This lesson uses the 5E model for instruction to help students make the connection between practices used to produce the foods they eat and the impacts they have on ecosystems both locally and globally.

### Student Science Performance

<table>
<thead>
<tr>
<th>Grade: 7th Grade Life Science</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topic:</strong> Stability and Change in Living Systems</td>
<td>What food would you choose?</td>
</tr>
</tbody>
</table>

#### Performance Expectation for GSE:

**S7L3. Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.**

- c. Ask questions to gather and synthesize information about the ways humans influence the inheritance of desired traits in organisms through selective breeding.
  
  *(Clarification statement: The element specifically addresses artificial selection and the ways in which it is fundamentally different from natural selection.)*

**S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.**

- c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.
- d. Ask questions to gather and synthesize information from multiple sources to differentiate between Earth’s major terrestrial biomes (i.e., tropical rainforest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e., freshwater, estuaries, and marine).
  
  *(Clarification statement: Emphasis is on the factors that influence patterns across biomes such as the climate, availability of food and water, and location.)*

#### Performance Expectations for Instruction:

**Lesson Note:**
The intent of this lesson is to use food production practices as an anchor for students to examine impacts on the ecosystems. The scope of the lesson includes all levels of the ecosystem (organism to biome) from both an industrial and sustainable perspective. Students will be able to determine the impacts of both practices on diversity in ecosystems, disease, resource availability (soil erosion, water pollution, habitat loss, etc). They will also incorporate selective breeding in their research since agriculture is a great application for it. The *elaborate* activity will allow students to examine impacts of agricultural practices globally which incorporates biome.

**Helpful background information for students:**
Students should be knowledgeable about:
- Selective breeding and how it differs from natural selection
- Levels of organization in ecosystems
- Differences in biotic and abiotic factors
- Interdependence of organisms in ecosystems
- Symbiotic relationships
- Aquatic and terrestrial biomes

*NOTE:* The student does not have to know all of these concepts fully in order to successfully complete the lesson but the lesson builds on them.

**Engage**

*Class Performance (Asking Questions)*
1. Students will generate questions to gather information about industrial food production practices and food production practices of local farmers in order to help the cafeteria manager with the grant.

*Group Performance*

2. Students will determine a food provided by a major food vendor for their cafeteria and conduct research to determine the impacts of the agricultural practices (human activity) used to produce the food on the ecosystem considering resource availability, biodiversity, and disease on organisms, populations, and the community.

*Individual Performance (Analyze and Interpreting Data)*

3. Students will analyze the data they collected about human activity (agricultural practices) on the ecosystem. They will report their findings and conclusions about the plan for the cafeteria to change its practices to help the environment. Students will answer questions posed by the class regarding their research and revise their report as needed.

*Exploring*

*Group Performance (Obtain, Evaluate, and Communicating Information)*

1. Students will use the sign developed by the cafeteria manager to determine the impacts of those practices on the environment. They will either research impacts of conventional practices, sustainable practices, or both. This depends on how the teacher divides the class.

2. Students share their findings around the class on the signs teachers post.

*Class Performance*

3. The class will evaluate the findings that students posted on the signs and point out compelling points from each of the signs in their evaluations.

*Group Performance (Developing Models)*

4. The group will take the information from their research and the class data to develop a second version of the cafeteria sign that better communicates how the practices in the original sign will help the environment. Student models should be presented to an audience. School cafeteria personnel would be great for this task.

*Explaining*

*Individual Performance (Using Mathematical and Computational Thinking)*

1. Students will examine how their personal food choices impact the ecosystem by making a record of the foods that they have eaten for the week. *Alternative:* The student may use a record from the teacher if they are not comfortable with sharing their meal. They will evaluate their meal based on the research they have conducted previously and develop a method for quantitatively scoring the sustainability of their meal.

*Individual Performance (Developing Models)*

2. Students will develop a model that communicates how their food choices (or the teacher’s) impact the ecosystem. They will construct an explanation supported by evidence of how their food choices could change to better support the environment if they all the resources they needed to do so.

*Elaborating*

*Class Performance (Asking Questions)*

1. Generate questions relating the new phenomena that allows students to look at the global connections of the food they eat.

*Group Performance (Obtaining Information)*
2. Students will consider the questions generated by the class and use foreign trade data from the Census Bureau to obtain information about foods that imported to America from foreign countries. Each member in the group should conduct the research individually and share their findings with all other group members.

3. Students will analyze the data from their research and discuss trends in their findings.

*Individual Performance (Obtaining Information and Engaging in Argumentation from Evidence)*

4. Students will identify at least three foods that are imported from another country to focus on for the argument they will develop. They will compare the biomes of the foreign countries with their local biome and conduct further research to determine the impacts of the food production practices of the foreign countries on their ecosystem and look for trends in the biomes by comparing impacts on ecosystems in their local biome to the foreign biome(s).

5. Students will use the evidence from their research to develop an argument to support their claim for the question “Which food would you choose?” They will consider their research about the agricultural practices and sustainable efforts of the United States and other global agencies to provide evidence to support their claim.

