST.6-8.8 - Integration of Knowledge and Ideas
Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5)
**Common Core State Standards for ELA/Literacy**

**Speaking & Listening**

**SL.8.1 - Comprehension and Collaboration**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly. (MS-LS2-2)

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**Speaking & Listening**

**SL.8.4 - Presentation of Knowledge and Ideas**

Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS2-2)

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**Writing in Science**

**WHST.6-8.2 - Text Types and Purposes**

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. (MS-LS2-2)
**Writing in Science**

**WHST.6-8.9 - Research to Build and Present Knowledge**

Draw evidence from informational texts to support analysis reflection, and research. (MS-LS2-2)

**Common Core State Standards for Mathematics**

**Ratios & Proportional Relationships**

**6.RP.A.3 - Understand ratio concepts and use ratio reasoning to solve problems.**

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (MS-LS2-5)

**Statistics & Probability**

**6.SP.B.5 - Summarize and describe distributions.**

Summarize numerical data sets in relation to their context. (MS-LS2-2)
Common Core State Standards for Mathematics

Mathematical Practices
MP.4 - Model with mathematics
Model with mathematics. (MS-LS2-5)