OREGON CONTENT STANDARDS

# K-12 Climate Change and Sustainability Education

Health, Social Science and Science: Connections to Climate Change and Sustainability

2025

OREGON DEPARTMENT OF EDUCATION

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# Background

This document was developed in response to Oregon House Bill 3365 (2025), which requires the State Board of Education to ensure that academic content standards for science, health, and social science address the causes and effects of climate change and strategies for mitigating, adapting to, and strengthening community resilience to those causes and effects.

According to the current adoption schedule, the Oregon State Board of Education is expected to adopt revised **science standards** in **spring 2029**, **health standards** in **spring 2030**, and **social science standards** in **spring 2031**. In alignment with the bill, these revisions will include content focused on the causes and effects of climate change, strategies for mitigation and adaptation, and approaches for strengthening community resilience.

Oregon has long recognized the importance of preparing students to understand and respond to the defining challenge of their generation. HB 3365 formalizes this commitment by embedding climate change education across multiple disciplines and grade levels, ensuring that all Oregon students develop the knowledge, skills, and agency needed to navigate and shape a changing world.

# Purpose

This document identifies existing standards within Oregon's currently adopted Health, Social Science, and Science that provide meaningful connections to climate change and sustainability education. These standards represent opportunities for educators to integrate climate-related topics, skills, and perspectives into their current curriculum to reinforce these concepts, without requiring entirely new content or materials.

The document is organized by subject area and grade level, highlighting:

- **Health Standards** that connect climate change to the five dimensions of health (physical, social, emotional, mental, and environmental), wellness promotion, nutrition, and safety preparedness
- **Social Science Standards** that examine human-environment interactions, resource management, migration patterns, civic engagement, and the economic and political dimensions of environmental challenges
- **Science Standards** that build understanding of Earth's systems, weather and climate patterns, human impacts on natural systems, and evidence-based solutions—marked with a caret (^) to indicate proximal connections to climate change

# K-12 Health Standards:

## Connections to Climate Change and Sustainability

The 2023 Oregon Health Education Standards provide meaningful opportunities for students to explore climate change and sustainability through the integrated lens of the **five dimensions of health: physical, social, emotional, mental, and environmental**. These standards help students understand how personal and collective choices impact not only individual well-being but also the health of their communities as well as the global society.

Throughout the K-12 health standards, students examine how climate-related issues, such as air and water pollution, extreme weather, and loss of natural spaces affect physical health (e.g., respiratory health, heat-related illnesses). Students explore how environmental stressors contribute to mental and emotional health challenges such as anxiety and eco-grief. They can then apply this learning to develop strategies to build resilience and cope with climate-related stress through mindfulness, physical activity, and community support, while promoting a sense of agency that strengthens both their emotional and social health.

## Kindergarten Health Standards

### Wellness and Health Promotion

*K.WHP* *Wellness and Health Promotion*

**K.WHP.7** **Understand the importance of access to clean air, clean water, food, and shelter.**

## Grade 1 Health Standards

### Wellness and Health Promotion

*1.WHP* *Wellness and Health Promotion*

**1.WHP.1** **Recognize at least three dimensions of being healthy and well (physical, social, emotional, mental and/or environmental).**

**1.WHP.6** **Define environment and environmental health.**

## Grade 3 Health Standards

### Wellness and Health Promotion

*3.WHP* *Wellness and Health Promotion*

**3.WHP.7** **Recognize the connection between environmental health, including the effects of climate change, and personal health.**

### Safety and First Aid

*3.SFA* *Safety and First Aid*

**3.SFA.5** **Describe safety procedures for responding to natural disasters.**

## Grade 4 Health Standards

### Food, Nutrition, and Physical Activity

*4.FNP* *Food, Nutrition, and Physical Activity*

**4.FNP.9** **Discuss factors that affect the availability of food, including socioeconomic status and location.**

## Grade 5 Health Standards

### Wellness and Health Promotion

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|---|---|
| *5.WHP* | *Wellness and Health Promotion* |
| **5.WHP.1** | **Reflect on what the five dimensions of health (physical, social, emotional, mental, and environmental) look like for individuals, families, and communities.** |
| **5.WHP.7** | **Discuss how the location and environment of where people live can affect their health.** |

## Grade 6 Health Standards

### Wellness and Health Promotion

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|---|---|
| *6.WHP* | *Wellness and Health Promotion* |
| **6.WHP.1** | **Describe the interrelationship of the five dimensions of health (physical, social, emotional, mental, and environmental).** |
| **6.WHP.8** | **Identify actions that can help to create a healthier environment for individuals and communities.** |