6. Students will revise their arguments based on student feedback and submit a final written product.

**Additional notes on student supports**

<table>
<thead>
<tr>
<th>Materials (linked within instructional segment):</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engage</strong></td>
</tr>
<tr>
<td>● Food choices from cafeteria (Breakfast)</td>
</tr>
<tr>
<td>● Food choices from the cafeteria (Lunch)</td>
</tr>
<tr>
<td>● Student Research Organizer 1</td>
</tr>
<tr>
<td>● Data Examples</td>
</tr>
<tr>
<td>● Analyzing and Interpreting Data Rubric</td>
</tr>
<tr>
<td><strong>Explore</strong></td>
</tr>
<tr>
<td>● Food Poster</td>
</tr>
<tr>
<td>● Student Research Organizer 2</td>
</tr>
<tr>
<td>● Rubric for sign</td>
</tr>
<tr>
<td><strong>Explain</strong></td>
</tr>
<tr>
<td>● Artifact for meal record (developed by teacher)</td>
</tr>
<tr>
<td>● Rubric for student model</td>
</tr>
<tr>
<td><strong>Elaborate</strong></td>
</tr>
<tr>
<td>● Rubric for argument (free versions available on the internet)</td>
</tr>
</tbody>
</table>

*Students will continuously obtain, evaluate, and communicate information. This is not a linear process. Students will communicate through writing and discussions to allow for formative assessment. This benefits the teacher, student, and whole group to guide instruction to clarify misconceptions or extend content.*

<table>
<thead>
<tr>
<th><strong>Engaging Learners</strong></th>
<th><strong>Phenomenon</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>S7L4. <strong>Obtain, evaluate,</strong></td>
<td>The meals we choose impact ecosystems.</td>
</tr>
</tbody>
</table>
and communicate information to examine the interdependence of organisms with one another and their environments.

c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.

Driving question- What is the connection between food and the environment?

Obtaining

The school cafeteria manager is talking to your class about an exciting opportunity to link local farmers to the foods choices offered in the cafeteria. The cafeteria manager is excited about the opportunity to provide fresh and nutritious school food options and make a better impact on the environment at the same time. The manager states that he/she is applying for a federal food nutrition grant funded by the United States Department of Agriculture called Farm to School and wants to be able to use local food vendors (farmers) that produce environmental friendly food. A sign has been created advertising the practices that will be displayed in the cafeteria. The school manager wants your class to help with the grant by providing evidence of how improved agricultural practices can help ecosystems. When the school manager leaves the class, a student asks the teacher, “do my food choices really affect the environment?”

Class discussion: Generate questions to obtain information about the agriculture practices used to produce the current food choices in the cafeteria and practices of local farmers.

- What are sustainable food choices?
- What are the benefits of using local farm providers over conventional methods?
- How does local farm-produced food impact the environment? Industrially produced food?
- What are alternative food production practices vs. conventional food production practices?
- How do your food choices impact the stability of ecosystems?
- Are the foods processed or fresh from current vendors?
- What are the environmental impacts of processed food? Fresh foods?

Teacher Note: Allow students to conduct research to the questions they generate in the library or using devices if they have them. You may also encourage students to interview local farmers.

Suggested Guest Speakers and Resources:

- School Nutrition Manager- to discuss food vendors and how they are chosen
- Georgia School Nutrition- www.georgiaschoolnutrition.com (a list of industry partners can be found here)
- Department of Natural Resources
- Local Farmers
- Food Industry Operators
- USDA- www.usda.gov
- Georgia Department of Agriculture- http://www.agr.georgia.gov/
Georgia Farm Bureau- http://www.gfb.org/

Suggested Google search topics
- Environmental impacts of farming
- Agriculture and ecosystems
- Sustainable agriculture
- Sustainable agricultural practices
- Industrial agriculture and ecosystems
- National agricultural practices

**Evaluating**

**Group Task:**

Students will first choose a particular food provided by food vendors for the cafeteria and use the questions generated by the class to conduct research about the agricultural practices (by vendors and farmers) used to produce the food (See the pictures in Food Choices from Cafeteria links above). Students should consider the impact on resources, disease, and human activity in each level of organization from the organism to the ecosystem. Students should then use the data from their research to draw a conclusion about how the food production practices impact the ecosystem. **Student Research Organizer**

**Teacher Note:**

- It may be helpful to split students into groups and have them focus their research to one or two food choices. They can use the vendor list on the GA School Nutrition site to find a vendor and a specific crop. Once they have their crop, they will conduct research on the impacts listed in the student graphic organizer [here](#).
- Students will use the data they collect to draw a conclusion about the food production practices for the grant application. Help students to determine relationships in the data they collect.
- Students should provide data that is relevant to their conclusion and analyze that data thoroughly, identifying linear (data is a straight line which indicates a direct relationship) and nonlinear relationships (graph of data is not a straight line which indicates a more complex relationship), temporal (time) and spatial (space) relationships, and provide evidence for the phenomenon.

