

Woolly Wonders

Exploring Sheep, Wool, and Micron Counts Across the Globe

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Sheep Curriculum: <https://tinyurl.com/sheepzone>

Learning Objectives

Students will:

1. Describe the process of wool production, including its properties, measurements, and uses in various industries.
2. Explain how biogeography influences sheep breeds, wool characteristics, and micron counts, shaping global wool markets.

Curriculum is designed for middle school aged and adaptable for high school students.

Duration: 90 minutes (each unit is ~45 minutes)

Preparation and Supplies:

- **Presentation:** Open the “Woolly Wonders” PowerPoint presentation to aid in discussion.
- **Wool Samples:** provide wool samples of different micron counts for hands-on comparison (links to purchase are included below).
- **Global Wool Map:** print one map per student or group. Alternatively, students can use the interactive Story Map (<https://arcg.is/1fbTa1>)
- **Wool Buyer Scenarios:** Print and cut out one set of “**Wool Buyer Scenarios.**” If you have more than 20 students, print additional copies so everyone can participate.
- **Research Materials:** students will need to research their selected sheep breed. If possible, provide access to computers or other research tools.

Introduction (10 minutes):

- Begin the lesson by engaging students in a discussion about wool.
- Invite the class to share their experiences with wool.
- Ask a question such as:

How do we use wool?

Why might different regions around the world have different breeds of sheep and types of wool?

- Answers may include:
 - Wool uses: clothing and textiles (e.g., apparel, blankets), home goods (e.g., rugs, bedding, etc.), fertilizers, and more.
 - Warmer climates tend to have lighter, finer wool fibers to prevent overheating.
 - Higher altitudes (or mountainous regions) with colder temperatures often develop thicker, more insulated wool fibers to protect against harsh weather.
 - Cultural traditions may influence sheep breeding for specific wool characteristics. For example, some cultural preferences for wool color (natural whites, browns, and grays) can lead to selectively breeding that enhances these traits.
- Show pictures of various sheep breeds or samples of different wool fibers.
- Explain that today’s lesson will explore why sheep in different places have different types of wool, and how we measure and describe these differences.

UNIT 1: WONDERS OF WOOL—FROM SHEEP TO FABRIC

Covers wool production, properties, measurement, and uses.

What is Wool? (5 minutes)

- Explain that wool is a natural fiber that comes from the fleece of animals like sheep, goats, and alpacas. Emphasize the importance of wool in various industries, including fashion, textiles, and insulation^{2,3,7}.
- Discuss the unique properties of wool, such as warmth, moisture-wicking, and durability¹.
 - **Warmth:** Wool insulates animals in cold climates. This same warmth can be felt by you when using wool products, such as sweaters and blankets².
 - **Moisture-Wicking:** Each wool fiber has an outer layer of overlapping scales, covering a moisture absorbent interior. This structure allows wool to absorb moisture away from the animal's body or environment and then release it into the air (i.e., evaporate), keeping the animal dry and comfortable. This is same for wool wearers!⁷.
 - **Durability:** Wool fibers are naturally strong and flexible due to their unique protein structure, which contains over 20 amino acids. This unique structure gives wool flexibility and strength (e.g., withstand stretching, bending), making it tough enough to withstand wear and tear.
 - **Natural Fire-Resistance:** Wool is naturally fire-resistant⁷ due to its unique protein structure. Unlike many other materials, it does not easily catch fire and will self-extinguish when the flame source is removed.
 - **Fashion and Textiles:** Wool is a versatile natural fiber used to create everything from soft, fine fabrics for clothing to durable materials for carpets and upholstery. In fashion, wool is often associated with luxury and quality. It can be dyed in various colors and textures, offering endless creative possibilities in design.
 - **Natural and Sustainable:** Wool is a renewable, biodegradable resource, making it an eco-friendly alternative to synthetic fibers.

How is Wool Produced? (5 minutes)

Step 1: Wool Growing—Taking Care of Sheep

Wool doesn't just magically appear in stores; it starts with raising and managing sheep, a practice known as **husbandry**. Ranchers ensure high-quality wool by providing excellent care, including:

- **Breeding**—Selecting sheep with the right genetics to produce lambs with desirable traits, such as soft and fine wool.
- **Feeding and Grazing**—Providing a balanced diet to keep sheep healthy and their wool strong.
- **Herding**—Moving sheep to fresh pastures for better nutrition and safety.
- **Veterinary Care**—Treating illnesses and keeping sheep in top condition.

