**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.**

Further explanation: 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. Other examples include the impacts of climate change on Maine’s ski industry, fishing industry, maple sugar industry and on sea levels or droughts.

Constructing Explanations and Designing Solutions, Natural Resources, Natural Hazards, Cause and Effect

**HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.**

Further explanation: 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 (for farming, timber industry, blueberry and potato crops), 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.

Engaging in Argument from Evidence, Natural Resources, Developing Possible Solutions

**HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.**

Further explanation: 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. Consider the effects of urban sprawl and the loss of farmland.

Using Mathematics and Computational Thinking, Human Impacts on Earth Systems, Stability and Change

**HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.**

Further explanation: 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). Other examples include the use of propane-powered buses in Acadia (evaluate pros and cons).

Constructing Explanations and Designing Solutions, Developing Possible Solutions, Stability and Change

**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’s systems.**

Further explanation: 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).

Analyzing and Interpreting Data, Global Climate Change, Stability and Change

**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.**

Further explanation: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a 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. Use and interpret graphs and data of carbon dioxide levels in the Gulf of Maine for oysters and sea scallops. Consider the impacts of ocean acidification on shellfish.

Using Mathematics and Computational Thinking, Weather and Climate, Global Climate Change, Systems and System Models