

# Cotton Science and Sustainability



## Dear Educator,

Take your students on a surprising journey from fashion to science! This free, standards-based teaching kit, made possible by Cotton Incorporated, the not-for-profit U.S. cotton research and promotion company, starts with something literally close to students' hearts — their clothing — and ends with a look at farming and recycling practices that help to sustain our environment and make our world a better place.

Designed for upper elementary school STEM classes, **Cotton Science and Sustainability** engages students in hands-on classroom lessons that will enhance your curriculum, and includes a fun video whiteboard activity that introduces students to some interesting and perhaps surprising facts about cotton — the most popular fabric on the planet.

We hope that you will share this program with other teachers in your school. Please return the enclosed reply card or comment online at [ymiclassroom.com/feedback-cotton](http://ymiclassroom.com/feedback-cotton) to provide your feedback. We look forward to hearing from you.

Sincerely,  
Dr. Dominic Kinsley  
Editor in Chief  
Young Minds Inspired

 Questions? Contact YMI toll-free at 1-800-859-8005 or by e-mail at [feedback@ymiclassroom.com](mailto:feedback@ymiclassroom.com).

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## Target Audience

Students in grades 4 to 6 and their families

## Program Objectives

- Help students learn about and evaluate the properties and benefits of cotton
- Teach students about cotton's value to the environment as a natural fiber
- Raise student awareness of sustainable practices adopted by cotton farmers
- Explore the versatility of cotton

## Program Components

- This one-page teacher's guide
- Three reproducible activity sheets
- A colorful classroom poster
- A whiteboard activity available at [ymiclassroom.com/cotton](http://ymiclassroom.com/cotton)
- A reply card for your comments, or comment online at [ymiclassroom.com/feedback-cotton](http://ymiclassroom.com/feedback-cotton)

## How to Use This Program

Photocopy the teacher's guide and the three activity sheets before displaying the poster. Review the websites and videos for use with each activity in advance. To review alignment with Common Core and Next Generation Science Standards, visit [ymiclassroom.com/cotton](http://ymiclassroom.com/cotton).

## How to Use the Poster

Display the poster and have students use the facts to create math word problems, e.g., If one bale of cotton can make 215 pairs of jeans, how many pairs can three bales make? Collect students' word problems to create a class quiz. As an extension, have students calculate what fraction or percentage of a bale of cotton produced the number of pairs of jeans worn by students in the classroom.

## How to Use the Whiteboard Activity

**Cotton: From Farm to Fashion to Food**, available at [ymiclassroom.com/cotton](http://ymiclassroom.com/cotton), is an interactive video-based quiz that takes students on an amazing journey to find out how cotton is used beyond clothing — from providing insulation for homes to feeding people. Share the activity on your whiteboard, or have students explore the activity on a home computer or mobile device.

## Activity 1

### The Fiber Factor

Ask students if they're familiar with ingredient labels on foods. Did they realize clothing also has a similar label? Just as the ingredients in food can determine how tasty or nutritious something is, the ingredients on a clothing label can determine how it feels, how to care for it, and how it will wear. Do the "ingredients" they are wearing help or hinder their fashion style or comfort?

Introduce the idea that cotton, found in many types of clothing, is a natural fiber grown by farmers, not synthesized from chemicals or made from crude oil. Ask students to watch the *All the Reasons Why Damsel in Dior Loves Cotton* video at [youtube.com/watch?v=vKtE5qyROgw](http://youtube.com/watch?v=vKtE5qyROgw) (1:19 minutes) and consider: What properties or characteristics of cotton would influence someone to choose clothing made from it?

Then have students share their thoughts, e.g., cotton is natural, breathable, durable, and comfortable, and can be rugged, yet still soft — like their favorite pair of jeans. Cotton also absorbs water and sweat.

Have students complete the activity sheet in small groups, pointing out the directions on the bottom to be taken home to their parents.

