

### Problematic Plastic: Then and Now

Everywhere you look, you can find plastic. It is what our food and goods are packaged in, what our electronics are made of, and it is also what is polluting the natural world around us.

As the plastic industry continues to grow, many of us are recognizing our duty to be mindful of what we purchase and how we dispose of objects when we are finished with them. We need to work together, all generations and countries, individuals and industries, to make good choices and to fight the plastic pollution problem.

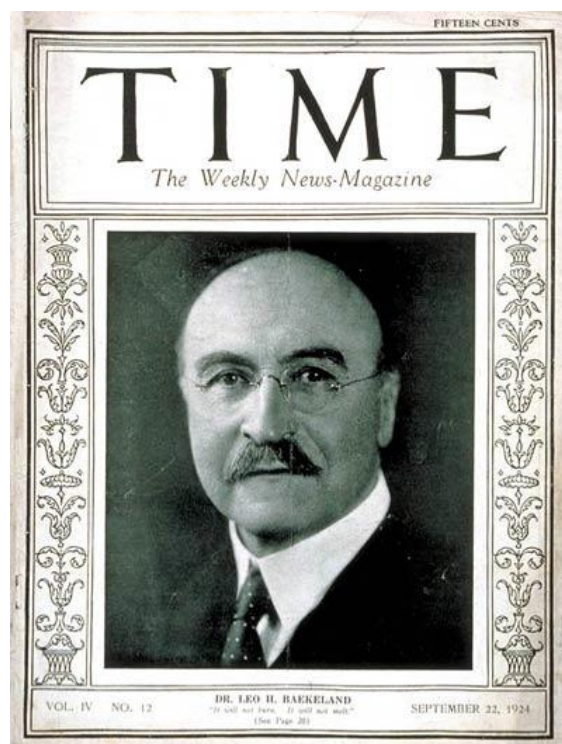
### A Quick History of Plastic

It was the late 1800's when electricity was just starting to be commercially used and insulation that would not melt or combust was needed for electrical wiring. Scientists everywhere were having difficulty tackling this problem and turned to fossil fuel byproducts as an answer, but soon considered this a failed approach.

While some scientist disbanded their search, the ever-so-persistent chemist, Leo Baekeland, began experimenting in a new way. He initially tried for 5 years to create something from fossil fuel byproduct until he finally realized that he needed to create an environment where he could control the pressure and temperature. He created the "Bakelizer", which was basically an oven. Finally, in 1907, he succeeded in creating a non-flammable plastic by combining the byproduct with formaldehyde and baking it. This was the first form of fully synthetic plastic that was ever created. In 1909, he started to market his creation as "Bakelite". Eventually, Ford would utilize this sturdy material, and during WWII plastics were heavily relied upon for a multitude of applications. This led to the booming industry of plastics.

Leo Baekeland is known as "The Father of the Plastics Industry".

<https://www.npr.org/sections/money/2019/05/28/726326078/how-everything-became-plastic>



## A Plastic World

It has only been about 100 or so years beyond these first steps into plastic manufacturing and the world is now producing an estimated 300 million tons of plastic each year. Half of what is produced is created as single-use plastics. Single-use plastics are items like disposable plastic straws and utensils, grocery bags and water bottles. Although these materials have a short life span, in a short amount of time, they have become staple items in the lives of humans across the world. Have we stopped to think if we really need these items?

<https://plasticoceans.org/the-facts/>

## The 3 R's

This leads into the concept of sustainability and the 3 R's. To live sustainably is to live by meeting your own needs without compromising the needs of others or future generations, which includes avoiding over-consumption and purchasing sustainable products.

You can also live sustainably by embracing the 3 R's: Reduce, reuse, recycle.

First, we need to focus on reducing our consumption. This means less waste overall, which is ultimately our goal!

After we practice that step, we need to focus on reuse. From the items that you did not eliminate from your lifestyle, how can you reuse or repurpose them to keep them from the landfill? (examples: coffee containers can be used to store things; plastic jugs can be used as a watering jug)

Finally, when you have done everything you can with the first two steps, you can recycle. Be sure to check out the recycling guidelines in your county or city. Some areas provide a picture ID of acceptable items because some things that you think are recyclable might not be. Also, keep an eye out for specific drop-off recycling days in your area that accept items that can't be picked up curbside. Some companies recycle items that generally can't be picked up during scheduled curbside pick-up days.

