**Unit 7: Stability and Change of Earth's Resources**

**Standard(s):**

**Standard ESS.4.1 Construct an explanation** for how the availability of natural resources, the occurrence of natural hazards, and changes in climate affect human activity. Examples of natural resources could include access to fresh water, clean air, or regions of fertile soils. Examples of factors that affect human activity could include that rising sea levels cause humans to move farther from the coast or that humans build railroads to transport mineral resources from one location to another. (ESS3.A, ESS3.B)

**Standard ESS.4.2 Use computational thinking** to explain the relationships between the sustainability of natural resources and biodiversity within Earth systems. Emphasize the importance of responsible stewardship of Earth's resources. Examples of factors related to sustainability could include costs of resource extraction, per-capita consumption, waste management, agricultural efficiency, or levels of conservation. Examples of natural resources could include minerals, water, or energy resources. (ESS3.A)

**Standard ESS.4.3** Evaluate **design solutions** for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales. *Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution*. Emphasize the conservation, recycling, and reuse of resources where possible and minimizing impact where it is not possible. Examples of large-scale solutions could include developing best practices for agricultural soil use or mining and production of conventional, unconventional, or renewable energy resources. Examples of small-scale solutions could include mulching lawn clippings or adding biomass to gardens. (ESS3.A, ETS1.A, ETS1.B, ETS1.C).

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
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| **Engaging in Argument from Evidence**<br>Students support their best explanations with lines of reasoning using evidence to defend their claims.<br><br>**Designing Solutions to Problems**<br>Students design solutions to problems using observations that are consistent with current evidence and scientific principles. | **ESS3.A Natural Resources**<br><br>**ESS3.B Natural Hazards** | **Stability and Change**<br>Students evaluate how and why a natural or constructed system can change or remain stable over time. |

**Big Ideas:**

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources, including air, water, soil, minerals, metals, energy, plants, and animals. Some of these resources are renewable over human lifetimes, and some are nonrenewable (mineral resources and fossil fuels) or irreplaceable if lost (extinct species).

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- All forms of resource extraction and land use have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors—for example, scientific modeling of the long-term environmental impacts of resource use can help identify potential problems and suggest desirable changes in the patterns of use.
- Much energy production today comes from nonrenewable sources, such as coal and oil. However, advances in related science and technology are reducing the cost of energy from renewable resources, such as sunlight, and some regulations are favoring their use. As a result, future energy supplies are likely to come from a much wider range of sources.
- Natural hazards and other geological events have shaped the course of human history, sometimes significantly altering the size of human populations or driving human migrations.

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**Preceding Grade Bands:**

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources.
- Minerals, fresh water, 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 geological processes.
- Renewable energy resources, and the technologies to exploit them, are being rapidly developed.
- Some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions. Others, such as earthquakes, occur suddenly and with no notice, and thus they are not yet predictable.

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**Target Grade Bands:**

- Resource availability has guided the development of human society.
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits. New technologies and regulations can change the balance of these factors.
- Natural hazards and other geological events have shaped the course of human history by destroying buildings and cities, eroding land, changing the course of rivers, and reducing the amount of arable land. These events have significantly altered the sizes of human populations and have driven human migrations.