**Communicating**

**Individual Student Task:**

Students should use their analysis and interpretation of the data to draw a conclusion about the cafeteria’s decision to change their practices in order to reduce its impact on the environment. Their report should include specific data points (identified in the Student Research Organizer) that help them to
determine the impact of the practices for the grant. The data analysis and interpretation should identify linear (graph will be a straight line) and/or nonlinear (graph will not look like a line and indicates a more complex relationship between variables) relationships, temporal (time) and spatial relationships (space), and provide evidence for the phenomenon. See examples below. Students will present their findings to the class and revise their report if necessary.

**Data Examples**

Suggested data sources include:

- World Wildlife Federation- [https://wwf.panda.org/](https://wwf.panda.org/)
- USDA Ag and Food Statistics- [USDA Agriculture and Food Statistics](https://www.ers.usda.gov) (p. 9-15; 20-22)

**Teacher Note:** Students will only analyze data that is available about the food production practices. The USDA has reports available [here](https://www.ers.usda.gov). Land and Natural Resources starting on p.9 and Food Consumption and Availability p. 20 will be most helpful for this section. Students will notice nonlinear data and spatial data. They should notice trends in land usage over time, resources for land conservation, farm productivity (what could the impact on ecosystems to maintain high productivity rates?), specific crops. This information should give students further ideas or questions to research if needed. Remember that they want to ultimately present their conclusion on the impacts of the food production practices to the ecosystem. The data should help students to narrow down their research and go deeper based on questions they generate. Advise them to look at the citations below the graphs and possible resources. Determine the format of the report based on the student groups, individual students or needs of the class. Instruct students to prepare the report to explain their conclusion to the class. Allow time for the class to pose questions and answers after the presentations. Allow students to revise their reports if needed.

**Sample Rubric**- Analyzing and Interpreting Data Rubric

<table>
<thead>
<tr>
<th>Exploring</th>
<th>Obtaining</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S7L3. Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.</strong></td>
<td><strong>School Cafeteria Sign</strong></td>
</tr>
<tr>
<td>c. Ask questions to gather and synthesize information</td>
<td>Students have now had the opportunity to explore impacts of the food production practices of the industrial foods provided to the cafeteria. They will now use the practices identified on the sign the manager developed to advertise the grant to determine if they are sustainable to the ecosystem.</td>
</tr>
<tr>
<td></td>
<td><strong>Group Task:</strong></td>
</tr>
<tr>
<td></td>
<td>Use the sign developed by the cafeteria manager in order to determine the impacts on the ecosystem. Students will conduct research to determine the impacts of the conventional practice and/or the sustainable practice on the</td>
</tr>
</tbody>
</table>
about the ways humans influence the inheritance of desired traits in organisms through selective breeding.

(Clarification statement: The element specifically addresses artificial selection and the ways in which it is fundamentally different from natural selection.)

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.

c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.

Driving Questions:

What is factory farming and what foods are produced this way?

What are the land conservation practices and efforts in the United States?

What is the impact of overfishing on marine ecosystems?

What regions of the world are known for overfishing?

Research should focus on:

Selective breeding practices in order to produce the food

Impact of agricultural practices on resources in the ecosystem

Impact of agricultural practices on disease (human and/or animal)

Suggested Resources:

World Wildlife Federation

USDA website on Farm Practices and Management of Biotechnology (There is a children’s version available as well.)

Department of Natural Resources

Agricultural Science Colleges Websites

Sites on sustainable agricultural practices

Helpful Terms:

Agroecology

Industrial Agriculture

Factory Farming

Overfishing

Terrestrial Ecosystems

Aquatic Ecosystems

Marine Ecosystems

Population

Organism

Community

Teacher Note:

Students will now focus solely on the sign the cafeteria manager developed.

At the end of this lesson, students should be knowledgeable about the impacts of the sustainable and conventional practices for each of the topics listed on the sign. The evidence provided by students should address the conventional practices and alternative practices and how both impact ecosystems and all levels below it. Students will ultimately use this evidence to determine if the practices the cafeteria manager wants to focus on for the grant are sustainable to the ecosystem. The students’ conclusions should be supported by evidence.

The teacher may decide to have groups of students explore both sustainable and conventional methods of agricultural practices for each set of changes or divide the class up and the groups will explore either the sustainable or conventional practices. If the latter is chosen, the teacher may then pair the groups by their practice and have them share their findings with their counterpart.

Evaluating
**Group Task- Choose one of the options below.**

Note: The teacher may decide to have groups of students explore both types of agricultural practices for each method listed on the sign (see option A below) or divide the class into two large groups and the groups will explore either the sustainable or conventional methods for each of the practices listed on the sign (see option B below). If the latter is chosen, the teacher may then pair the students and have them share their findings with their counterpart.

**Option A:**

Teacher will post a sign (see sample below) around the classroom for each of the practices listed on the cafeteria sign. Students will remain with their groups and visit each of the practices listed. When they visit the practices, they will write their findings of the impacts in the appropriate place on the sign.