Something to think about:

Even if every manufacturer stopped producing plastic right now, plastic litter would still pose a huge threat to wildlife and the environment.

In Part 2 of the Problematic Plastic series, we will discuss related facts and issues.



### Challenge:

There are many instances when plastic is NEEDED. As an extension, list plastic items that you believe are irreplaceable. Discuss this list with your family or class and state why there cannot be a substitute.

For example, can items like surgical gloves and plastic syringes at hospitals be replaced? What did medical professionals use prior to plastics. What was the result and why?

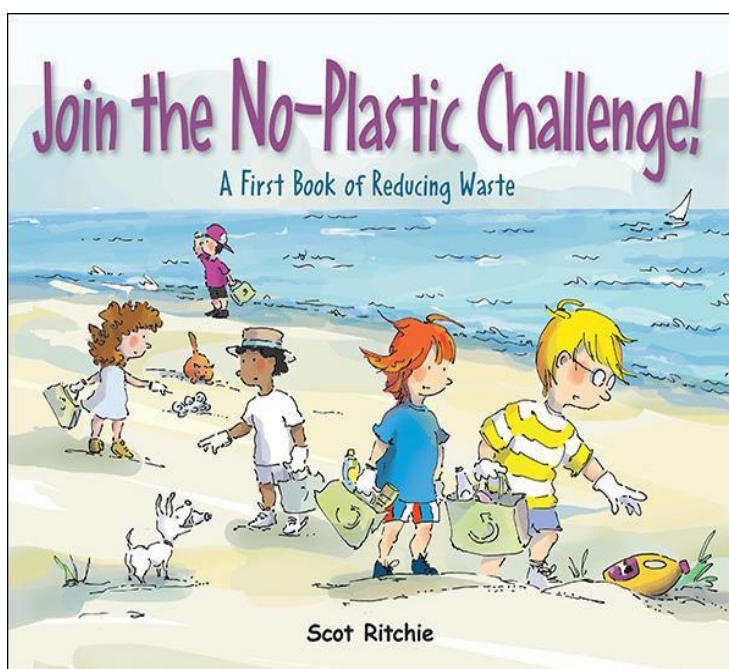
Participants can also select an industry or workplace and study their use of plastics. What did you discover?

### Related Books to Investigate



Plastic Past, Present, and Future by Eun-ju Kim (trans. Jounghmin Lee Comfort) (illus. Ji-won Lee)

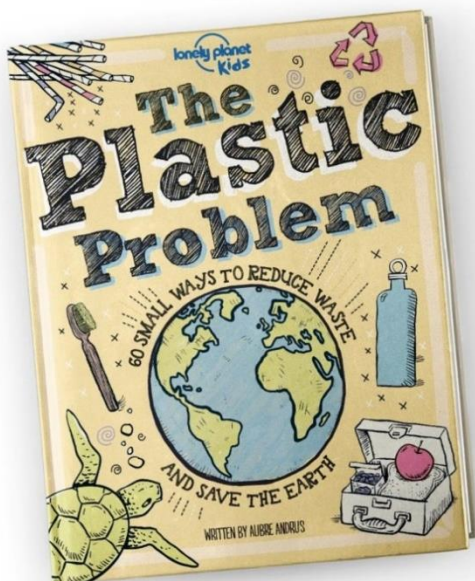
As states in one review...The book offers scenes to help kids digest the complex story of plastics .... Readers are encouraged to reduce single-use plastic consumption, to learn about innovative solutions from scientists and activists, and to acknowledge that eliminating plastics use is unlikely. It aims to make the topic of plastics accessible to a younger crowd beginning with a brief account of a wayward shipment of bath toys spilling into the Pacific Ocean and making their way across the globe.



