Sample Science Learning Plan

**Big Idea/Topic**

Human Impact on Natural Resources

**Standard Alignment**

**SEV4. Obtain, evaluate, and communicate information to analyze human impact on natural resources.**

a. Construct and revise a claim based on evidence on the effects of human activities on natural resources. (Human Activities: Agriculture, Forestry, Ranching, Mining, Urbanization, Fishing, Water use, Pollution, Desalination, Wastewater treatment. Natural Resources: Land, Water, Air, Organisms.)

b. Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

c. Construct an argument to evaluate how human population growth affects food demand and food supply (GMOs, monocultures, desertification, Green Revolution).

**Connection to Other Content Areas:**

**ELAGSE11-12RI7** Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

**ELAGSE11-12W1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.

**ELAGSE11-12W7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
Instructional Design

Engage:
Phenomena: How do humans impact planet Earth?

So, one of the things that can impact natural resources is human populations. Have students analyze and evaluate data about human population on Earth. Data about human population can be found in multiple places but one example is data found here.

Students should focus on:
What has happened to human population over time?
What countries have large populations?
How is the population today different from the year 1700?
How are human populations spread out around the world?
What innovations do you think have allowed humans to grow their population at such a rate?

Discuss with the class their observations and inferences about the data. Be sure to help students see that agriculture is the innovation that has given people the ability to settle and grow the population at such a fast pace. Then ask students to brainstorm a list of things that humans need to survive on Earth. This list could include food, water, shelter, and many other things. Tell students that you are going to start by looking at food supply and demand.

Have students make a prediction about how food demand has changed with the increase in human population.

Then have students obtain information about how population size impacts food demand. Have students find information about plans or options to meet the food demands. Students include GMOs, Monocultures, desertification, and the green revolution in their research. Finally, students should construct an argument that evaluates how human population growth affects food demand and food supply.

Students should share their arguments with classmates, get feedback and revise arguments.

Now, ask students to make predictions about how Population growth is impacting the Earth. Have students put their predictions aside for the rest of the lesson. We will return to this prediction a little later.

Unplugged: Provide students with the data in printed format. Provide students with articles and images to allow the students to obtain information. Provide students with a way to add their thoughts to the class discussion via phone, sending the thoughts or ideas to the teacher to add to the class discussion or any other way that allow students to participate in a way that conforms to district guidelines. Students can share ideas and get feedback from other members of their household. Be sure to provide students with clear goals and expectations for the lesson.

Explore:
Next explore some different human impacts. Start with a human impact that we see in this state every summer.
Start by having students evaluate this image. Students should ask questions and make observations. Some ideas to help with this is to ask students: what do you notice? What do you think? What do you wonder? This chart could be used to assist students in organizing their thoughts.

Then have a class discussion about what students have observed and what questions they have. Some expected observations:
- I have seen this before
- The air is not clear
- It is hard to see the buildings

Some questions that students might have:
- What causes this?
- Why is the air opaque?
- What is in the air?
- Why have I seen it more in the summer?

Have students go outside and observe the air in their environment. Does it look the same as the image or different? Why?

Discuss with the class if any of the students have seen smog. Allow students to obtain information about smog and how it affects natural resources in the environment.

Students should then construct a claim about what causes smog, where it collects most frequently and how it impacts the environment.

Students could extend their claim by describing how smog impacts humans. Have students look for historical data about air quality. How does air quality relate to smog?

Students should share their claims with the class and discuss why smog is most often seen over cities.

Students should then revise their claims as needed.

Unplugged: Provide students with an image to annotate and the chart to help students organize their thoughts. Have students discuss their ideas and thoughts with a member of their household and send things to share with the class in a way that conforms to district policy. Have students go outside and make observations. Provide students with resources to obtain information about smog. Consider providing students with rubrics and a clear list of expectations for their claim. Students can ask members of their household for feedback.