<table>
<thead>
<tr>
<th>List Practice Here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of Industrial Agricultural Practices</td>
</tr>
</tbody>
</table>

**Option B:**

Teacher will post a sign (see sample above) around the classroom for each of the practices listed on the cafeteria sign. Students will remain with their partner and visit each of the practices listed. When they visit the practices, they will write their findings of the impacts in the appropriate place on the sign.

**Class Discussion:**

Teacher will conduct a class discussion to evaluate the findings that students posted on the signs. Students will point out compelling points from each of the signs in their evaluations. Teacher should encourage students to question anything on the posters that they feel might need to be addressed.

**Communicating**

**Group Task:**

The group will **develop a sign that is a second version of the original sign so that it includes the potential impact of the topics listed on all levels of organization on the ecosystem (aquatic and/or terrestrial).** The final product is a sign developed by the group that better communicates how the efforts of the cafeteria are better than the current practices.

**Teacher Suggestion:**

Students are free to use electronic infographic resources to make their sign. There are free versions available.
<table>
<thead>
<tr>
<th><strong>Driving Question:</strong> How do my meal/food choices impact the ecosystem?</th>
<th><strong>Obtaining</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driving Question:</strong> How do my meal/food choices impact the ecosystem?</td>
<td><strong>Individual Task:</strong> Students will make a record of the foods that they have eaten for the week. Students may include food eaten from the cafeteria, restaurants, or home in their record. If a student is uncomfortable with keeping a list of food that they have eaten, they can make a record of their favorite foods to eat or foods they would choose from a restaurant. The objective of this assignment is for students to examine their personal food choices and how they impact the ecosystem. <strong>It is not the intent of this portion of the lesson to make a student feel uncomfortable to complete it.</strong> <strong>Alternative:</strong> The teacher should make a record of their food choices for the week as another option for the meal record the students will examine. <strong>Teacher Notes:</strong> It is suggested that teachers provide students with an artifact for them to record their meals for the week. Be sure to advise students that nutrition and eating habits will not be examined in this activity.</td>
</tr>
<tr>
<td><strong>Evaluating</strong></td>
<td><strong>Individual Task:</strong> Students will develop a scoring system based on the research that they have conducted previously to determine the level of sustainability of the meals in their record. The scoring system developed by the students should have a quantitative value (See the example below). Students will also determine the categories to score their meals, i.e. Fully Sustainable, Highly Sustainable, etc. Students will also identify patterns in the food choices in the meals they are eating. <strong>Example:</strong> A meal that is <strong>fully sustainable</strong> will have 100% of the food choices produced by sustainable practices. A meal that is <strong>highly sustainable</strong> might have 80-99% of the food choices in the meal produced by sustainable practices. <strong>Teacher Notes:</strong> Help students to understand the importance of making their score quantitative</td>
</tr>
</tbody>
</table>
and not qualitative.

Help students to make a decision about food that is processed.

Help students to calculate percentages if they need it.

The scoring system will be applied to each meal in the meal record.

Help students to analyze their results to see trends in their data, like more of their dinner meals are sustainable over other meals or where they eat, etc.

**Communicating**

**Individual Task:**

Students will develop a model that communicates how their food choices (or the teacher’s) impact the ecosystem. The model will represent the scoring system developed by the student to determine how sustainable their meal choices (or their teacher’s meal choices) are.

Students will use their models to determine how they might change their food choices if they were given all the resources they need to do so. Their final conclusions on their food choices will be supported by evidence. The final conclusions will be included in the student model.

**Teacher Note:**

The student model should show a connection to the meal choices and the research gathered regarding the impact of the food on the ecosystem.

[Rubric for student model](#)

**Elaborating**

**S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.**

c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.

d. Ask questions to gather and synthesize information

**Phenomenon**

Some foods we eat have a local and global connection because they are imported to the United States.

**Obtaining**

**Class Discussion:**

Share the phenomena “Some foods we eat have a local and global connection” with students and allow them to generate questions related to it.

Sample questions include:

- What are the major countries that import food to America?
- What foods are imported to America?
- How much does the U.S. spend on food imports?
- Why don’t we produce our own food?

**Group Task:**

Students will consider the questions generated by the class and use foreign trade data from the Census Bureau found [here](#) to explore the food imports from the...
from multiple sources to differentiate between Earth’s major terrestrial biomes (i.e., tropical rain forest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e., freshwater, estuaries, and marine).

(Clarification statement: Emphasis is on the factors that influence patterns across biomes such as the climate, availability of food and water, and location.)

Driving question:

How do ag practices of our area compare to those of other global agencies?

How do the impacts of agricultural practices compare in different biomes?

How do the effects of sustainability efforts compare in different biomes?

What foods are imported to America? Exported from America?

countries listed. Students will be able to choose the countries they want to explore. Each student in the group should choose a minimum of three countries to explore and the foods that are imported. Students may use the research template provided to guide their work. **OPTION:** Students may develop a graph of their data from the countries that show the food and value for 2016. Students will need to determine the graph to use for their data. Graphs can be generated through google sheets if this resource is accessible to students.