Join the No-Plastic Challenge! by Scot Ritchie

For his birthday celebration, Nick has challenged his friends --- Yulee, Sally, Pedro and Martin --- to spend the day without using any single-use plastic. This means they use their own cloth bags for shopping, they say no thanks to plastic straws and, instead of balloons, they decorate with kites and streamers made of natural materials. The children discover that not using

plastic is not that hard. They also learn about what plastic is made of, how much of it surrounds us and how it's polluting our oceans and affecting the food chain. Most importantly, the five friends learn ways to use less --- including just saying NO! The book concludes with fun ideas for readers to do a No-Plastic Challenge of their own!



### The Plastic Problem by Lonely Planet Kids, Aubre Andrus

As described the author's summary: Look around you— plastic is everywhere! It's in your shoes, pens, toothbrush, car, toys, TV, water bottles, food packaging... It's almost impossible to get through one day without using it. And it's creating major problems for our world, our oceans, our animals and marine life, and ourselves.

In The Plastic Problem, learn how to become a 'plastic patroller' instead of a plastic polluter by learning about the easy ways you can cut plastic out of your life. The simple actions found in this practical guide will help you protect our world and inspire your friends and family to do the same. Tips include:

- Pack a zero-waste travel kit to help your family reduce its rubbish on trips
- Take better care of your clothes, swap items with friends, and get excited about hand-me-downs
- Switch your toothpaste for natural tooth powders and choose an electric, non-throwaway toothbrush
- Take your lunch to school in a reusable container and bring reusable cutlery
- Reduce the number of things you buy, reuse what you have, and recycle what you no longer need
- Take reusable bags to the supermarket or with you when you go shopping
- Think twice about single use bottled water and fruit juices



## Ideas for Using Student Learning Standards

The topic of plastics and the impact on the environment can certainly be treated in a multidisciplinary manner.

At the high school level, most local chemistry curricula include aspects pertaining to the composition of different types of plastic and how it is manufactured.

Human impact on earth's system is also a thread that continues for elementary to high school levels. And, through the students' ability to analyze and interpret data, models can be made and shown via various graphic displays. Importantly, students may also create solutions to the plastic problem that the earth currently faces. These solutions may include the formulation of models connected to engineering and technology applications.

Specifically, the following NGSS serve as examples:

### ***Students who demonstrate understanding can:***

**K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment. \*** [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<p><b>Science and Engineering Practices</b></p> <p><b><u>Obtaining, Evaluating, and Communicating Information</u></b></p> <ul style="list-style-type: none"> <li>Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.</li> <li>Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.</li> </ul>	<p><b>Disciplinary Core Ideas</b></p> <p><b><u>ESS3.C: Human Impacts on Earth Systems</u></b></p> <ul style="list-style-type: none"> <li>Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.</li> </ul> <p><b><u>ETS1.B: Developing Possible Solutions</u></b></p> <ul style="list-style-type: none"> <li>Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (<i>secondary</i>)</li> </ul>
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### 3.5: Engineering Design

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled.**  
Planning and Carrying Out Investigations
- Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
  - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

For more information about how to apply lessons such as this one to your own curriculum, contact Kate Reilly, Manager of Education, Duke Farms at [kreilly@dukefarms.org](mailto:kreilly@dukefarms.org).

## Problematic Plastic: An Overview Activity Sheet

### Plastics Evaluation

Take a walk around your home and search for at least 10 different plastic items: 5 that are single-use, and 5 that are reusable.

For single-use plastics: Do you need them? Can they be replaced with another item that isn't intended for single use? Or how can you repurpose these items to expand their life?

For reusable plastics: What do you think the longevity of this item is? A month? A year? 5 years? What is a non-plastic alternative to this item?

Single-use Plastic Item	Do you need this item? (Y/N)	How can it be replaced with a reusable item or repurposed?
Example: Water Bottle	No	I can buy a metal water bottle and repurpose plastic water bottles into bird feeders
1.		
2.		
3.		
4.		
5.		

Reusable plastic item	Lifespan of this product?	What is a non-plastic alternative?
Example: DVD case	60 years	I can download movies rather than buy a physical copy

1.

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2.

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3.

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4.

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5.

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