Step 2: Harvesting—Shearing the Wool

Once the wool has grown, it is harvested through **shearing**, which is like giving a sheep a haircut. Instead of scissors, shearers use electric clippers to carefully remove the fleece. To maintain wool quality, shearers follow a specific order. Belly wool is removed first, leg and body wool next, finally, the head is sheared^{5,8}. Shearing is important for the sheep's health and comfort. While they may not love the process, it helps them stay cool in warm weather and prevents overgrown wool from becoming too heavy or dirty.

Step 3: Preparation—Getting Wool Ready for Use

Before wool can be turned into products, it must be cleaned and sorted through several steps:

- **Sorting and Grading**—Classifying wool based on color, length, and cleanliness to ensure the right wool is used for the right products.
- **Scouring**—Washing wool to remove dirt, grease, and other impurities, making it ready to spin into yarn, woven into fabrics, or knitted into cozy garments.
- **Pressing**—Compacting wool fibers into bales for easier storage, transport, and sale⁸.

Step 4: Production—Turning Wool into Products

Once the wool is clean, it's transformed into useful products through several key processes:

- **Combing**—Aligning the fibers and removing any remaining debris.
- **Spinning**—Twisting wool fibers into strong, durable threads.
- **Manufacturing**—Weaving, knitting, or felting wool into clothing, blankets, and more⁸.

Step 5: Retailing—Bringing Wool Products to You

Finally, wool products are distributed and sold in stores and online:

- **Distribution**—Shipping wool products from factories to stores worldwide⁸.
- **Selling**—Wool items are sold in clothing stores, online shops, department stores, and specialty boutiques.

Understanding Micron Counts (5 minutes)

- Introduce the concept of micron counts as a measurement of wool fiber diameter, or thickness^{5,9}. A micron is equal to one-millionth of a meter⁹.
- **How is Micron Count Measured?**
 - Wool fineness is determined by measuring the diameter of many individual fibers from a representative sample.
 - This measurement is typically done using specialized instruments such as an optical microscope or an electronic fiber diameter analyzer^{5,6}.
 - Share other ways sheep wool is measured.
 - **Staple Length** – Staple length is measured while the wool is in its raw form using a machine called the ATLAS (Automatic Tester of Length and Strength). It is a measure of the length of the wool after it has been sheared, often in millimeters².
 - **Staple Strength** – Staple strength measures how much force is required to break a bundle of wool with a given thickness. It is important to measure staple strength, because if the wool is too weak, it won't be able to undergo combing and spinning and should be discarded beforehand. Staple strength is often measured in Newtons².
 - **Yield** – Yield estimates the amount of wool remaining after being cleaned. Sheep wool can contain contaminants such as plant material and dust that add extra weight to wool in its raw form. Yield can be measured in kilograms².
 - **Crimp** – Crimp refers to how much individual fibers in the wool curl, or the natural waves and kinks in wool fibers. Wools with more crimp are more elastic, allowing them to stretch and rebound more^{2,9}.

- Discuss how micron counts affect the quality and softness of wool products. Lower micron counts indicate finer, softer wool, which is less likely to cause itching, while coarser wool has a higher micron count².
- **Why is Micron Count Important?**
 - Micron counts are crucial in determining the commercial value and appropriate applications.
 - Finer wool (lower micron count) is softer, more comfortable to wear, and less likely to cause itching or irritation. It is also more valuable and often used for high-end clothing like suits and sweaters.
 - Coarser wool (higher micron count) is used for durable products like carpets, upholstery, and outerwear.

Hands-On Activity—Comparing Micron Counts (15 minutes)

- Provide students with wool samples of different micron counts.
- Instruct students to examine the samples and share their observations.
- Encourage them to compare the softness, thickness, and overall quality of the wool.
- As a group, students should discuss the differences and similarities they observe between the samples. Then, have them rank the wool from softest to coarsest.

Helpful links for purchasing wool samples:

- Namaste Farms (<https://www.namastefarms.com/breed-sampler-boxes/>)
- Wildwood Farms (<https://www.wildwoolfarm.com/product-page/natural-wool-sampler>)
- Paradise Fibers (<https://paradisefibers.com/pages/search-results-page?collection=sheep-breed-specific-fiber>)
- Clemes (<https://clemes.com/product-category/good-clean-fiber/fleece/>)

Reflection and Conclusion (10 minutes)

- Come back together as a class and discuss key concepts learned throughout the lesson. Allow each student 3-4 minutes to share what they learned with the person sitting next to them.
- Answer any questions students may have about wool and micron counts.