**Answers:** Part 2. C - 1, 3, 5; S - 2, 4.

## Activity 2

### Break It Down!

Have students recap the characteristics of cotton that they learned in Activity 1. Then explain that our clothes can shed microfibers when we wear and wash them. These tiny microfibers get into water through the washing machines and can accumulate in wastewater treatment plants, freshwater, and even seawater environments, potentially harming the ecosystem. Once in the water system, these microfibers break down at

different rates depending on the fabric and the environment they are in (i.e., sea versus fresh water). For cotton, this process is called *biodegradation*.

Explain that the cotton industry worked with North Carolina State University to determine how quickly microfibers of cotton, rayon (a manufactured fiber made from wood), polyester (a synthetic fiber made from crude oil), and cotton/polyester blends biodegrade in aquatic environments. Can students predict the results?

Distribute the activity sheet, review the directions, and have students use the graphics to complete the activity. **Answers:** Part 1. T; F-polyester degrades at 4% in seawater; T; F. Part 2. Answers will vary.

Explore the results between the microfibers of different fabrics. Ask students to think about why materials decompose. Explain that bacteria, enzymes, and marine fungi in water break down the biodegradable microfibers shed into water systems through washing machines. Since cotton is mostly made up of cellulose, a naturally occurring sugar-based compound, it is more easily broken down. Synthetic fibers, such as polyester, do not biodegrade as easily. As a regenerated cellulose from wood pulp, rayon also breaks down relatively quickly, although not as quickly as 100% cotton.

## Activity 3

### Cotton and the Planet

Taking care of the environment is important to the cotton industry. Cotton farmers and producers adopt practices to increase cotton production sustainability, which means they farm and manufacture cotton in ways that help conserve our planet and its natural resources. Ask students how their families do this. For example, maybe they turn off the water when they brush their teeth, or compost or recycle.

Show students the *Cotton and the Planet* video at [youtube.com/watch?v=zt2D8x1UtFo](http://youtube.com/watch?v=zt2D8x1UtFo) (1:17). Distribute the activity sheet and divide the class so that each group researches sustainable cotton farming practices in one of three areas — water, soil health, or land — and then creates a summary presentation. Examples: Water — Most cotton in the U.S. is grown with just rainwater; Soil health — Improved cotton varieties now defend against the boll weevil, which destroyed crops in the past in the U.S.; Land — In the U.S., twice the cotton is grown on the same amount of land as 40 years ago due to improved farming practices. Have students share their slideshows once done.

## Resources

- [thefabricofourlives.com](http://thefabricofourlives.com)
- [ymiclassroom.com/cotton](http://ymiclassroom.com/cotton)

## ACTIVITY 1

# The Fiber Factor



REPRODUCIBLE MASTER: G4-6

**Food can be tasty or nutritious depending on the ingredients.** Clothing has ingredients, too. Clothing ingredients can be natural, meaning they occur in nature, or synthetic, meaning they are manufactured from chemicals or other sources such as crude oil.

**Part 1:** Look at these two clothing labels from different shirts. Each label lists the fiber ingredients in the shirt. Check out the link at <https://thefabricofourlives.com/the-benefits-of-cotton>. Then answer the questions.



Shirt #1



Shirt #2

1. Which shirt is made of all-natural fibers? What are the “ingredients” in that shirt?

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2. Which shirt is made of synthetic fibers? What are the “ingredients” in that shirt?

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3. Thinking about what you learned from the websites about the properties of fibers, which shirt best fits your style, and why?

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**Part 2:** For each of the statements below, write a C for “cotton” or an S for “synthetic” to show which type of fabric best answers the question.

1. It’s a hot, humid day. Which fabric breathes to help keep you cool?

2. You are performing on stage and want to avoid embarrassing static cling. Which fabric will you also want to avoid?

3. You’ve been up late doing homework, and you need a good night’s sleep. Which sheet fabric will help you best catch some zzzz’s?

4. It’s time to run the marathon! You grabbed some sweats, but can detect an aroma that never washes out. What type of fabric is in your clothing?

5. You are headed to the store to buy a durable pair of jeans. What fabric is the only *real* denim?

**Part 3:** Show off your style! You need an outfit for a fall festival, where it could be chilly or warm, sunny or damp. On the other side of this sheet, design your outfit, and describe how the fibers can keep you comfortable in unpredictable conditions. Don’t forget options like the ability to add or remove layers as the temperature changes during the day.