## Grade 7 Health Standards

### Wellness and Health Promotion

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|---|---|
| *7.WHP* | *Wellness and Health Promotion* |
| **7.WHP.4** | **Set a personal health goal for a habit that promotes physical, social, emotional, mental, and environmental health.** |

### Safety and First Aid

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|---|---|
| *7.SFA* | *Safety and First Aid* |
| **7.SFA.6** | **Describe basic fire safety and wildfire prevention steps.** |

## Grade 8 Health Standards

### Wellness and Health Promotion

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|---|---|
| *8.WHP* | *Wellness and Health Promotion* |
| **8.WHP.8** | **Examine the relationship between environmental conditions, including air and water quality and climate change, on personal and community health outcomes.** |

## High School Health Standards

### Wellness and Health Promotion

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|---|---|
| *HS.WHP* | *Wellness and Health Promotion* |
| **HS.WHP.10** | **Discuss the intersections between built environment, green spaces, climate change, and the five dimensions of health.** |

### Safety and First Aid

| | |
|---|---|
| *HS.SFA* | *Safety and First Aid* |
| **HS.SFA.5** | **Examine laws and practices related to increasing accessibility for people with disabilities and identify why they are important for individual, interpersonal, community, and environmental health.** |

# K-12 Social Science Standards:

## Connections to Climate Change and Sustainability

The 2024 Oregon Social Science Standards provide numerous opportunities for students to explore climate change and sustainability through the lenses of geography, economics, civics, and history. These standards **engage students in examining human-environment interactions, resource management, migration patterns, and the social, political, and economic dimensions of environmental challenges**.

From early elementary investigations of renewable and non-renewable resources to high school analysis of climate-driven migration, carbon footprint assessment, and international climate summits, students develop critical thinking skills to understand the interaction between societies and the environments throughout history and into the present day. By connecting past patterns of resource use and land stewardship to contemporary challenges, students develop informed civic engagement skills necessary for addressing climate change and advocating for environmental and sustainable practices in their communities and beyond.

## Kindergarten Social Science Standards

### Geography

*K.G.HI* *Human Interactions and Interconnections*

**K.G.HI.7** **Identify and begin to understand ways humans interact with their environment.**

**K.G.HI.8** **Explain the influence of seasonal change on human activities.**

## Grade 1 Social Science Standards

### Geography

*1.G.HE* *Human Environmental Interactions*

**1.G.HE.6** **Provide examples of local natural resources and describe how people use them.**

**1.G.HE.7** **Describe ways people modify their environment.**

### Economics

*1.E.MI* *Micro and Macro*

**1.E.MI.4** **Describe how people are buyers (consumers) and sellers (producers).**

*1.E.ST* *Specialization, Trade, & Interdependence*

**1.E.ST.6** **Investigate how people can benefit themselves and others by developing specific skills, strengths, and goods.**

### History

*1.H.CP* *Communities and Pluralism*

**1.H.MCP.5** **Identify and explain various viewpoints, including those from historically marginalized or underrepresented groups and individuals within our community, regarding local matters.**

## Grade 2 Social Science Standards

### Civics

*2.C.IR* *Identity, Roles, and Responsibilities*

**2. C.IR.3** **Describe and analyze the many ways students can affect their local community.**

### Geography

*2.G.HE* *Human Environmental Interactions*

**2.G.HE.8** **Explain and describe how humans either adapt to, or change, the environment to meet their needs for survival and living and why humans prefer to settle by rivers, bodies of water, and in or near certain landforms.**

### Economics

*2.E.MI* *Micro and Macro*

**2.E.MI.3** **Describe how examples of capital, human, and natural resources are related to goods and services.**

*2.E.ST* *Specialization, Trade, & Interdependence*

**2.E.ST.7** **Identify resources as renewable and non-renewable.**

## Grade 3 Social Science Standards

### Civics

*3.C.IR* *Identity, Roles, and Responsibilities*

**3. C.IR.4** **Explain how a community relies on active civic participation and identify opportunities for student participation in local and regional issues.**

**3.C.CE.7** **Identify a local public issue and describe ways individuals and groups can engage with decision-makers**

## Geography

*3.G.MM* *Migration and Movement*

**3.G.MM.4** **Investigate the causes behind global migration, distinguishing between voluntary relocation and forced displacement.**

