REIMAGINE WOOL

DIGITAL POSTER CONTEST

Finalist Posters

Wool is the Miracle Fiber!
Right now, there is untapped potential with millions of pounds of American wool being underutilized.

Innovative ideas were submitted for >25 micron wool that showcases a new use, twist on a current product, or a new method of processing.

Winner received
$1,000
+ Networking Opportunities

Congratulations 2026 Winner:
Center, CO Conservation District

AMERICAN WOOL

ASI

www.sheepusa.org/reimagine-wool-digital-poster-contest

Wool Erosion Mat

A revolutionary product that tackles the issue of soil erosion and uses underutilized American wool .

“An estimated 36 billion tons of soil is eroded per year”

-globalsoildiversity.org

Benefits:

- Environmentally safe
- All natural
- Utilizes wool
- Can be left in place forever
- Doesn’t require washed wool
- Prevents erosion

Materials & Process:

- Unwashed wool
- Twine or yarn

Lay the wool in mats and weave it together with the twin or yarn. It will felt with time, repel water, and prevent erosion.

Description:

Wool erosion mats will be woven from unwashed, >25 micron count wool by weaving it together with twine or yarn. These wool mats can be produced in a variety of sizes and can be used to reduce the effects of wind and water on soil by covering at risk areas such as river banks or slopes.

Why?

This product is a way to use unwashed, undervalued wool and also benefit the earth. The unwashed wool can put nutrients into the soil, will self felt with weathering which will increase its soil holding capacity, is cost effective to make, and is all natural.

UPCYCLED REGARDLESS

USING A LOW-TOXICITY ENZYMATIC PROCESS.

Wool is a remarkable material, possessing unique properties. Its most familiar application is in fashion; however, for a substantial portion of the annual American production, this market remains inaccessible. Unlike superfine wools, fibres with diameters exceeding 25 µm often lack viable value-adding pathways due to certain aesthetic limitations - such as coarse scales, irregular fibre diameters, and occasional brittleness. This represents a significant waste of potential: a high-quality raw material, the pride of national farming communities, and the underutilized co-product of a well-established meat industry.

For these coarser fibres as for post-consumer wool, the challenges are similar - to sum it up: the condition of the fibre is not suitable for fashion, especially in a competitive market flooded by synthetic alternatives. Fortunately, wool is made of proteins: enzymatic chemistry can unlock a variety of applications that reveal its full potential, and valorize its many qualities.

METHOD

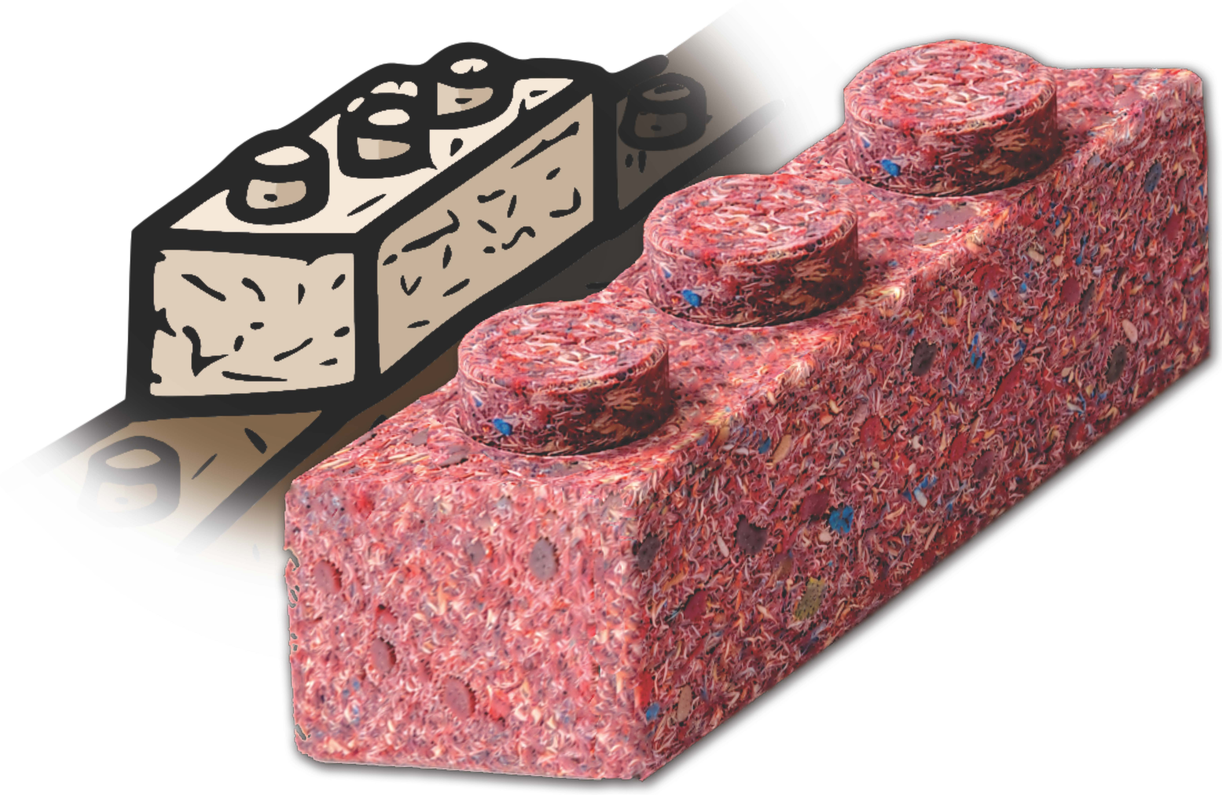
A reducing agent, such as the non-toxic amino acid **L-cysteine**, can erode wool's protective cuticle and open the access to the fibre core's. Then, a **protease** - a digestive enzyme like the one used by wool's natural decomposers in the soil - can solubilize the inner regions.