At the end of the research session, allow students within the groups to share their research with each other. This can be done in a round-robin model where one student shares with the rest of the group for a specified amount of time. Once all the students have shared in the group, they should discuss trends in their data. Trends may include common foods that were researched, the foods with highest values from the countries researched, and the number of different countries importing the same food.

**Individual Task:**

Now that students have been able to look at the trends in the group data, they will identify at least three foods that are imported from another country to focus on for the argument they will develop. Students will first generate research questions to obtain information about the major biomes of the foreign countries where their chosen foods are produced and their local biome. They will then investigate the impacts of the agricultural practices on the ecosystems in the foreign countries where their chosen food is produced. They will focus on effects on habitat loss which affects resources availability in the community, biodiversity (organisms and populations), disease, pollution which affects resource availability in the community. Finally, they will research sustainable efforts and the potential impacts they will have on the ecosystem and compare all of their data to the efforts in the United States.

Note: Students may use the Student Research Organizers linked above.

Additional Resources:

**Teacher Note:**

The intention of this elaborate task is for students to first determine foods that are imported from other countries and the countries they come from. They should also be able to determine the major food import from the country based on the values reported. They will then research the biomes of those countries to identify environmental patterns. Once they identify the environmental patterns of the countries, they will determine how to the food production practices of the foods they researched initially impact the ecosystems in that country so that they can develop an argument to answer the question, “Which food would you choose.” In the argument, students should compare the impacts of the agricultural practices in the United States to other countries in order to develop their claim.
Suggested Resources

NASA Earth Observatory- Mission: Biomes
United States Census Bureau- www.census.gov
USDA- www.usda.gov
WWF- World Wildlife Fund
*Other previously listed resources can be used as well.

Suggested Google searches:

- Global impacts of industrial agriculture
- Global impacts of meat production
- Global impacts aquaculture
- Impacts of industrial agriculture in _______ (insert country of interest)

Evaluating

Driving Question: Considering the agricultural practices here and the practices of other global agencies, which food would you choose?

Individual task:

Students will develop an argument for the driving question. They will analyze the data from research conducted about agricultural practices both locally and foreign to develop their claim. Their claim must be supported by evidence and should focus on impacts on the ecosystem. Students arguments should have claim, evidence, and reasoning (justification), and a conclusion. See the sample planning form below:

<table>
<thead>
<tr>
<th>Claim:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence:</td>
</tr>
<tr>
<td>Conclusion:</td>
</tr>
</tbody>
</table>
**Teacher Note:**

Students may need guidance on developing a claim for their argument. The claim is very similar to a hypothesis for an experiment. They may also need help with justifying their evidence. This is the place where students connect their evidence to the science topics they are emphasizing in the argument. In this case, it is how the practices impact ecosystems, comparing the foreign impacts to local or domestic impacts on the ecosystem. Students should also include in their comparison a connection to the biomes of each country used in the research. They should reference their evidence and be able to show a strong connection.

**Communicating**

**Individual Task:**

Students will share the draft of their argument with their peers. Students will peer assess the work and offer feedback for the student argument. Students will reflect on the feedback they receive, make revisions, to their argument and submit a final written draft.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Assessment of Student Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analyzing Data</strong></td>
<td>Students will analyze data about the impacts of agricultural practices (human activity) on the environment and provide a report with their conclusions.</td>
</tr>
<tr>
<td><strong>Developing Models</strong></td>
<td>Students will develop a second version of the school cafeteria sign that communicates the impacts of proposed sustainable practices on the ecosystem.</td>
</tr>
<tr>
<td><strong>Using Mathematical and Computational Thinking</strong></td>
<td>Students will determine a quantitative to measure how sustainable their meal choices are and develop a model to communicate their measures and trends about how their meals impact ecosystems.</td>
</tr>
<tr>
<td><strong>Engaging in Arguments with Evidence</strong></td>
<td>Students will develop an argument relating the impacts of domestic agricultural practices on the ecosystem to foreign agricultural practices on the ecosystems and their respective biomes.</td>
</tr>
</tbody>
</table>

**SEP, CCC, DCI**

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Science Essentials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing and using models</td>
<td>Developing and using models</td>
</tr>
<tr>
<td>Analyze and interpreting data</td>
<td>Analyze and interpreting data</td>
</tr>
<tr>
<td>Engaging in argument from evidence</td>
<td>Engaging in argument from evidence</td>
</tr>
<tr>
<td>Obtaining, evaluating, and communicating information</td>
<td>Obtaining, evaluating, and communicating information</td>
</tr>
<tr>
<td>Asking questions</td>
<td>Asking questions</td>
</tr>
<tr>
<td>Using mathematics and computational thinking</td>
<td>Using mathematics and computational thinking</td>
</tr>
<tr>
<td>Crosscutting Concepts</td>
<td>● Patterns</td>
</tr>
<tr>
<td></td>
<td>● Stability and Change</td>
</tr>
<tr>
<td></td>
<td>● Systems and System Models</td>
</tr>
</tbody>
</table>

| Disciplinary Core Ideas       | ● LS2.A: Interdependent Relationships on Ecosystems |
|                              | ● LS2.C: Ecosystem Dynamics, Functioning, and Resilience |
|                              | ● LS4.B: Natural Selection        |
**Additional Supports for struggling learners:**

The following supports are suggestions for this lesson and are not the only options to support students in the classroom. These supports target students that struggle with science material, this lesson or a previous lesson. These are generalized supports and do not take the place of IEP accommodations as required by each student’s Individualized Education Program.

