MIDDLE SCHOOL EARTH SCIENCE: HUMAN IMPACT

Standards Bundle
Standards are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* (SEP: 6 ; DCI: ESS3.C; CCC: Cause/Effect, Technology) [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).]

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. (SEP: 7; DCI: ESS3.C; CCC: Cause/Effect, Technology, Nature Science/Consequence-Actions) [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.]

Content Overview
This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.

In general, an increase in population will cause an increase in the use of natural resources. For example, as a city grows in population the humans may clear areas of natural vegetation or use forest products for homes. Population data can be used to predict future consumption of natural resources. Still other investigations can show how the Earth's systems are impacted by a decrease in natural resources in an area. Patterns can be seen and comparisons can be made between the areas prior to and after the decrease in the described resource. Evidence gathered is used to create an argument for ways in which humans can control or limit the use of many natural resources.

In addition, human activities have had major effects on Earth's systems. Humans are recognizing how their individual contributions to this impact could be small or possibly far-reaching. By recognizing the cause and effect relationships between their own lives and their environment, humans are designing ways to reduce that impact. Analysis of various types of energy production can be done to minimize their outcome on the Earth. Ways in which to monitor community environments and evaluating local manufacturing processes that could disturb those environment are being investigated.

Phenomena

Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.

- Many of the lakes in the upper midwest states get very green by the end of the summer.
- No-till farming is promoted by the Natural Resource Conservation Service.
- Native American traditional farming and land use techniques.
- The Great Pacific Garbage Patch.
- Mutagated frogs.
- The flow of water over the Earth's surface has changed after the removal of the trees in an area.
- Chinese law limits the number of children that can be born to parents.

Storyline

This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for student learning, including both rationale and context for the bundle.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions: ● Apply scientific principles to design an object, tool, process or system. **Engaging in Argument from Evidence --** ● Construct 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.	**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. **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.	**Cause and Effect** ● Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. ● Cause and effect relationships may be used to predict phenomena in natural or designed systems.

The human population is continuing to increase. As the per-capita consumption of natural resources increases so do the negative impacts on the Earth's systems. Evidence is analyzed to show the cause-and-effect relationships between population growth, the availability of resources, and Earth's systems. For example, the use of a natural resource, such as water, might be investigated to draw relationships between human consumption and the effect of that reduction in water on the biosphere. Also, population data can be compared to the use of land resources or consumption of minerals and fossils fuels through mining to present evidence of cause-and-effect relationships between humans and their environment.

There are some specific and some general cause and effect relationships that help explain human impacts on the environment. Scientists have developed and used models as well as studied and analyzed data to both predict and investigate these relationships. Scientists are constantly comparing both natural and human-induced changes to the Earth. An example might be the investigation of changes to a river ecosystem because of the natural processes of erosion and deposition or the building of beaver dams, compared to the human impact of building a bridge or a dam in a river. Data from certain populations of organisms have been analyzed for example to determine the human impact of harvesting that organism for human use.

Formative Assessment

Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.

SEP Constructing Explanations and Designing Solutions
- Give a description of one way in which the use of water by humans has affected the natural environment in an area.
- Give a specific example of how pollution from humans has impacted the environment in an area.
- Design a method for monitoring and minimizing the amount of garbage produced by your school building.

SEP Engaging in Argument from Evidence
- Use evidence from a case study to construct an argument for the use of crop-rotation farming to prevent the loss of land resources and the overuse of fertilizers on crops.
- Give evidence from the lab activity to support your claim for whether clear-cutting of trees in the Black Hills is a negative or positive human impact on the environment.

CCC Cause and Effect
- How do you think humans are altering land and soil on Earth?
- What actions can you take to minimize your impact on Earth's systems?
- How did the introduction of farming and the huge amount of land conversion for that affect the Earth's surface in the midwest states?
- How did the construction of levees on the Mississippi River affect the course of that river?
- Use data from the custodians in the school district to design a method for decreasing the amount of trash output from the school and increase the amount of recyclables.

Performance Outcomes

These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.

- **Use evidence** to *examine* how the growth of human populations affects Earth's systems.
- **Analyze** the *cause-and-effect relationships* between *population growth, the availability of resources (such as water or natural habitats, etc..), and Earth's systems.*

- **Use evidence** to evaluate the *cause-and-effect relationships* between population growth and the human use of plant and animal resources.
- **Develop and use a model** and identify *cause-and-effect relationships* that help explain human impacts on Earth's systems.
- **Construct an explanation** to *distinguish* between natural and human-induced changes to Earth's environments.
- **Develop and use a model** of a dam on a river and **monitor** the *impact* on the surrounding geosphere.
- **Design a method to minimize** the human *impact* on a local nature park.
- **Construct an argument** that *supports* the claim that as the human population grows, so does its effect on the environment.
- **Analyze data** and **construct an argument** to *determine* that an increase in per-capita consumption of natural resources can result in negative impacts on Earth.