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**Following Grade Bands:**

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**Proficiency Scale:**

| 4<br>Advanced | 3<br>Proficient | 2<br>Approaching Proficiency | 1<br>Beginning Proficiency |
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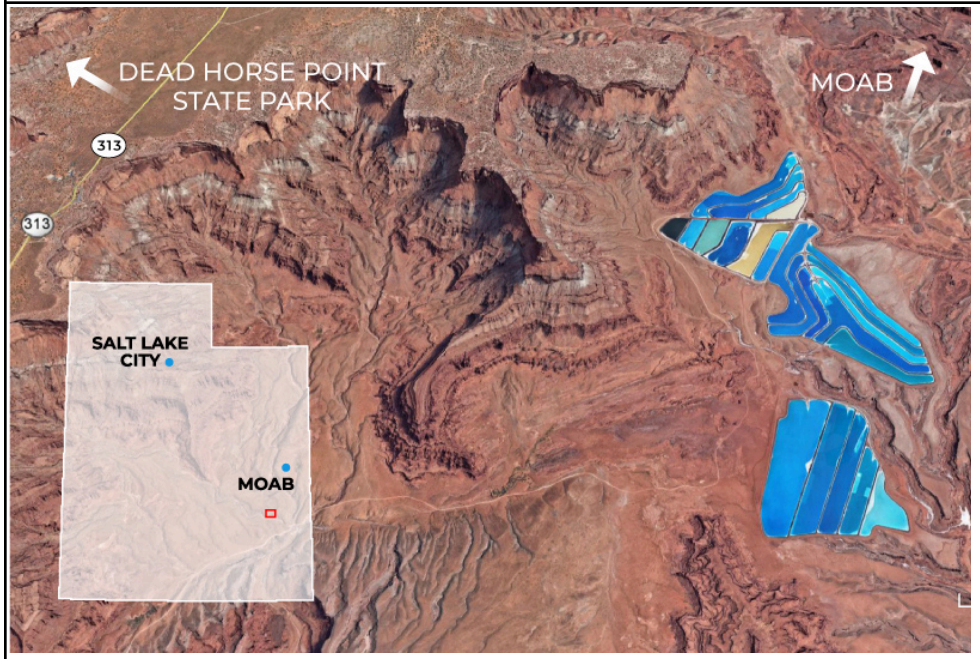
| **I can:**<br><br>Use current evidence and scientific principles to **construct an argument** for the risks and benefits of natural resource extraction.<br>AND<br>Use current evidence and scientific principles to **construct an argument** for how the availability of natural resources, the occurrence of natural hazards, and climate changes have caused human populations and migration patterns to remain stable or to change in the past and will continue to affect them in the future.<br>AND<br>**Design a solution** to a problem involving the management of a natural resource on Earth.<br>AND<br>Respectfully critique and revise the solution of others by providing supporting or refuting data. | **I can:**<br><br>Use current evidence and scientific principles to **construct an argument** for the risks and benefits of natural resource extraction.<br>AND<br>Use current evidence and scientific principles to **construct an argument** for how the availability of natural resources, the occurrence of natural hazards, and climate changes have caused human populations and migration patterns to remain stable or to change in the past and will continue to affect them in the future.<br>AND<br>use current evidence and scientific principles to **design a solution** to a problem involving the management of a natural resource on Earth and/or to enable long-distance space travel. | **I can:**<br><br>**Construct an argument** for the risks and/or benefits of natural resource extraction.<br>AND<br>**Construct an argument** for how the availability of natural resources, the occurrence of natural hazards, and/or climate changes have caused human populations and/or migration patterns to remain stable or to change.<br>AND<br>**Design a solution** to a problem involving the management of a natural resource on Earth and/or to enable long-distance space travel. | **I can:**<br><br>**Argue** that humans need natural resources.<br>AND<br>**Propose a solution** to a problem involving natural resources. |

**Anchoring Phenomenon: Potash Evaporation Ponds - Moab, Utah area.**



**Essential Question:**

What natural resources do humans depend on and what is the best way to manage them?

**Learning Goals:**

**Students will be able to:**

- **7A:** Identify several different types of natural resources and differentiate between renewable and nonrenewable resources. (Air, Water, Minerals, Soils, Plants, Animals & Energy)
- **7B:**Explain how natural resources, natural hazards, and changes in climate have affected human population and migration in the past and will continue in the future.
- **7C:** Explain the risks and benefits associated with natural resource extraction and use.
- **7D:** Design a solution for managing a natural resource.

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| **Engage** | Natural Resource Phenomenon Pictures<br>Natural Resource Phenomenon Document<br><br>1. What do you notice?<br>2. What do you wonder? What do you think these ponds are used for?<br>3. Draw an initial model that shows your thinking about what is happening in the pictures. What are they for and how does this relate to natural resources?<br>4. Students share models with one another and discuss the evidence they used to justify their models.<br>5. What questions do you have? | **Suggested for this activity:**<br><br>**Options:**<br>● Student answers to questions<br>● Student Discussions<br>● Exit Ticket |
| **Learning Goal 7A:** Identify several different types of natural resources and differentiate between renewable and nonrenewable resources. (Air, Water, Minerals, Soils, Plants, Animals & Energy) | | |
| **Explore** | The goal of these activities is for students to collect evidence they can use to answer the question: **What are the differences between renewable and nonrenewable resources?**<br><br>Mapping Utah Resources- Teacher Guide<br><br>Utah's Natural Resources - Student Instructions<br>Utah Natural Resources - Analysis - Student worksheet for own map/resource<br>Walkabout Sheet - Student worksheet when looking at other groups' work | **Suggested for this activity:**<br><br>**Options:**<br>● Student answers to questions<br>● Student Discussions<br>● Exit Ticket |
| **Explain** | 1. Discuss evidence from the investigation(s). **What are the differences between renewable and nonrenewable resources?**<br><br>2. Use one of the following resources. **What evidence do you find in the resource (text, video, etc.) that helps to explain the differences between renewable and nonrenewable resources?**<br><br>Mining in Utah | **Suggested for this activity:**<br><br>**Options:**<br>● Revised Models<br>● CER Paragraph<br>● Student Discussions<br>● Demonstrate a skill<br>● Student answers to Questions<br>● Quiz |