## What’s your style?

Check your closets! Write down the different types of fibers you find on up to five of your clothing labels. Bring the list back to class and compare results. Which fibers were most common, and which were least common? Discuss the benefits and pitfalls of the fibers you found.



## ACTIVITY 2

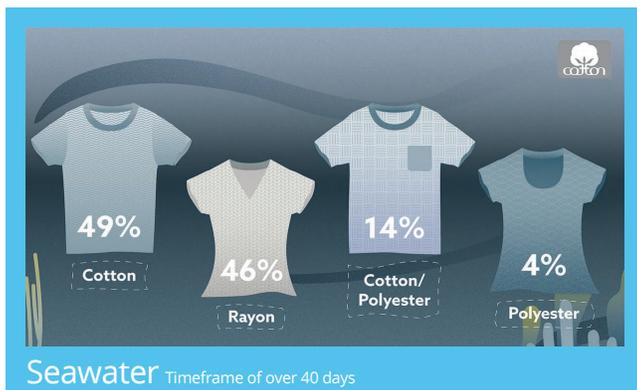
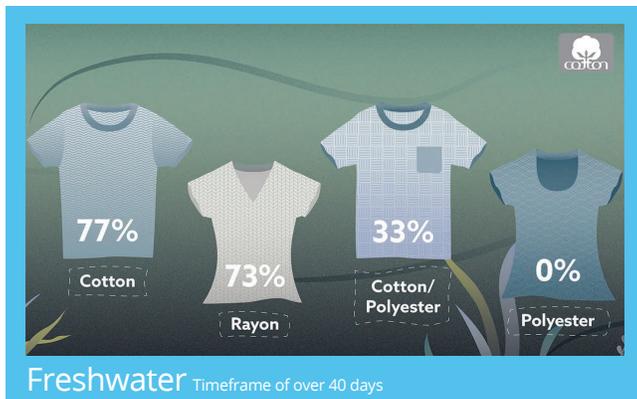
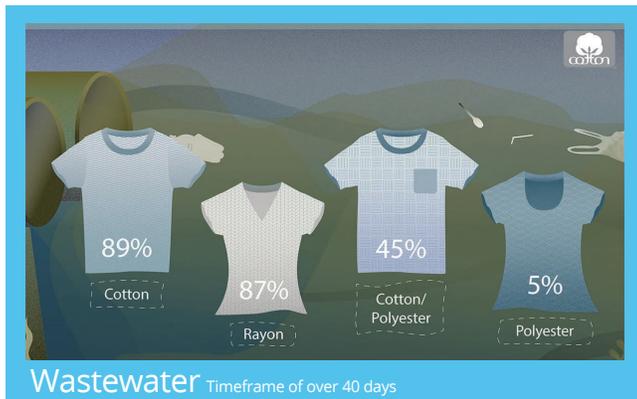
# Break It Down!



REPRODUCIBLE MASTER: G4-6

**Our clothes can shed microfibers when we wear and wash them.** These tiny fibers can find their way into our water systems through washing machine drains. If they build up in freshwater and seawater environments, they could even harm the ecosystem.

The cotton industry and North Carolina State University did a study to examine how textile microfibers break down or biodegrade in aquatic environments for more than 40 days. They compared cotton, rayon (a manufactured fiber made from wood), polyester (a synthetic fiber made from crude oil), and cotton/polyester blends.



Use the information you learn from the graphics at left to answer these questions.

**Part 1:** Write T for true or F for false in the boxes beside each statement.

Cotton microfibers degrade faster in freshwater than in seawater environments.

Polyester microfibers did not degrade in freshwater or seawater over a period of 40 days.

During the 40-day test, polyester microfibers degraded 5% in wastewater.

Overall, cotton/polyester blends degraded more rapidly than rayon microfibers.

**Part 2:** Now answer these questions:

1. Why do you think the cotton microfibers degraded more rapidly than the cotton/polyester microfibers?

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2. How could an awareness of this degradation process help influence clothing choices?

