

**Subject(s): Environmental Science, Math, Geography**

**Driving Geography Theme: Location, Human Environment/Interaction**

**Key Words: Gathering, using and Interpreting Evidence, Chronological Reasoning and Causation, Civic Participation, cause and effect, water, Sargassum, Barbados**

**Time Allotted: 90 minutes**

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| <b>Lesson Overview</b>              | This inquiry is an exploration into the concepts of time, continuity, and change in a community/geographical region with the dual purpose of establishing students' understandings of the passage of time and explaining why current environmental events matter. The inquiry taps into a common student assumption about the authority of the present and its existence independent of future events and contexts. One way to explore present circumstances is through an examination of the short- and long-term effects. The constructs of cause and effect are complex, chiefly because multiple causes may be associated with one event, just as multiple effects can be tied to a single cause. Through identifying the relationship of cause and effect, students learn to recognize how continuity and change over time help us understand historical developments in our present communities/geographical regions. |
| <b>Compelling Question</b>          | <i><b>How do current environmental events impact a community/geographical region?</b></i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Supporting Questions</b>         | <ol style="list-style-type: none"><li>1. What's the difference between a cause and an effect?</li><li>2. How have events from the current day changed our lives in the future?</li><li>3. How do people today solve problems?</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Learning Objectives (2-3)</b>    | The student will be able to:<br><br>A. Explore the causes and effects of a major event that has transformed a community/geographical region.<br>B. Investigate what people in the community/geographical region are doing to confront and/or address the event.<br>D. Design to problem solves for the event.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>C3 Standards &amp; Practices</b> | <ol style="list-style-type: none"><li>1. Developing Questions and Planning Inquiries</li><li>2. Applying Disciplinary Tools and Concepts</li><li>3. Evaluating Sources and Using Evidence</li><li>4. Communicating Conclusions and Taking Informed Action</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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| Materials/<br>Resources (PPTS,<br>Worksheets, Teacher<br>Guides, Primary<br>Sources, Etc.) | <p>INCLUDE a List of Materials Needed and Provide these supporting materials.</p> <p><b>Materials</b></p> <p>Notebook<br/>Pencil/Pen<br/>Markers<br/>Graphing Paper<br/>Laptop with Internet access<br/>Copies of news articles<br/>UTube video<br/>Photo<br/>Timer<br/>Poster Paper/Post-It note chart paper<br/>Sticky notes (2 different colors)</p> |
| <b>Modifications/<br/>Extensions</b>                                                       | <p>Teachers are encouraged to adopt the inquiries to meet the requirements and interests of their students. Resources can also be modified as necessary to meet individualized education plans (IEPs) or Section 504 Plans for students receiving special education services.</p> <p>Flexible grouping</p>                                              |

### **375 (to 750 max) word Contextual Essay that provides background to your topic**

The presence of sargassum seaweed on the South Coast and the South-East Coast of Barbados has posed a serious challenge for the island. Sargassum seaweed is the unwelcome visitor that began washing up on beaches in parts of the Caribbean. Sargassum made a brief appearance in summer 2011 and had a massive comeback in the summer of 2018. Now, undulating rafts of the stinking slimy seaweed are turning Caribbean waters on some islands reddish-brown, swamping beaches and trapping sea turtles and marine life as it washes ashore on each tide.

In Barbados, the trickle started in January but had ramped up dramatically by late May and early June. Sargassum has been around for hundreds of years. It "blooms" in the Sargasso Sea, a 2-million-square-mile body of warm water in the North Atlantic. The floating masses are carried by currents, winds, and tides south into the Gulf of Mexico where it then heads toward the Caribbean, the Yucatan or up onto Florida beaches.

*What is sargassum?*

Sargassum is a brown marine alga (seaweed) that is found throughout the oceans of the world but generally associated with the Sargasso Sea (in the North Atlantic). Most species are attached

to the seafloor. However, there are two species, *Sargassum natans* and *Sargassum fluitans* that are never attached but instead are free-floating for their entire life cycle. Since 2011, the Caribbean region has been experiencing a year-to-year variation of an influx of these two species having the highest record level.

