

Environmental Literacy Model



Title	Wave of Plastic: Student inquiry of plastic waste and its impacts on marine ecosystems
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School, District	Systemic implementation in St. Mary's & Calvert County Public Schools, MD
Audience (grade, course)	Course: Earth and Space Sciences Grades: 6th grade in St. Mary's County, 8th grade in Calvert County Public Schools

Curriculum Anchor

Defining the Learning Objectives and Curriculum Connection

Curriculum indicators, performance expectations, and/ or student learning objectives.

Learning Objectives:

- Students demonstrate an understanding of the impact of plastics on wildlife species and the environment, and ways to address this issue
- Students can describe how to collect and analyze data to understand the marine plastic issue
- Students justify and plan an effective community solution for reducing plastic use and marine debris

The Wave of Plastic unit has been designed to support: NGSS standards, Maryland Environmental Literacy Standards, Maryland Service-learning Graduation Requirements and the Student Outcome of the Environmental Literacy Goals of the 2014 Chesapeake Bay Watershed Agreement. Specifically, Wave of Plastic aligns with the following standards:

NGSS:

- 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.
- 2. MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Maryland Environmental Literacy Standards:

- Standard 1- Environmental Issues
- Standard 5 – Humans and Natural Resources
- Standard 7 – Environment and Society
- Standard 8 – Sustainability

Maryland Student Service Learning: The Wave of Plastic Unit has been designed to meet all 7 Best Practices of Service-Learning in Maryland:

1. Meet a recognized need in the community.
2. Achieve curricular objectives through service-learning.
3. Reflect throughout the service-learning experience.
4. Develop student responsibility.
5. Establish community partnerships.
6. Plan ahead for service-learning.
7. Equip students with knowledge and skills needed for service.

Describing the Local Context

The life-relevant issue that will serve as the context for learning.

Over the last several decades, plastics have come to dominate daily life. Their versatility, durability, and low cost have made them a favored material for a wide variety of products from eating utensils to medical equipment. However, some of these same features make them amongst the most common and persistent environmental pollutants in the world today. Students use plastic everyday in school, at home and in their communities, and they may have noticed plastic pollution too. Large amounts of plastic and microplastics have been found throughout the world's oceans and in the Chesapeake Bay. Environmental education has raised awareness about the benefits of recycling, but an understanding of the connection between plastic consumption and use, and trash on land and in the marine environment is still lacking. Every person can make a difference by making choices that reduce the use of plastics and their entry into our oceans.

Identifying the Driving Question

A broad, open-ended, life-relevant question that is based on the standards/learning objectives. Guides inquiry for the investigation(s), prompts the development of actionable claims.

How do human choices regarding the consumption and disposal of plastics impact ecosystems and our communities and what actions can we take to minimize those impacts?

Issue Investigation

Asking Questions, Defining Issues and Problems

Students define the issue, problem, or phenomenon to be investigated and develop supporting questions that are relevant for investigation.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
<p>Supporting question across lessons 1-5: How do we describe, quantify, and communicate about issues related to plastic waste?</p>		
<p>Supporting question across lessons 1-3: How can we communicate our ideas, inform perspectives, and inspire action?</p>		
<p>Lesson 1 supporting questions: What is per-capita consumption and how do our choices and activities regarding the consumption and disposal of materials contribute to plastic waste? What choices are available for reducing our own personal plastic waste? What are the effects of those choices?</p>	<p>Lesson 2 supporting questions: What are some of the consequences of the manufacture, use, and disposal of plastic? What happens to plastic over time? What are some of the alternatives to plastic? What properties of plastic influence our everyday choices to use plastic? Lesson 3 supporting questions: What are the causes and effects of pollution? What are the sources of plastic pollution? How and why does plastic pollution enter our waterways?</p>	<p>Lesson 4 supporting questions: What causes disruptions to the stability of ecosystems? How can we use models to make predictions about the impacts of plastic pollution on ecosystems? How can personal choices and behaviors reduce the impacts of plastic pollution on ecosystems? Lesson 5 supporting questions: What is environmental stewardship? How are students and other citizens engaging in informed action to address issues of plastic pollution? What can we do?</p>

Planning and Conducting Investigations

Students plan and conduct investigations and classroom activities (indoor and outdoor) that actively address students' supporting questions. Students collect data that will be used to inform actionable claims.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
<p>In addition to reading, reviewing and responding to resources about per-capita consumption, students complete a Personal Waste Inventory and participate in “Waste Reduction Roundabout” which is an activity designed to evoke questions about what happens to different types of waste and why. Students participate in group discussions using discussion questions from the Student Workbook.</p>	<p>Students read, review and respond to a variety of resources about the manufacture and properties of plastic, and what happens to different types of waste over time. Students make their own bio-plastic and revisit their personal waste inventory to explore what happens to the waste they created over time.</p> <p>Students read, review and respond to a collection of resources focused on building understanding about pollution. Students participate in the activity “Plastic Waste Sort” thinking through the properties that may help plastic travel across landscapes and waterways. Students head outside for field investigations to determine how runoff will move waste across local surfaces. They collect data about plastic pollution in the local community.</p>	<p>Students read, review and respond to a variety of resources to make sense of how the biotic and abiotic components of an ecosystem exist and rely on each other. Students investigate how plastic pollution disrupts and or comprises elements of ecosystems through these readings and the activity “You are What You Eat!” that models how plastic pollution ingestion and entanglement can impact different organisms.</p> <p>Students reflect on what they’ve learned and explore and discuss examples of different types or categories of informed actions.</p> <p>Students brainstorm ideas for their own action projects in their Student Workbooks following a Plan, Implement, Evaluate Action prompt.</p>