*3.G.HE* *Human Environmental Interactions*

**3.G.HE.7** **Identify and analyze Oregon's natural resources and describe how people in Oregon and other parts of the world use them.**

## Economics

*3.E.ES* *Earning, Saving, and Spending*

**3.E.ES.1** **Consider the effect of individual financial decisions on personal, community, regional, and world resources.**

**3.E.MI.4** **Analyze the effect of government and business decisions on personal and community resources.**

# Grade 4 Social Science Standards

## Geography

*4.G.MM* *Migration and Movement*

**4.G.MM.4** **Compare and contrast varying patterns of exploration and settlement in the Pacific Northwest over time, considering how physical features and the availability of natural resources affected exploration and settlement patterns, including the development of major urban/suburban areas, industries, or trade.**

*4.G.GE* *Human Environmental Interactions*

**4.G.GE.7** **Identify the effects on environmental stability and sustainability of technologies and policies such as dams, wind turbines, and transportation in shaping Oregon's physical and human geography.**

## Grade 5 Social Science Standards

### Geography

*5.G.HE* *Human Environmental Interactions*

**5.G.HE.8** **Describe how physical, human, and political features influence events, movements, and adaptation to the environment.**

**5.G.HE.9** **Describe how technological developments, societal decisions, and personal practices affect sustainability in the United States.**

## Grade 6/7 Social Science Standards

### Geography

*6/7.G.HE* *Human Environmental Interactions*

**6/7.G.HE.6** **Identify how physical environments influence and effect changes in population, technical advancements, culture, and approaches to resource use, stewardship, and sustainability from the Paleolithic to 900 CE.**

**6/7.G.HE.7** **Identify and describe examples of how conquest and colonialism affected traditionally underrepresented identities, cultures, and communities.**

### History

*6/7.H.CE* *Cause and Effect*

**6/7.H.CE.7** **Identify and describe examples of how conquest and colonialism affected historically underrepresented identities, cultures, and communities.**

## Grade 8 Social Science Standards

### Geography

*8.G.HI* *Human Interaction and Interconnection*

**8.G.HI.6** **Identify and describe how the physical and human characteristics of places and regions connect to human identities and cultures.**

*8.G.HE* *Human Environmental Interactions*

**8.G.HE.7** **Identify and describe examples of how conquest and colonialism in North America affected Indigenous peoples' identities, cultures, and communities.**

## High School Social Science Standards

### Geography

*HS.G.GR* *Geographic Reasoning*

**HS.G.GR.1** **Use geographic tools, various kinds of maps, and geospatial technologies to examine geographic components of past and current world events or to solve geographic problems.**

*HS.G.MM* *Migration and Movement*

**HS.G.MM.2** **Analyze recent voluntary and forced migration patterns to identify and understand the push and pull factors and their effect on people and places.**

*HS.G.HI* *Human Interaction and Interconnection*

**HS.G.HI.6** **Identify the effects of geographical factors on the interactions among societies.**

**HS.G.HI.7** **Assess the effect of human settlement activities on the environmental and cultural characteristics of specific places and regions.**

**HS.G.HI.8** **Identify examples of conflict and cooperation involving the use of land and natural resources.**

*HS.G.HE* *Human Environmental Interaction*

**HS.G.HE.9** **Explain how technological developments, societal decisions, and personal practices influence global resource consumption patterns, conservation, and environmental sustainability.**

**HS.G.HE.10** **Evaluate efforts at the local, national, or international level to address the use of limited or environmentally harmful resources.**

**HS.G.HE.11** **Identify and describe how the relationship to land, utilization of natural resources, displacement, and land ownership affects historically underrepresented identities, cultures, and communities.**

*HS.US.CP*

**HS.US.CP.19** **Identify and analyze political, social, and intellectual movements in the post-WWII United States.**

# K-12 Science Standards:

## Connections to Climate Change and Sustainability

The adopted 2022 Oregon Science Standards include the foundational understanding of weather, climate, and human impacts on natural resources in Kindergarten through Grade 5. The standards also specifically **identify global climate change and human impact on earth's system** as a disciplinary core idea in middle school and high school.

Oregon's Science Standards provide continuous opportunities to learn and make connections to the complex nature and causes of climate change, and learn the skills to develop and advocate for solutions.

