**HS-ESS3 Earth and Human Activity**

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<tr>
<td><strong>Analyzing and Interpreting Data</strong></td>
<td><strong>ESS2.D: Weather and Climate</strong></td>
<td><strong>Cause and Effect</strong></td>
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<td>Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.</td>
<td>• Current models predict that, though future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary to HS-ESS3-6)</td>
<td>• Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1)</td>
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<td>Using Mathematical and Computational Thinking</td>
<td><strong>ESS3.A: Natural Resources</strong></td>
<td><strong>Systems and System Models</strong></td>
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<td>Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, and developing computational tools for statistical analysis to represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.</td>
<td>• Resource availability has guided the development of human societies, and these tools and logical arguments allow for the exploration of possible future scenarios. (primary to HS-ESS3-3)</td>
<td>• When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-4)</td>
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<td><strong>Constructing Explanations and Designing Solutions</strong></td>
<td><strong>ESS3.B: Natural Hazards</strong></td>
<td><strong>Stability and Change</strong></td>
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<td>Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.</td>
<td>• Natural hazards and other geologic events have shaped the course of human history; they have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)</td>
<td>• Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3), (HS-ESS3-5)</td>
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<td><strong>Engaging in Argument from Evidence</strong></td>
<td><strong>ESS3.C: Human Impacts on Earth Systems</strong></td>
<td>**Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)</td>
<td>• Modern civilization depends on major technological systems. (HS-ESS3-1), (HS-ESS3-3)</td>
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<td>Engaging in argument from evidence in 9–12 builds on K–8 experiences</td>
<td>• The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)</td>
<td>• Engineers continuously modify these technological systems by applying scientific knowledge and engineering design principles to increase benefits while decreasing costs and risks. (HS-ESS3-2), (HS-ESS3-4)</td>
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*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.*

**Scientific Knowledge is Based on Empirical Evidence**

- Scientific knowledge is based on empirical evidence. (HS-ESS3-1)
- New technologies advance scientific knowledge. (HS-ESS3-2)
- Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS3-5)
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**Science Investigations Use a Variety of Methods**

- Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)
- New technologies advance scientific knowledge. (HS-ESS3-5)
- Science knowledge is based on empirical evidence. (HS-ESS3-5)

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**Connections to Nature of Science**

**Science is a Human Endeavor**

- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)
- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2)
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)

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

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**Connections to Other Disciplines**

**Articulation of Disciplines across Grade Bands**

**ELA/Literacy - RST.11-12.1**

Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-ESS3-5)

**RST.11-12.2**

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)

**RST.11-12.7**

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5)

**RST.11-12.8**

Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4)

**WHST.9-12.2**

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)

**Mathematics - MP.2**

Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

**MP.4**

Model with mathematics. (HS-ESS3-3), (HS-ESS3-6)

**HSN-Q.A.1**

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

**HSN-Q.A.2**

Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

**HSN-Q.A.3**

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)