Vocabulary:

1. Crimp: The extent to which individual wool fibers curl.
2. Husbandry: the care, cultivation, and breeding of animals and crops.
3. Micron counts: A measure of the average diameter of wool fibers.
4. Pressing: Wool fibers are compacted together into bales or packages for storage, transportation, or sale.
5. Scouring: The process of cleaning contaminants such as plant material, dust, and bacteria from wool.
6. Staple: A lock of wool.
7. Staple length: A measure of the length of the wool after it has been sheared, often in millimeters.
8. Staple strength: Staple strength measures how much force is required to break a bundle of wool with a given thickness, often in Newtons.

UNIT 2: SHEEP BIOGEOGRAPHY—HOW ENVIRONMENT SHAPES BREEDS AND WOOL

Explore how geography, climate, and environment influence sheep breeds, wool characteristics, and micron counts.

Sheep Biogeography (10 minutes)

- Introduce the concept of biogeography and its relevance to sheep distribution. Ask the students what the individual roots “bio,” “geo,” and “graph” mean to help them understand the definition as a whole.
 - **Bio** = Life
 - **Geo** = Earth
 - **Graph** = Write or Describe
- **Biogeography** is the study of the distribution of life across space and how it has changed through time⁴.
- Discuss how environmental factors, such as climate and geography, can also impact wool characteristics, including micron counts².
 - **Climate:** Sheep living in colder regions, such as those found at high altitudes or in the north, tend to grow wool with finer fibers and more crimp, which contributes to its softness and warmth. In contrast, sheep in warmer or more arid regions may produce coarser wool with larger fibers and less crimp⁷.
 - **Vegetation and Diet:** Different regions offer varying types and qualities of forage, which can influence the nutritional composition of a sheep’s diet. Nutritional factors affect the growth and development of wool fibers, resulting in variations in fiber thickness, strength, and overall quality⁷.
 - **Genetic Adaptation:** Over time, sheep populations have adapted genetically to their specific environments. Natural selection has played a role in shaping the wool characteristics of different sheep species. Breeds that have been selectively bred or naturally adapted to specific geographical regions may exhibit distinct wool properties, including micron counts, crimp, staple length, and color¹⁰.

Hands-On Activity—Sheep Wool Around the World (20-25 minutes)

Students apply knowledge of wool characteristics to real-world scenarios.

- Distribute the “**Global Wool Map: Common Sheep Breeds and Their Journeys**” map (or use the StoryMap).
- Explain that different sheep breeds are found in unique regions around the world and that different breeds of sheep are bred to have wool with unique characteristics for various purposes. Factors like micron count, staple length, crimp, and durability determine how wool is used in industries.
- **Instructions:**
 - Divide students into small groups (2-3 students).
 - Each group represents a wool buyer looking for the right wool for their company’s needs. Assign or allow each group to choose one of the 10 wool buyer scenarios (e.g., a luxury fashion designer, a military supplier). *The scenarios are listed below and are also available as a printable PDF on the website.*

- Analyze the map and select a breed:
 - Groups examine the sheep biogeography map to find breeds that match their wool needs. Consider environmental factors such as how does geography impact wool characteristics?
- Research: once students select a sheep breed, they spend 5-10 minutes researching it further (suggested resources: online sources—trusted livestock databases, breed registries, agricultural websites; textbooks or reference guides).
- Make a decision: based on both the map and research, groups finalize their best sheep breed(s) choice for their scenario. They must explain their choice based on micron count, durability, or other properties.
- Present and discuss: each group presents their chosen breed, reasoning, and new facts from their research to the class. As a class, compare decisions and discuss how geography influences wool types and industry applications.

Vocabulary:

1. Biogeography: The study of the distribution of life across space and how it has changed over time.

Sheep breeds highlighted in the “Global Wool Map: Common Sheep Breeds and Their Journeys” map.