A caret or up arrow (**^**) was added to those K-12 science standards that have proximal connections to climate change and human impact on earth's system. These standards were identified by utilizing a research analysis conducted by MADE CLEAR through a National Science Foundation Grant that could further support climate change education.

**^** This performance expectation references a proximal connection to climate change and the disciplinary core ideas: Earth's Systems and Earth and Human Activity.

# Kindergarten Science Standards

## Earth & Space Science

*K.ESS2* *Earth's Systems*

**K.ESS2.1** **Use and share observations of local weather conditions to describe patterns over time.^** [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.]

**K.ESS2.2** **Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.^** [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.][Assessment Boundary: Assessment is limited to a single example of a plant or animal per item or task.]

*K.ESS3* *Earth and Human Activity*

**K.ESS3.2** **Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.*^** [Clarification Statement: Emphasis is on local forms of severe weather and preparation efforts to respond to weather events that sometimes happen more often in some regions or locations.][Assessment Boundary: Assessment focuses on a particular region at a particular time to describe weather and notice patterns, including severe weather events.]

**K.ESS3.3** **Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*^** [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.][Assessment Boundary: Assessment focuses on the ability to choose solutions and communicate ways to reduce the impact(s) on land, water, and air, and other living things. Communication can be written, oral, drawings, modeling, or other ways that are comprehensible to others.]

*K.PS3* *Energy*

**K.PS3.1** **Make observations to determine the effect of sunlight on Earth's surface. ^** [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and

water] [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.]

**K.PS3.2** **Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.*^** [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.][Assessment Boundary: Assessment does not include information about how light travels or mechanisms of solar radiation.]

## Grade 1 Science Standards

### Physical Science

*1.PS4* *Waves and their Applications in Technologies for Information Transfer*

**1.PS4.3** **Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.^** [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [Assessment Boundary: Assessment does not include speed of light or the interaction of waves for the purpose of magnification.]

## Grade 2 Science Standards

### Earth & Space Science

*2.ESS1* *Earth's Place in the Universe*

**2.ESS1.1** **Use observations from several sources to provide evidence that Earth events can occur quickly or slowly.^** [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]

*2.ESS2* *Earth's Systems*

**2.ESS2.1** **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*^** [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.][Assessment Boundary: Assessment does not include explicit naming of hydrosphere, biosphere, atmosphere, and geosphere.]

# Grade 3 Science Standards

## Earth & Space Science

*3.ESS2* *Earth's Systems*

**3.ESS2.1** **Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.^** [Clarification Statement: Examples of data at this grade level could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs.]

*3.ESS3* *Earth and Human Activity*

**3.ESS3.1** **Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*^** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.][Assessment Boundary: Assessment does not include types (hurricane, tornado, tropical storm) of names of storms (Hurricane Andrew), jet streams, or El Nino or La Nina weather patterns.]

## Life Science

*3.LS4* *Biological Evolution: Unity and Diversity*

**3.LS4.3** **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.^** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.][Assessment Boundary: Assessment does not include multi-generational shifts in population traits due to natural selection.]

**3-LS4-4** **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.^** [Clarification Statement: Examples of environmental changes could include global climate change, changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change.]

# Grade 4 Science Standards

## Earth & Space Science

*4.ESS2* *Earth's Systems*

**4.ESS2.1** **Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.^** [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]

*4.ESS3* *Earth and Human Activity*

**4.ESS3.1** **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.^** [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non- renewable energy resources that cannot be replaced are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.][Assessment Boundary: Assessment does not include the distribution of resources around the planet as a result of geologic processes such as volcanic or tectonic activity. Does not include specific scientific information about how natural resources are used to generate energy (e.g. chemical process of burning coal to generate energy).]

## Physical Science

*4.PS3* *Energy*

**4.PS3.2** **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. ^** [Clarification Statement: Emphasis is on gathering evidence through observations to explain how energy is transferred and transformed within a system (e.g. relative rate an ice cube melts on different surfaces or obtain observational data for what affects how to change the amount of electricity a solar panel makes.][Assessment Boundary: Assessment does not include quantitative measurements of energy.]

# Grade 5 Science Standards

## Earth & Space Science

*5.ESS2* *Earth's Systems*

**5.ESS2.1** **Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.^** [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

*5.ESS3* *Earth and Human Activity*

**5.ESS3.1** **Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.^** [Clarification Statement: Emphasis is on gathering data to construct an explanation on how and why the selected activity protects the Earth's resources and environment for the identified region or community (e.g. agriculture practices, solar or wave energy).][Assessment Boundary: Assessment is limited to describing how communities use science ideas to protect Earth's resources and environment and does not focus on cause and effect of human impacts on the environment.]