### General supports for the following categories:

<table>
<thead>
<tr>
<th>Reading:</th>
<th>Writing:</th>
<th>Math:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Provide reading support by reading aloud or doing partner reads</td>
<td>1. The teacher can provide a sentence starter for the students.</td>
<td>1. Provide calculators as needed.</td>
</tr>
<tr>
<td>2. Have the teacher model what they are thinking when reading the text</td>
<td>2. The teacher can give students an audience to write to (i.e. Write a letter to your sibling explaining this topic).</td>
<td>2. Provide graph paper as needed.</td>
</tr>
<tr>
<td>3. Annotate the text with students so that they may refer to it as they work through the activities.</td>
<td>3. The teacher can provide constructive feedback during the writing process to help students understand the expectations.</td>
<td></td>
</tr>
</tbody>
</table>

### Supports for this specific lesson if needed:

**Performance expectations for instruction:**

1. The teacher should provide information to students in various formats to reach as many students as possible.
2. The students should be given adequate time to complete each part of the lesson.
3. The students should be allowed to express their knowledge in various formats.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material.

**Engage:**

1. The teacher should consider showing students a video, giving students an article or having an expert come discuss how food production impacts the environment.
2. The teacher should consider giving students an organizer to help students generate questions. The organizer can provide question stems as needed.
3. The teacher should have students come back together as a group and make a list of the questions generated. The teacher can then help students decide which questions are the most important and relate to the standards or lesson most directly.
4. The teacher should consider giving students sources to help with their research.
5. The teacher may need to provide words or phrases to help students find information that relates to the question that they are researching.
6. The teacher can consider giving students a list of foods that the cafeteria uses as needed to assist students in working on this assignment.

7. The teacher should guide students to look at the area around the farms to find impacts in the environment.

8. If students are having a hard time with research, then students may need a list of agriculture practices that they might need to look at as part of their research.

9. The teacher should consider giving students an organizer to record their research.

10. The teacher should use intentional and flexible grouping to group students. Best practice is to use data to group students.

11. The teacher may need to consider modeling their thinking about a set of data. This may help students use data in their conclusion.

12. The teacher can then help students identify things that can be used as data.

13. The teacher should consider giving students a CER template and graph paper to record their claim and graph data to support the claim.

14. Many students struggle with graphing and may need a refresher on how to graph data.

15. The teacher should consider giving students sharing options such as presentations, gallery walk or using technology.

16. Students may need additional time to revise their conclusions.

17. The teacher should consider giving a rubric for self-evaluation.

18. The teacher should have clear and consistent guidelines for presentations. This should help students feel more comfortable presenting.

19. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing or verbally explaining.

Exploring:

1. The teacher may need to explicitly point out the practices that are on the cafeteria sign.

2. The teacher may want to consider writing a list of the practices on the board for the students to refer to.

3. The teacher should consider giving students sources to use for research.

4. Some students may need additional help in narrowing down their research. This can be accomplished through group discussions, think-pair-share or teacher assistance depending on student needs.

5. The teacher may need to remind students what evidence is and help determining what might count as evidence for their conclusions.

6. The teacher should use intentional and flexible grouping. Best practice is to use data to group students.

7. The teacher should have students work with partners or groups to determine what to put on the different practices.

8. The teacher should consider other options for students to share information about the agricultural practices. This could be done using technology, sticky notes or have the practice sheets rotate groups to allow the students to write down information.

9. The teacher should have clear and consistent guidelines for group work and class discussions. This should help students feel more comfortable participating.

10. The students should be reminded that any feedback or questions should be adding to the productivity of the class. So, questions should be about material and feedback should be positive and constructive.
11. The teacher should be sure to provide multiple ways for the students to design their ad. These formats could include writing, drawing or making a video.

12. The teacher should help prepare for visitor for visitors. Many students are anxious when change occurs and will function better when warned of the change in advance.

13. The teacher should consider giving students a rubric so that they can self-evaluate their ad. This increases student ownership.

**Explaining:**

1. The teacher should consider providing a list of foods that students can use if they are uncomfortable keeping a list of foods that they eat.
2. The teacher should consider providing students with an organizer to record foods and research.
3. The teacher may want to give students an example of a quantitative scale or scoring system and explain why this is an important component of their scoring scale.
4. The teacher should consider providing students with a calculator to do any calculations that might be needed.
5. The teacher may want to lead a class discussion about processed foods. The teacher should have clear and consistent guidelines for class discussions. This should help students feel more comfortable participating in the discussion.
6. The teacher may need to assist students to identify trends in data.
7. The teacher should provide students with a rubric to self-evaluate their own model.
8. The teacher should consider giving students an organizer to guide their creation of the model.
9. The teacher could consider allowing students to give one another feedback and then the students can use the feedback to revise their model.
10. Students may need additional time to construct their model.