Explain:
Students should brainstorm a list of human impacts on the environment. This list should include but is not limited to the following:
- Agriculture
- Forestry
- Ranching
- Mining
• Fishing
• Desalination
• Wastewater treatment

Students should then choose a human impact that they are interested in from the list that the class brainstormed to work with on the following activity. Students should develop some questions about the human impact that they chose. The questions should be things that can help them obtain information about the human impact.

Then, students should obtain information about the human impact that they chose. Students should focus on finding information about what causes the impact, where it affects the environment the most and how it impacts natural resources in those areas.

Students should then construct a claim that describes the impact, the cause of the impact and the effects on natural resources.

Then students should share their claim and supporting evidence about the human impact that they chose. Students could accomplish this communication part in many ways both synchronous, such as a discussion, or asynchronous, in an online discussion forum within a learning platform.

Unplugged: The teacher could consider providing students with a list of human impacts or questions to help students identify human impacts. The teacher should provide students with resources to obtain information about different human impacts. The teacher should consider providing students with a rubric and a clear set of expectations for the claim. Students can share with members of their household to get feedback and revise prior to sharing with the teacher and class.

Extend:
Students should evaluate the images at the following website. These images show temperature and vegetation in New York City from NASA. Students should then discuss their ideas about the images. Things that students should be considering when looking at images are the following:
• What is occurring in the area?
• What all exists within the area?
• These images of New York City show different things. What does each image show?
• What do these two images have in common?
• What differences do you notice in the images?
• What causes the changes in temperature?
• What causes the changes in vegetation?
• What are cities constructed of?

Be sure that students understand that cities contain a lot of concrete and it retains more heat from the sun than vegetation.

Students should then obtain information about heat islands. Students should look for information about what causes heat islands and how this is an example of human impact.

Students should then develop a claim about how heat islands impact natural resources in the areas that they occur in. Students should be sure to include evidence to support their claim.
Students should then share their claim and discuss with classmates. As part of the discussion students should determine what other human impacts might occur in the same areas as heat islands. Some examples might be:

- Pollution
- Urbanization
- Water use changes and availability

Then students should evaluate the following scenarios. Students should determine how these scenarios impact the natural resources in the area.

Finally, students should return to their prediction about human population growth and its effect on the Earth. Was your prediction correct, based on the information you have found in this lesson? Why or why not?

**Unplugged:** The teacher should provide students with images to evaluate. The teacher can provide students with a graphic organizer and questions to help students evaluate the images. The teacher should provide students with resources to obtain information. Then the teacher should provide students with the scenarios that they should evaluate.

**Evaluate:**
Next, students should choose one of the human impacts that we have discussed to design a solution for.

Then students should share their solution and the reasoning for their solution with a classmate. Students should then take the feedback and revise as needed.

Then the student should communicate their solution to the class. Have the students provide feedback and allow students to revise their solutions again.

**Unplugged:** The teacher should consider providing students with a rubric and a set of clear expectations for the solution that students should design. The teacher should encourage students to share their solution with a member of their household to get feedback.

**Lesson Goals Checklist:**

**Standards:**

**SEV4.** Obtain, evaluate, and communicate information to analyze human impact on natural resources.

* a. Construct and revise a claim based on evidence on the effects of human activities on natural resources. (Human Activities: Agriculture, Forestry, Ranching, Mining, Urbanization, Fishing, Water use, Pollution, Desalination, Wastewater treatment. Natural Resources: Land, Water, Air, Organisms.)
* b. Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.
* c. Construct an argument to evaluate how human population growth affects food demand and food supply (GMOs, monocultures, desertification, Green Revolution).
Checklist:
- Construct a claim containing evidence that describes the effects of human activities on natural resources.
- Design, evaluate and refine a solution to reduce human impact on the environment.
- Construct an argument to evaluate how human population growth affects food supply and demand.

**Evidence of Student Success**

Student mastery is assessed throughout this unit using formative and summative components. Student discussion, explanations and products should reflect the understanding indicated in the Evaluate section above. Each activity in the segment functions as an assessment opportunity as well to plan targeted supports or provide extension items. Formative options using the self-evaluation checklist and the activities at various points during the segment.