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Source: Zambrano, M. C., Pawlak, J. J., Daystar, J., Ankeny, M., Goller, C. C., & Venditti, R. A. (2020). Aerobic biodegradation in freshwater and marine environments of textile microfibers generated in clothes laundering: Effects of cellulose and polyester-based microfibers on the microbiome. *Marine Pollution Bulletin*, 151 (February). <https://doi.org/10.1016/j.marpolbul.2019.110826>

### ACTIVITY 3

# Cotton and the Planet



REPRODUCIBLE MASTER: G4-6



**Become a cotton expert!** Do some web research to find out what U.S. cotton farmers are doing to help take care of the environment. Then share what you find with your class.

Your teacher has assigned your group to research sustainable cotton farming practices in one of three areas: water, soil health, or land. What is your group's topic?



**Part 1:** Do your research using these sources, then answer the questions below.

- Water Management: [cottontoday.cottoninc.com/cotton-production/water](http://cottontoday.cottoninc.com/cotton-production/water)
- Soil Health: [cottontoday.cottoninc.com/our-sustainability-story/land/soil-health/](http://cottontoday.cottoninc.com/our-sustainability-story/land/soil-health/)
- Land Use: [cottontoday.cottoninc.com/cotton-production/land](http://cottontoday.cottoninc.com/cotton-production/land)

1. How is your topic important to cotton growth or production?

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2. List four important facts about your topic:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

3. How do sustainable farming practices in your topic area help the environment?

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4. What did you find most interesting or surprising?

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**Part 2:** Now, with your group, create a PowerPoint or slideshow presentation to teach the other groups what you have learned. Create one slide for question #1, four slides for question #2 (one for each fact), one slide for question #3, and one slide for question #4, for a total of 7 slides. Then share your presentation with the rest of the class!



**No lesson is complete without a quiz!**



Using what you've learned, create a quiz to test your peers on their knowledge about cotton farming today. Consider taking your quiz home to challenge your parents, too!

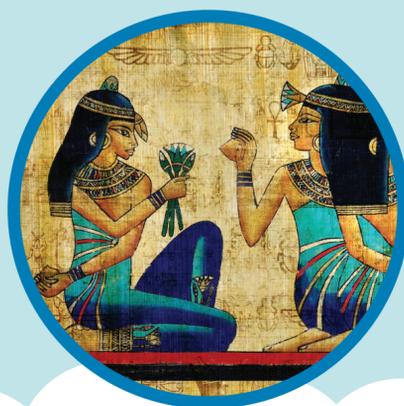
# Count on Cotton

Check out these fun facts to discover what makes cotton so unique!

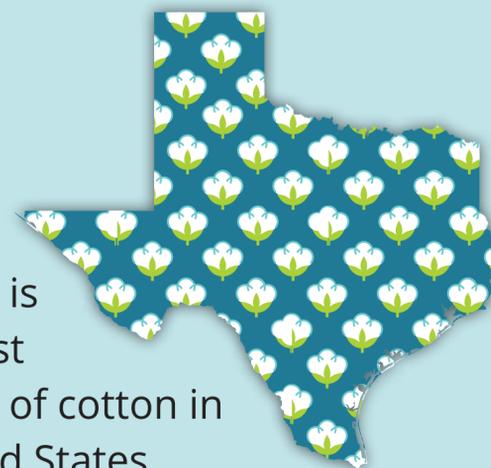


1. Cotton is natural and grown from the Earth.

2. Cotton has been grown and used to make fabric for at least 7,000 years.



3. Texas is the largest producer of cotton in the United States.



× 17,500,000

4. In 2021, 17,500,000 bales of cotton were produced in the United States. One bale of cotton weighs approximately 480 pounds and can make 690 bath towels or 215 pairs of jeans.

5. In 2021, 537 million pairs of adult and kids' jeans were sold in the United States.



6. The U.S. dollar bill contains 75% cotton. One bale of cotton can make 313,600 \$100 bills.

7. Cottonseed oil is used as an ingredient in bread, cereals, and snacks, including potato chips.



8. Scientists have found a way to make cottonseed edible for humans, which could make it an inexpensive food source for millions of people around the world.