### *Where is it coming from?*

One theory holds that a change in the sea currents attributable to climate change has resulted in higher sea temperatures and increased amounts of carbon dioxide that enhance its growth. It's not dangerous to humans, but it is unsightly and smells like rotten eggs when it dries out on shorelines and begins to rot, attracting flies and insects. The foul-smelling masses are heavy, hard to remove and can stand in piles as much as 10 feet high.

Some experts speculate there could be a connection between the *Sargassum* and agriculture run-off in the Amazon River, as well as deforestation. Fertilizer runoff taking the path of the ocean currents impacting the overgrowth of the species. Nitrogen pollution is widely known to feed algal blooms, including *Sargassum*, and is a possible cause of the red tide plaguing the coast of Barbados.

### *Implications on Geography & Tourism*

According to the Barbados Tourism Investment, Inc., Barbados welcomes approximately 1 million visitors in the region and is the #1 for visitors per capita in those top 10 categories. Barbados is the #1 destination in the region from the United Kingdom. Tourism revenues totaled approximately USD \$1billion in 2108. The tourism industry generates over 50% of the country's foreign exchange while generating 4,528 jobs directly in 2017.

The hospitality industry across the region is concerned about the seaweed's unsightly appearance, the cost of mechanical removal and the possibility of reputation damage. The seaweed's arrival also coincided with the start of the season when many visitors arrived in the Eastern Caribbean, negatively affecting tourism. Piles of red algae along the coastline can be seen from the sky, mixing in with the usual blue waters. Along the beaches, hotel employees can be seen shoveling it and consolidating piles of seaweed.

### **Teacher Preparation Instructions** (explain lesson preparation steps)

In addressing the compelling question students work through a series of supporting questions, formative performance tasks, and featured sources to construct an argument with evidence and counterevidence from a variety of sources.

- Create Cause and Effect T-charts on poster paper.

Chart 1: Banning the use of Plastic Straws

Chart 2: Building New Homes

Chart 3: Fertilizing lawns and farms

- Secure T-Charts around the room prior to the lesson.

**Instructional Procedures/Process** (Explain the instructional steps to your activity – write the directions for a general audience so that the lesson is easy to replicate – provide sample talking points, etc.)

**Source A: Teacher/Student-generated examples of cause and effect**

“What’s the difference between cause and an effect?” suggests that students can use cause and effect as a lens to view historical events in communities/geographical regions over time. The featured source for this question is a teacher-generated example of cause and effect from current events (examples are also provided). After listening to the example, students create a T-chart with a list of the cause(s) on the left side and the corresponding effect(s) on the right.

1. Hang poster paper sheets/large Post-It chart paper with T-Charts around the room prior to the start of the lesson with teacher-generated examples.  
Suggested examples:
  - A. Banning the use of plastic straws
  - B. Building new houses
  - C. Fertilizing lawns and farms
2. Separate the class into three groups. Provide each group with a specific colored marker to easily identify the group’s response to the chart. They will remain with the same group as they rotate around the room to interact with the Cause and Effect T-Charts.
3. Allot 6 minutes (2 min. per chart) for students to interact and respond to the Cause and Effect prompt on each poster chart. Using a timer or displaying a visual timer is suggested.
4. Students will list cause(s) on the left side and the corresponding effect(s) on the right.
5. After the 6 minutes, have students return to their seats with their groups.
6. As the teacher, discuss the responses on the T-Charts with the class. (5 minutes)

**Source B: Sargassum Algae Invades Barbados**

“How do current events impact communities/geographical regions?” continues the study of cause and effect by examining a case in which the effects of a situation are not all positive. Using the social and environmental issues around the Sargassum Blooms in Barbados as an example, the formative performance task asks students to identify effects on sticky notes of one color and effects on sticky notes of a different color and then discuss their findings with their groups. The featured sources are a collection of written, photo and audio documents that provide evidence of present-day effects.

1. In their groups from the Cause and Effect Activity, provide each group with:
  - one artifact; either written, photo or audio
  - sticky notes (two different colors)

Article:

<http://www.sciencemag.org/news/2018/06/mysterious-masses-seaweed-assault-caribbean-islands>  
<https://mission-blue.org/2014/10/sargassum-inundates-the-beaches-of-the-caribbean/>

3. After 5 minutes, conduct a whip around and ask students to share their reflections from their group artifact.
3. Post/project on the board prompts for the groups to respond to.