**Elaborating:**

1. The teacher should have clear and consistent guidelines for class discussion. The guidelines should help students feel more comfortable participating in the discussion.
2. The teacher should consider providing students with sources to research food growth in other countries.
3. The teacher should have clear and consistent guidelines for student group work.
4. The teacher should remind students of the definition of a scientific argument.
5. The teacher should provide students with a rubric to self-evaluate their own argument.
6. The teacher may need to help students determine what type of evidence might be useful in supporting their arguments.
7. The teacher should consider giving students an organizer to guide their creation of an arguments.
8. The teacher can consider giving students sentence starters to help students start their arguments.
9. The teacher could consider allowing students to give one another feedback and then the students can use the feedback to revise their argument.
10. Students may need additional time to construct their arguments.

**Evaluating:**

1. The teacher should consider giving students multiple options to express their knowledge. These options could include writing, drawing or designing a presentation.
2. The teacher should consider having students explain their models, data and reasoning as they move through the lesson.

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Georgia Department of Education
October 2019
3. The teacher should complete a formative assessment several times throughout the lesson and re-teach, review and enrich as needed.
Food Choices from the Cafeteria
Teacher Note: These are samples of items that could found in the cafeteria.

BREAKFAST

Juices

Milk
Fresh Fruit

Yogurt

Cereal

Breakfast Bar

Pancakes

Scrambled Eggs

Waffles
Sausage (Turkey or Pork)  Bacon  Grits

Biscuits

[Images of breakfast foods]
Food Choices from the Cafeteria
Teacher Note: These are samples of items that could be found in the cafeteria.

LUNCH

Milk:

Apples  Peaches  Bananas

Applesauce  Raisins  Smoothies
<table>
<thead>
<tr>
<th>Cherry Tomatoes</th>
<th>Baby Carrots</th>
<th>Pepper Strips</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Cherry Tomatoes" /></td>
<td><img src="image2.png" alt="Baby Carrots" /></td>
<td><img src="image3.png" alt="Pepper Strips" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corn</th>
<th>Collard Greens</th>
<th>Steamed Broccoli</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Corn" /></td>
<td><img src="image5.png" alt="Collard Greens" /></td>
<td><img src="image6.png" alt="Steamed Broccoli" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Salads</th>
<th>Tuna</th>
<th>Pasta</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7.png" alt="Salads" /></td>
<td><img src="image8.png" alt="Tuna" /></td>
<td><img src="image9.png" alt="Pasta" /></td>
</tr>
</tbody>
</table>
Student Research Organizer 1

Student Research Questions:

Potential Environmental Impacts of Agriculture
- Habitat Loss
- Water Consumption
- Soil Erosion
- Pollution (Water Included)
- Diversity Loss (Monocultures)

<table>
<thead>
<tr>
<th>Environmental Impact:</th>
<th>Notes (Consider your research question):</th>
<th>Data Sources (Include links):</th>
</tr>
</thead>
</table>

Websites:

Conclusion about the food choices in the cafeteria:

Return to Instructional Segment
Examples of Data Relationships

NOTE: The graphs depicted below are only examples of data relationships and do not necessarily represent data for this activity.

Linear Data

Data shows a linear regression line, as the performance of the products provided by the supplier improves or increase the price increases and a similar rate. Supplier A, Product 2 has a nonlinear relationship to the other products. It would be considered an outlier.

Nonlinear Data

The data above represents a nonlinear relationship between the predator and prey populations over time. There are other factors not depicted here that cause the populations to fluctuate over time. The predator and prey populations are inversely related. When the prey population increases there is a decline in the predator population and vice versa.
Spatial Data

This graph shows the occurrence of fires in the southeastern states (space) over a range of time (temporal) from 1970-2007. Mississippi shows fires that extend diagonally across the state. Most of the other states tend to have fires concentrating along the borders, however there is another diagonal trend across the western region of North Carolina.

Temporal Graph

https://commons.wikimedia.org/wiki/File:A_line_graph_showing_the_of_population_for_Thoralby.jpg

The graph shows the population trends of Thoralby over a period of 140 years. It does not indicate any other factors that could be affecting this population over the years.
## Analyzing and Interpreting Data Rubric