## Life Science

*5.LS1* *From Molecules to Organisms: Structures and Processes*

**5.LS1.1** **Support an argument that plants get the materials they need for growth chiefly from air and water.^** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.][Assessment Boundary: Assessment does not include photosynthesis or the photosynthesis reaction equation.]

*5.LS2* *Ecosystems: Interactions, Energy, and Dynamics*

**5.LS2.1** **Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.^** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

## Physical Science

*5.PS1* *Matter and Its Interactions*

**5.PS1.1** **Develop a model to describe that matter is made of particles too small to be seen.^** [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]

# Middle School Earth & Space Science Standards

## Grade 6 Earth & Space Science

*6.ESS2* *Earth's Systems*

**6.ESS2.5** **Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. ^** [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]

**6.ESS2.6** **Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. ^** [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

*6.ESS3* *Earth and Human Activity*

**6.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).]

**6.ESS3.5†** **Ask clarifying questions based on evidence about the factors that have caused climate change over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

†The language in this performance expectation has changed from its original NGSS form. View original language here.

## Grade 7 Earth & Space Science

### *7.ESS3 Earth and Human Activity*

**7.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).]

**7.ESS3.2** **Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.** ^ [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

## Grade 8 Earth & Space Science

### *8.ESS3 Earth and Human Activity*

**8.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.]

## Middle School Engineering, Technology, and the Application of Science

### Grade 6-8 Engineering, Technology, and the Application of Science

*MS.ETS1* *Engineering Design*

**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. ^**

## Middle School Life Science Standards

### Grade 6 Life Science

*6.LS1* *From Molecules to Organisms: Structures and Processes*

**6.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.]

### Grade 7 Life Science

*7.LS1* *From Molecules to Organisms: Structures and Processes*

**7.LS1.6** **Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. ^** [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]

*7.LS2* *Ecosystems: Interactions, Energy, and Dynamics*

**7.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 the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

**7.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.]

**7.LS2.4** **Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** ^ [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

**7.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.]

## Middle School Physical Science Standards

### Grade 6 Physical Science

*6.PS3* *Energy*

**6.PS3.4** **Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.** ^ [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]

### Grade 7 Physical Science

*7.PS1* *Matter and Its Interactions*

**7.PS1.1** **Develop models to describe the atomic composition of simple molecules and extended structures.** ^ [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or

diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]

**7.PS1.3** **Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.** ^ [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]

**7.PS1.4.** **Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.** ^ [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]

## Grade 8 Physical Science

### *8.PS4* *Waves and Their Applications in Technologies for Information Transfer*

**8.PS4.2** **Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.** ^ [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]

# High School Earth & Space Science Standards

## Grade 9-12 Earth & Space Science

### *HS.ESS3* *Earth and Human Activity*

**HS.ESS3.1** **Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils

such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

**HS.ESS3.2** **Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*** [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

**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.]

**HS.ESS3.4** **Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

**HS.ESS3.5** **Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.** [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary:

Assessment is limited to one example of climate change and its associated impacts.]

**HS.ESS3.6** **Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

## High School Engineering, Technology, and the Application of Science

### Grade 9-12 Engineering, Technology, and the Application of Science

*HS.ETS1* *Engineering Design*

**HS.ETS1.1** **Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants**. **^**

**HS.ETS1.3** **Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.^**

**HS.ETS1.4** **Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.**

## High School Life Science

### Grade 9-12 Life Science

*HS.LS2* *Ecosystems: Interactions, Energy, and Dynamics*

**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 factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

**HS.LS2.2** **Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** ^ [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

**HS.LS2.4** **Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** ^ [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]

**HS.LS2.5** **Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.** ^ [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

**HS.LS2.6** **Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.** ^ [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and, extreme changes, such as volcanic eruption, or sea level rise due to climate change.]

### *HS.LS4 Biological Evolution: Unity and Diversity*

**HS.LS4.5** **Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.** ^ [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

# High School Physical Science

## Grade 9-12 Physical Science

*HS.PS4* *Waves and Their Applications in Technologies for Information Transfer*

**HS.PS4.4** **Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. ^** [Clarification Statement: Emphasis is on the idea that different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [Assessment Boundary: Assessment is limited to qualitative descriptions.]

^This performance expectation references a proximal connection to climate change and the disciplinary core ideas: Earth's Systems and Earth and Human Activity.