Once all wool material is dissolved and dried into a powder, it can be regenerated into new shapes of our choice. To rebuild the previously cleaved bonds within the fibre's protein chains, another enzyme can be used: **transglutaminase**, which naturally contributes to the fibre's growth in the sheep's hair follicle. This cross-linking compound regenerates strong, cohesive and smooth wool-based structures.

Resorting to enzymes is an optimal choice: they are inexpensive, effective in small quantities (< 20% w/w), and deactivated into an inert compound simply by heating the solution to 176°F.

By following this simple and easily upscaled protocol, it is possible to build wool-based bricks, pads or moldings for indoor builds.

The perks? Plenty! Regenerated wool preserves most of its native physical properties: insulation - thermal (cold or hot), but also acoustic, fire-resistant, antimicrobial, non-toxic (no microplastics or resin volatilisation), lightweight and eventually, biodegradable.



Besides, regenerated wool keeps its native color: raw fibres' natural pastels or recycled fabrics' vivid shades.

Southern Colorado Wool Pellet Project

An agricultural wool pellet application study

Developed by the Center Conservation District

Introduction

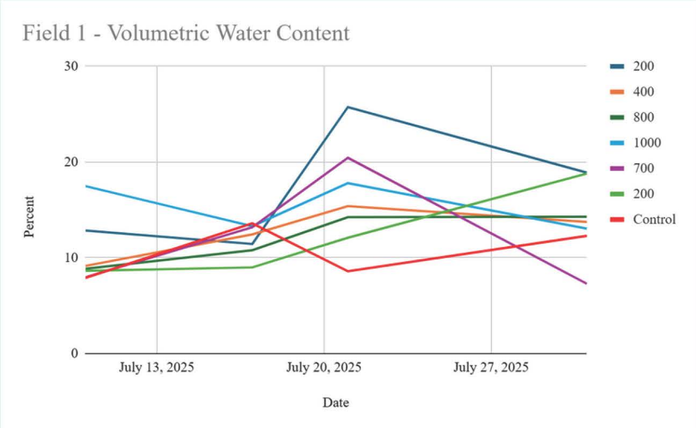
The Southern Colorado Wool Pellet Project (SOCOWPP) was developed as a research study to determine the efficacy of wool pellets as a means of increasing the soil moisture holding capacity and organic matter in agricultural applications while providing a unique market for local sheep growers.

Methodology

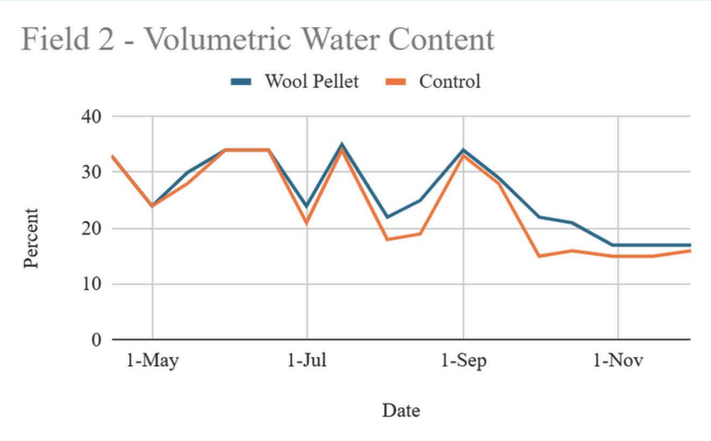
There are three components of the SOCOWPP:

1. **Field Trials**: The SOCOWPP just concluded its second year of field trials, with three fields involved in the study. Each field was monitored for soil moisture levels, tested different application rates, and performed the study using varying soil types and crop structures.
2. **Business Planning:** Building a market for the wool pellets in the agricultural industry is key to the project's longevity. The SOCOWPP has determined the following necessities for its business plan: the target supply chain, value proposition, market analysis, and a revenue model.
3. **Engineering:** To ensure that wool pellets are being made to a standard that can withstand agricultural equipment, the SOCOWPP's team of engineers has been developing prototype mill equipment to produce pellets with high integrity.