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<p>Analyzing and Interpreting Data Students analyze data through graphs, models, and other methods to reveal patterns and relationships. Students synthesize and apply evidence from their investigations to draw conclusions that address the supporting questions.</p>		
Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
<p>Students graphically present their data from the Personal Waste Inventory. Students analyze resources to make sense of per-capita plastic consumptions and respond to questions in their Student Workbooks.</p>	<p>Students read an article about waste over time and respond to questions in their Student Workbooks. They then revisit their Personal Waste Inventories to explore what happens to their waste over time.</p> <p>Students design and administer a survey for the school community to understand, inform and influence people's choices regarding plastic use and then analyze, summarize and share the results with the community.</p> <p>Students participate in a jigsaw activity to organize information and responds to questions in their Student Workbooks. Students use a map and field observations to explore the ways that water moves across the surfaces of their school grounds to help them make predictions about how and where the pollution might be transported based on the data they collected in the community.</p> <p>Students develop a model in the form of an infographic to represent possible sources, movement, and destinations of plastic pollution in their communities.</p>	<p>Students analyze a variety of resources to understand the ways that plastic pollution contributes to marine debris and respond to questions in their Student Workbooks. Students brainstorm ideas for their own action projects in their Student Workbooks following a Plan, Implement, Evaluate Action prompt.</p>
<p>Constructing and Communicating a Claim Students draw on the conclusions from their investigations to make a claim about the driving question and communicate these evidence-based claims to internal and/or external audiences.</p>		
Issue Investigation 1	Issue Investigation 2	Issue Investigation 3

<p>Students reflect on and discuss their Personal Waste Inventory data.</p> <p>Students create a public service announcement to persuade others to consider choices regarding the consumption and disposal of plastic waste.</p> <p>Students complete a CER describing the connections between the number of people in a society, the amount of plastic waste that they generate, and why it might be a problem.</p>	<p>Students complete a CER describing what makes plastic a synthetic material, and how the properties of plastics impact society.</p> <p>Students complete a CER describing how plastic pollution can enter an environment and how it might travel to other environments.</p>	<p>Students make and share personal pledges to reduce the impacts of per-capita consumptions and plastic pollution on ecosystems.</p> <p>Students complete a CER describing how plastic pollution can cause changes to physical or biological components of an ecosystem.</p> <p>Students plan, implement and evaluate an action focused on reducing plastic pollution.</p> <p>Students summarize the experience and respond to the NGSS Performance Expectations MS-ESS3-3 and MS-ESS3-4</p>
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Stewardship and Civic Action

Identifying Solutions

Students identify and explore solutions that directly address the problem, challenge, or opportunity reflected in their claim. Students use decisionmaking processes to identify the solution(s) to implement.

- Students demonstrate an understanding of the impact of plastics on marine species and the environment and ways to address this issue through group discussions, the public service announcements and infographics they create, the community survey they develop and analyze and through their final action projects.
- Throughout the unit, students learn about per-capita consumption and their own plastic use as well as issues in the community. They also learn about the properties of plastic and why those properties both make it a useful material but also a long-lasting pollutant. By reviewing a variety of resources, participating in hands on activities and making observations/collecting data, students hopefully come to the conclusion that all plastic is produced and used by humans and therefore we each can reduce plastic pollution.
- Students research local solutions to plastic waste and marine debris
- Using conclusions, students brainstorm actions they can take to minimize the plastic pollution or its impacts and develop plan for stewardship action and community outreach

Designing a Plan and Taking Informed Action

Students design a plan for implementing solutions through informed action in their classrooms, schools, and/or communities. The plans should include criteria for determining the extent to which the action successfully addresses the problem, challenge, or opportunity reflected in the claim. Students implement their plans.

- Prior to the culminating action project in Lesson 5, students develop smaller action projects in lessons 1-4 with the goal of applying what they have learned and informing others. These actions include creating a public service announcement, developing and administering a community survey, creating an infographic, and developing a personal pledge.
- In Lesson 5, students develop a culminating action project that communicate their findings to raise public awareness and advance environmental stewardship.
 - Projects may include encouraging school system elimination of single use plastics from lunchrooms, a waste-free lunches campaign, writing to local representatives to encourage legislation such as D.C.'s plastic bag ban, developing an exhibit for display at a community event, community storm drain stenciling projects, or a plastic reduction art exhibit or video message. Students will share their action projects within their communities through outreach activities.

Evaluating Action

Students reflect on the action and determine the extent to which it successfully addresses the problem, challenge, or opportunity reflected in the claim. Students communicate their findings and share proposals for sustaining or extending the action.

Students analyze, summarize and then share the results of their community survey, and use this data to help inform their culminating action projects.

Students complete the Student Action Project Summary in their Student Workbook which has them describe the problem they addressed; their solution; the scientific principles that informed their solution; the impact(s) of their solution; and advice for others working to address this problem.