**Student Learning Supports**

The vision for science education in the state of Georgia is as follows: All Students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.

The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions.

This lesson includes the disciplinary core ideas, science and engineering practices and crosscutting concepts to actively engage students in exploring science concepts with real world topics. As part of the vision we must support the inclusion of all students in science learning. Some general ideas to consider when designing things to support students that struggle are as follows:

- Be sure that students can access the information that you they are learning. Make sure that you can answer the following questions:
  - Do students have what they need to get the information? This is about them having the book or internet access to get to the information.
  - Once students obtain the information, are students able to determine what information is important? This is about the students having materials on the appropriate grade level and that is in a format that students can understand.
  - Is the material presented in multiple ways that allows all students to interact with information in a way that works for them? Such as video, audio, and articles.
  - Consider read aloud as a potential option for students that have reading deficits as an option to assist students in accessing the material. This could be done using video, read aloud or via phone.
- Students may need ideas about where to find information. Providing students with information about what a reliable source is and even where to find reliable sources may be beneficial for students.
• Some students may find it difficult to complete the entire lesson workload. Some students may benefit from a reduced workload (note: this should be used only when absolutely necessary). Be sure that the information that is removed will not negatively impact the student’s understanding of the disciplinary core idea.
• Consider how students show their knowledge. Students need multiple ways and opportunities to show their knowledge. Things to consider:
  ○ Recording video or audio
  ○ Drawing
  ○ Writing
  ○ Typed
  ○ Verbal

• Provide students with a way to ask questions in a forum that does not cause anxiety. Frequently students do not want to ask questions in front of their peers because they are afraid of what their peers may think of them. So, be sure to provide students a way to ask questions that is private or anonymous.
• Consider materials that students need to complete the assignments.
  ○ Do students have needed materials?
  ○ What are some alternative materials that students may have available to them?
• Have a clear and consistent set of guidelines for providing consistent feedback to all students.
• Utilize graphic organizers such as those from the Wonderofscience.com
• Use high leverage and evidence-based practices to reach all students.

Some ideas for supporting this lesson specifically would be to make sure to consider the following:

• Consider providing students with guiding questions to help students evaluate data.
• The teacher should have clear and consistent guidelines for sharing in class.
• Consider sentence frames to get students started on their claims.
• Consider curating resources on the different human impacts that students can use to obtain information.
• The teacher should consider providing students with rubrics for the assignments. This will help students understand the expectations.
• The teacher should consider providing students with ways to share anonymously.
• The teacher should consider providing students with graphic organizers.
• The teacher should consider providing students with guiding questions and rubrics to help students with designing a solution.

Engaging Families
Additional resources to support this segment can be found at GPB: Georgia Home Classroom.
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Scenarios

1. A farmer has several thousand acres that he uses to raise cattle. The cattle frequently spend their day on the same 100 acres. The cattle graze all day, day after day. What impact does this have on the environment? What type of human impact would this be? Why?

2. A paper mill contracts with a local individual to plant and harvest the pine trees on their land. The land is cleared, and pine trees are planted on the land. At various intervals, the trees are harvested, and new trees are planted. What impacts on the environment would this have? What type of human impact would this be? Why?

3. In a country in South America a company has found diamonds under the rainforest. The company has deforested the area and begun to mine the diamonds. What impacts on the environment would this have? What type of human impact would this be? Why?

4. A farmer uses nitrogen fertilizer on his corn fields. This helps the corn grow year after year in the same soil. However, when it rains the fertilizer runs off the field and into the local waterways. What impacts on the environment would this have? What type of human impact would this be? Why?

5. A fisherman and the ship’s crew have spent the last 15 years pulling nets and nets of fish out of the ocean in the same location. Lately, the fisherman has noticed that their catches are getting smaller and smaller because the area has been overfished. What impacts on the environment would this have? What type of human impact is this? Why?