- **Merino:** Known for its fine and soft wool. It originated in Spain and is still prominent in countries like Australia, New Zealand, Argentina, and South Africa. Micron count: 11.5-26 microns.⁹
- **Rambouillet:** Originated in France. It produces fine wool that is great for insulating and is found predominantly in France and the United States. Known for their hardiness and their ability to graze western rangelands. Micron count: 18-24 microns.⁹
- **Border Leicester:** This breed originated in England and is renowned for its long, lustrous wool with good spinning properties. It is prominent throughout the United Kingdom, Australia, and New Zealand. Micron count: 29.25-40 microns (variable by geographic location and breeder).^{9,11}
- **Romney:** The Romney breed, hailing from England, is valued for its versatile wool, which is suited for a wide range of applications including apparel, handspinning, felting, carpet- and rug-making, upholstery and interior textiles, and arts and craft projects. This breed is particularly prominent in the United States and New Zealand. It was named after the Romney Marsh in southeast England, pointing to its ability to grow high-quality wool in damp conditions. Micron count: 29-37 microns.^{9,11}
- **Shetland:** This breed, native to the Shetland Islands of Scotland, produces fine wool with a wide color range, from white to brown to black. Shetland sheep are also found in North America and Australia. Micron count: 20-30 microns.^{9,11}
- **Suffolk:** This breed was developed in England and is primarily known for its meat production. However, it also has medium-coarse wool fleece, valued for its durability. It is common across the United Kingdom and the United States. Micron count: 25-33 microns.^{9,11}
- **Karakul:** This breed originated in Central Asia and is prominent in countries like Afghanistan, Iran, and Russia. It is valued for its uniquely strong wool fibers. Karakul sheep are also known to be a resilient breed that can withstand harsh, arid climates. Micron count: 25-36 microns.⁹
- **Hampshire:** Another breed with origins in England, Hampshire is one of the most popular sheep breeds in the world. Hampshire fleece is known to be strong and springy. Micron count: 24-33 microns.^{9,11}
- **Columbia:** This was the first sheep breed to originate in the United States. Columbia wool is made of fine fibers and can be white or brown. Micron count: 23-31 microns.⁹
- **Cormo:** Originating in Australia, this breed is known for its fluffy wool, ideal for lace patterns and gentle-touch baby clothes. Today Cormo sheep are also common in the United States. Micron count: 17-23 microns.⁹
- **Junin:** This breed originated in the high-altitude regions of the Peruvian Andes and have adapted well to the harsh conditions of the highlands, including cold temperatures, high altitudes, and rugged terrain. They have a dense fleece and robust build.¹²

There are an estimated 500 breeds of sheep worldwide¹³. Explore more breeds from our list or create your own!

- American Miniature Cheviot
- Badget Face Welsh Mountain
- Beulah Speckled Face
- Balwen Welsh Mountain
- Black Welsh Mountain
- Bleu du Maine
- Bluefaced Leicester
- Boreray
- British Milk Sheep
- California Red
- Cambridge
- Castlemilk Moorit
- Charollais
- Clun Forest
- Derbyshire Gritstone
- Dorset Horn
- East Friesian
- Exmoor Horn
- Finnsheep
- Herdwick
- Icelandic
- Jacob
- Navajo Churro
- Pelssau
- Polypay
- Rough Fell
- Rya
- Scottish Blackface
- Shropshire
- Swaledale
- Targhee
- Teeswater
- Wensleydale
- Zwartbles

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Wool buyer scenarios:

- 1. Luxury Clothing Designer**—A high-end fashion brand in Italy is launching a new collection of soft, lightweight wool suits. They need the finest, most comfortable wool available. What sheep breed should they buy from?
- 2. Outdoor Gear Manufacturer**—A company that makes cold-weather hiking and skiing gear needs warm, insulating wool that performs well in extreme conditions. Which breed's wool should they choose for their jackets and base layers?
- 3. Rug and Carpet Manufacturer**—A home goods company is looking for strong, durable wool for handwoven rugs and carpets that can withstand high foot traffic. Which sheep breed's coarse wool would be the best choice?
- 4. Historical Clothing Supplies**—A museum in Scotland is recreating traditional medieval wool garments for an exhibit. They need a breed with historically significant wool that was used in cloaks and kilts centuries ago. Which breed should they select?
- 5. Wool Blanket Producer**—A small business wants to produce warm, thick wool blankets that are cozy, soft, and durable for long winters. What breed's wool will keep people warm on cold nights?
- 6. Fire-Resistant Workwear Manufacturer**—A company is making flame-resistant wool uniforms for firefighters and welders. They need wool that is naturally fire-resistant and breathable. Which sheep breed's wool is best for safety gear?
- 7. Hand-Spinning and Knitting Store**—A fiber arts shop specializes in hand-spun wool for knitting and felting. Customers love soft, fine, easy-to-spin wool in natural colors. What sheep breed's wool would be ideal for their craft-loving customers?
- 8. Military and Survival Gear Supplier**—A government agency is looking for durable, moisture-wicking wool for military base layers and socks for soldiers in cold climates. Which wool type will provide warmth and durability?
- 9. Upholstery Fabric Manufacturer**—A car company is developing wool-blend fabric for luxury vehicle seats. The wool must be strong, breathable, and resistant to wear and tear. Which sheep breed produces wool that's durable enough for upholstery?
- 10. Eco-Friendly Insulation Company**—A green building company wants to use natural wool insulation in sustainable homes. The wool must be thick, crimped, and able to trap air for insulation. Which sheep breed's wool would work best for home insulation?