<table>
<thead>
<tr>
<th>Category</th>
<th>Emerging</th>
<th>Developing</th>
<th>Proficient</th>
<th>Distinguished</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct, analyze, interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.</td>
<td>The student can identify linear relationships in graphical displays of small data sets about how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.</td>
<td>The student can analyze graphical displays of small data sets or large data sets to identify linear relationships about how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.</td>
<td>The student can analyze and interpret graphical displays of data or large data sets to identify linear and nonlinear relationships about how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.</td>
<td>The student can analyze and interpret graphical displays of data and large data sets to identify linear and nonlinear relationships about how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems.</td>
</tr>
<tr>
<td>Use graphical displays of large data sets to identify temporal and spatial relationships.</td>
<td>The student can use graphical displays of small data sets to identify temporal relationships.</td>
<td>The student can use graphical displays of small data sets to identify temporal or spatial relationships.</td>
<td>The student can use graphical displays of small and large data sets to identify temporal or spatial relationships.</td>
<td>The student can use graphical displays of large data sets to identify temporal and spatial relationships.</td>
</tr>
<tr>
<td>Analyze and interpret data to provide evidence for the phenomenon the meals we choose impact ecosystems.</td>
<td>The student can identify data to provide evidence for the phenomenon the meals we choose impact ecosystems.</td>
<td>The student can analyze data to provide evidence for the phenomenon the meals we choose impact ecosystems.</td>
<td>The student can analyze and interpret data to provide evidence for the phenomenon the meals we choose impact ecosystems.</td>
<td>The student can analyze and interpret data from multiple sources to provide evidence for the phenomenon the meals we choose impact ecosystems.</td>
</tr>
</tbody>
</table>
Committed to reducing our environmental footprint

Sustainably sourced seafood

Crops produced through responsible soil practices

Farms with water conservation practices

Responsibly raised livestock

Natural pest control practices
### Student Research Organizer 2

<table>
<thead>
<tr>
<th>Agricultural Practice on Sign:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conventional Impact Notes:</strong></td>
<td><strong>Data Sources:</strong></td>
</tr>
<tr>
<td><strong>Sustainable Impact Notes:</strong></td>
<td><strong>Data Sources:</strong></td>
</tr>
</tbody>
</table>

Conclusion about the practice on the sign: (How sustainable is the practice? Should it be included? Do you suggest another practice?)

[Return to Instructional Segment]
## Student Sign Rubric

<table>
<thead>
<tr>
<th>Categories</th>
<th>Emerging</th>
<th>Developing</th>
<th>Proficient</th>
<th>Distinguished</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels of organization in the ecosystem</td>
<td>Students address no more than two levels of organization in the new sign.</td>
<td>Students address three levels of organization in the new sign.</td>
<td>Students address most levels of organization in the new sign from organisms to ecosystems.</td>
<td>Students address all levels of organization in the new sign from organisms to the biome.</td>
</tr>
<tr>
<td>Impact of proposed practice on level of organization</td>
<td>Students demonstrate how each proposed practice on the sign will affect two levels of organization or students demonstrate how three or less of the proposed practices will affect all levels of organization.</td>
<td>Students demonstrate how each proposed practice on the sign will affect three levels of organization or students demonstrate how four of the proposed practices will affect all levels of organization.</td>
<td>Students demonstrate how each proposed practice on the sign will affect most levels of organization including organisms to ecosystems.</td>
<td>Students demonstrate how each proposed practice on the sign will affect all levels of organization from organisms to the biome.</td>
</tr>
<tr>
<td>Usage of data</td>
<td>Students support the explanations of three or less of the proposed practices on the levels of organization with evidence.</td>
<td>Students support the explanations of four of the proposed practices on the levels of organization with evidence.</td>
<td>Students support each explanation of the impacts of each practice on the levels of organization with evidence.</td>
<td>Students support each explanation of the impacts of each practice on the levels of organization with evidence from multiple sources.</td>
</tr>
</tbody>
</table>
# Rubric for Meal Choice Model

<table>
<thead>
<tr>
<th>Categories</th>
<th>Emerging</th>
<th>Developing</th>
<th>Proficient</th>
<th>Distinguished</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization of model</strong></td>
<td>Student model reflects an organization that demonstrates 1 to 2 food choices for the entire week or demonstrates all food chosen for less than 5 days out of the week</td>
<td>Student model reflects an organization that demonstrates portions of the foods chosen for the entire week or demonstrates all food chosen for 5 to 6 days out of the week</td>
<td>Student model reflects an organization that demonstrates all of the foods chosen for the entire week.</td>
<td>Student model reflects an organization that demonstrates all of the foods chosen for the entire week with a higher level of sophistication.</td>
</tr>
<tr>
<td><strong>Student scoring system</strong></td>
<td>Student has developed a scoring system that uses an arbitrary numbering system to reflect how sustainable their meal choices are.</td>
<td>Student has developed a scoring system that uses a numerical scoring system to reflect how sustainable their meal choices are.</td>
<td>Student has developed a scoring system that uses a mathematical formula to determine how sustainable their meal choices are.</td>
<td>Student has developed a scoring system that uses multiple mathematical formulas to determine how sustainable their meal choices are.</td>
</tr>
<tr>
<td><strong>Analysis of meal choices</strong></td>
<td>Student provides an analysis of their meal choices that reflects how sustainable their meal choices are.</td>
<td>Student provides an analysis of their meal choices that reflects how sustainable their meal choices are and is supported by 1 to 2 pieces of evidence from previous research.</td>
<td>Student provides an analysis of their meal choices that reflects specific ways they would change their choices that is supported by 3-4 pieces of evidence from previous research.</td>
<td>Student provides an analysis of their meal choices that reflects steps they would take to change their choices and each step is supported by specific evidence from previous research.</td>
</tr>
</tbody>
</table>

*Return to Instructional Segment*