### **Source C: Algae Bloom Web Quest**

Students will search for web resources and find information on algae and algae blooms. The following sites will assist students in the quest:

Harmful Algae: Red Tide (<http://www.whoi.edu/redtide/>)

From the Top of the World (<https://archive.bigelow.org/foodweb/>)

1. Provide students a hard copy or electronic copy of Algae Bloom Web Quest.
2. Allow 10 minutes for students to search web resources to answer questions provided on the quest/
3. Have students' pair and share their findings with a partner.

### **Source D: Math/Economic Connection**

1. Students will access the United Nations Food and Agriculture Organization (FAO) statistical site to research the production of marine algae around the world; specifically, Barbados.
2. Pose the question to students: "How much Sargassum Is Produced in Barbados?"
3. Go to the FAO Global Aquaculture Production page.

<http://www.fao.org/fishery/statistics/global-aquaculture-production/en>

Available Format & Information Products, under Dataset, select Global Aquaculture Production (online query).

Select the Species tab.

Click on the plus next to Aquatic plants.

Check the checkbox next to Brown seaweeds.

Click submit.

Record the Aquaculture: Quantity & Value data for the past decade.

### **Interpreting Charts and Graphs**

1. Students will access the

### **Source E: Informed Action**

"How do people solve problems today for a better tomorrow?" has students consider the ways in which people today are working to confront and reduce problems to make their communities/geographical regions better. After working with the featured source, students should write an explanation with evidence that answers the questions about how people can address current problems.

Students can Take Informed Action by becoming aware of a community's history to better understand that community's future. They demonstrate their capacity to understand by exploring the causes and effects of a major event that has transformed their local community. They show their ability to assess by investigating what people in the community are doing to confront or address the event. And they act by inviting a local politician or community leader to class to discuss the event.

**Closure** (Activity/Procedure that brings the lesson/activity back to the guiding questions)

In the Summative Performance Task, students address the issue of whether they should care about current events, supporting their answers with evidence. After learning what the past is, contextualizing it through the lenses of cause and effect, and examining the positive and negative results of past actions, students should be able to draw on a range of examples to use as evidence in answering the compelling question "How do current events impact communities/geographical regions?" in the form of a paragraph/video response/Padlet/PSA.

Student arguments will likely vary but could include any of the following:

- We should care about the current events because we are connected to it through cause and effect.
- We should care about the current events because it helps to explain why things are the way they are today.
- The present is more important than the current events because we must fix the problems that have already happened.
- The past and present are equally important to understand so that we know what happened, why it happened, and how it can help us make a better future.

Upon completion of the closure activity, students will participate in a mock town hall meeting sharing their Performance Task.

## **Appendix**

College, Career, & Civic Life C3 Framework for Social Studies State Standard.

<https://www.socialstudies.org/sites/default/files/c3/C3-Framework-for-Social-Studies.pdf>

Video showing different ecological viewpoints above and below the Sargassum mats. Also shows organisms within the seaweed:

[http://videos.al.com/mobile-press-register/2010/06/a\\_day\\_in\\_the\\_sargassum\\_1.html](http://videos.al.com/mobile-press-register/2010/06/a_day_in_the_sargassum_1.html)

For Teachers/Educators to order samples of Sargassum for a class of 30 students:

<http://www.carolina.com/product/living+organisms/protists/algae+cultures+and+sets/sargassum,+living.do>

## **Provide all support materials**

Algae Webquest

<https://docs.google.com/document/d/1fEwhQUdYX5ILHIXVAFvTpQOrspwZCpc-IppjYvikmv0/edit>

Mysterious masses of seaweed assault Caribbean Islands

<http://www.sciencemag.org/news/2018/06/mysterious-masses-seaweed-assault-caribbean-islands>

Sargassum Inundates The Beaches of the Caribbean

<https://mission-blue.org/2014/10/sargassum-inundates-the-beaches-of-the-caribbean/>