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| | Potash Evaporation Ponds<br>Potash Evaporation Ponds - video worksheet<br><br>Ore to More<br><br>Utah's Natural Resources Research<br><br>**Experience Rio Tinto Kennecott Tour in Virtual Reality.**<br><br>3. CER summary that answers the question: **What are the differences between renewable and nonrenewable resources?**<br><br>4. Revisit student questions from engage<br>a. What questions did we answer?<br>b. Do we have any new questions?<br><br>5. Revisit phenomena and revise initial models based on evidence gathered and scientific principles learned. | ● Exit Tickets |

| | Learning Opportunities | Formative Assessments |
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| **Learning Goal 7B:** Explain how natural resources, natural hazards, and changes in climate have affected human population and migration in the past and will continue in the future. | | |
| **Explore** | The goal of these activities is for students to collect evidence they can use to answer the question: **How do natural resources affect human populations and migration?**<br><br>Global Patterns of Human Migration<br><br>Global Human Journey | **Suggested for this activity:**<br><br>**Options:**<br>● Student answers to questions<br>● Student Discussions<br>● Exit Ticket |
| **Explain** | 1. Discuss evidence from the investigation(s). **How do natural resources affect human populations and migration?** | **Suggested for this activity:** |

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| | 2. Use one of the following resources. **What evidence do you find in the resource (text, video, etc.) that helps to explain how natural resources affect human populations and migration?**<br><br>Causes and effects of human migration (article)<br><br>Mapping Human Migration \| Tales & Trails- Video<br><br>Feedback Loop<br><br>3. CER summary that answers the question: **How do natural resources affect human populations and migration?**<br><br>4. Revisit student questions from engage<br>c. What questions did we answer?<br>d. Do we have any new questions?<br><br>5. Revisit phenomena and revise initial models based on evidence gathered and scientific principles learned. | **Options:**<br>● Revised Models<br>● CER Paragraph<br>● Student Discussions<br>● Demonstrate a skill<br>● Student answers to Questions<br>● Quiz<br>● Exit Tickets |
| **Extension** | Settlers of Catan.docx<br>Water - The Most Precious Natural Resource | |

| **Learning Goal 7C:** Explain the risks and benefits associated with natural resource extraction. | | |
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| **Explore** | The goal of these activities is for students to collect evidence they can use to answer the question: **What are the risks and benefits of natural resource extraction?**<br><br>Cookie Mining \| Earth Science Week<br><br>Kennecott manages environmental impacts through concurrent reclamation | **Suggested for this activity:**<br><br>**Options:**<br>● Student answers to questions<br>● Student Discussions<br>● Exit Ticket |
| **Explain** | 1. Discuss evidence from the investigation(s). **What are the risks and benefits of natural resource extraction?**<br><br>2. Use one of the following resources. **What evidence do you find in the resource (text, video, etc.) that helps to explain the risks and benefits of natural resource extraction?**<br><br>Reclaiming the environment from a century of mining: A status report on the Last Century Cleanup Program<br>**teacher resource**<br><br>Wolf Restoration - Yellowstone National Park (US National Park Service)<br>**teacher resource**<br><br>Utah Resource Research Handout<br><br>3. CER summary that answers the question: **What are the risks and benefits of natural resource extraction?**<br><br>4. Revisit student questions from engage<br>e. What questions did we answer?<br>f. Do we have any new questions? | **Suggested for this activity:**<br><br>**Options:**<br>● Revised Models<br>● CER Paragraph<br>● Student Discussions<br>● Demonstrate a skill<br>● Student answers to Questions<br>● Quiz<br>● Exit Tickets |

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| | 5. Revisit phenomena and revise initial models based on evidence gathered and scientific principles learned. | |

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| **Learning Goal 7D:** Design a solution for managing a natural resource. | | |
| **Explore** | The goal of these activities is for students to collect evidence they can use to answer the question: **How should we manage our natural resources?**<br><br>Global Resources Outlook Intro Video<br><br>Teacher-led discussion about what resources are most important to humans and why. Are the resources more valuable than the potential damage to the planet? Should humans be responsible for managing these resources to protect the planet for the future?<br><br>Model Earth - Allocating Water Resources | **Suggested for this activity:**<br><br>**Options:**<br>● Revised Models<br>● CER Paragraph<br>● Student Discussions<br>● Demonstrate a skill<br>● Student answers to Questions<br>● Quiz<br>● Exit Tickets |
| **Explain** | 1. Discuss evidence from the investigation(s). **How should we manage our natural resources?**<br><br>2. Use one of the following resources. **What evidence do you find in the resource (text, video, etc.) that helps to explain how we should manage our natural resources?**<br><br>Global Outlook Findings<br><br>3. CER summary that answers the question: **How should we manage our natural resources?**<br><br>4. Revisit student questions from engage<br>g. What questions did we answer?<br>h. Do we have any new questions? | |

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| | 5. Revisit phenomena and revise initial models based on evidence gathered and scientific principles learned. | |

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| **Elaborate** | Natural Resource Management Paper Outline<br>Natural Resource Management - Teacher | |
| **Evaluate** | Please complete this **SURVEY** to request access to the summative assessments for the JSD High School Science Exemplar Units. | |