2025 Study



Field 1; Located: Center, CO; Potato Crop; Sandy Loam Soil



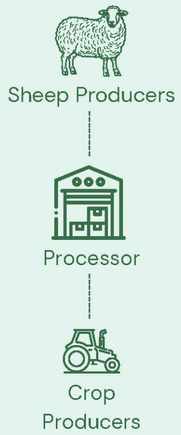
Field 2; Located: Rocky Ford, CO; Oat Crop; Clay Loam Soil

Engineering

The current most common use for wool pellets is in horticultural settings. With the assistance of our engineering committee and staff at Colorado Mill Equipment and Rapid Granulator, our prototype equipment will generate a pellet that is more durable and compact than standard wool pellets, which will allow them to be applied using agricultural equipment. These pellets will be created using unwashed, commercial wool and will be 75-95% wool, depending on the amount additive for soil conditioning and pellet integrity.

Field 3 in Center, CO. Wool pellets were combined with seed and drilled directly into rows

Target Supply Chain



Purpose

The Rio Grande and Arkansas River basins are facing severe drought conditions. Combined with groundwater irrigation withdrawals and depleting aquifer levels, many producers, especially in the San Luis Valley, face permanent well retirement. To remedy this and build a new market for unwashed, "undesirable" wool for our local sheep growers, the SOCOWPP was created.

Market Analysis

Wool pellets hold up to 25% of their weight in water, provide an NPK of 9-0-2, improve soil porosity, and release up to 50% of their weight in Carbon that stays in the soil. Improving soil health and water retention with wool pellets can drastically reduce input costs for the crop producer while also providing an outlet for excess wool.

Wool for Trapping

Grayson Maxwell

Kansas

Uncleaned Wool Fleece/Lower Wool Quality:

Sold to wildlife trappers

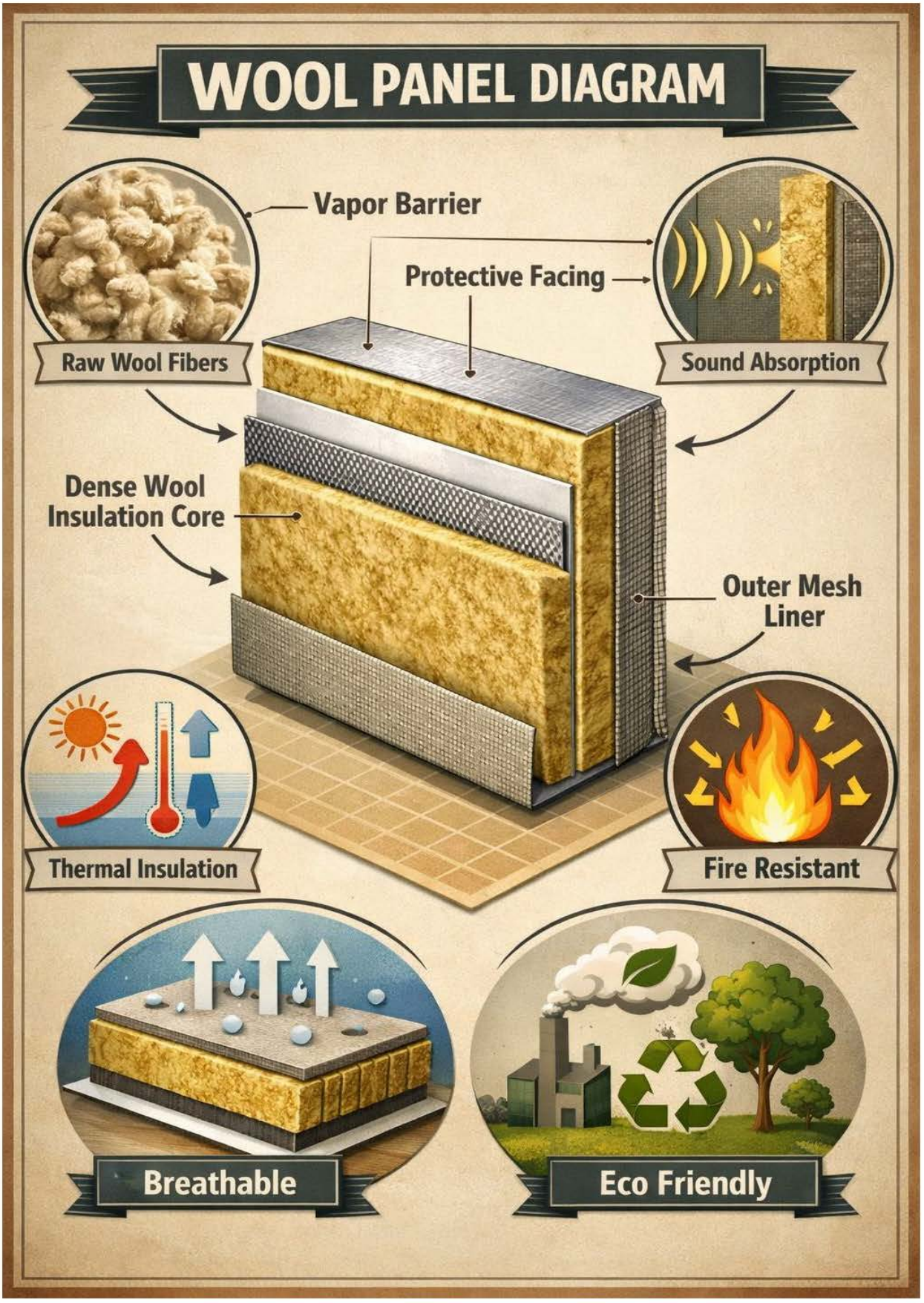
Catch Predators on properties

We sell in our farm store for more profit to the sheep producer!

Benefits:

No cleaning, sell whole fleece

Predator control on livestock farms


WOOL PANEL DIAGRAM
Vapor Barrier
Protective Facing
Raw Wool Fibers
Sound Absorption
Dense Wool Insulation Core
Outer Mesh Liner
Thermal Insulation
Fire Resistant
Breathable
Eco Friendly

FIGHTING FIRE WITH WOOL

THE PROBLEM & THE IDEA

Wildfires in the western US are increasingly intense and destructive, burning at extremely high temperatures and leaving behind exposed, nutrient-poor soils vulnerable to erosion. Controlling these fires on a large scale is challenging, and new tools are needed to slow their spread and protect at-risk areas. At the same time, many sheep producers have minimal market for coarse or low-volume wool, sometimes leading to discarding or burning it. This waste occurs despite wool's valuable natural properties: it has a high ignition point of 1058°F–1112°F, is self-extinguishing, and requires higher oxygen levels to burn.

The idea is to harness wool's natural fire-retardant qualities as a practical tool for wildfire prevention. By using wool batting to create fire-resistant barriers or coverings, firefighters and land managers could slow fire progression, protect vulnerable zones, and make better use of a currently underutilized agricultural resource.

THE MARKET IMPACT

Utilizing coarse wool for wildfire suppression could transform a low-value resource into a high-impact domestic market. By creating demand for the fleeces over 25 microns, this innovation would help producers balance the cost of shearing with the value of the fleece, strengthen the wool industry, and reduce reliance on exports vulnerable to trade or tariff disputes. Wool's natural fire-resistant and absorbent properties make it suitable for firefighting applications, appealing to federal, state, and local agencies, and creating opportunities for collaboration. Its adoption could develop a sustainable, functional product segment, expand industry applications, and increase both the economic and environmental value of U.S. wool while aiding wildfire mitigation.

PRODUCTION PLAN

The idea is technically feasible because manufacturers can use the same processes they use for wool quilt batting. The product would be 100% wool, utilizing wool with microns over 25 to provide strength for the batting. Production would begin with raw wool that has been carded to remove vegetative matter. Washing before use would not be a requirement as keeping the wool unwashed preserves the natural lanolin and surface properties that give wool its fire resistance, while also reducing processing costs. Fire season follows most shearing seasons, supporting the sustainability of long-term production by ensuring a steady and renewable supply of wool. Companies such as Hobs Bonded Fibers in Texas already produce similar wool-based materials, which shows that the necessary equipment and methods already exist. Pilot production, research and design, and field trials will verify key performance characteristics and will confirm that the material performs reliably in the intended application.

UTILITIZING THE PRODUCT

The product is designed as a supplementary tool to help slow the spread of wildfires. It can be deployed alongside roadways to cover combustible debris, applied to rooftops to protect accumulated leaves and plant litter from sparks, or placed over lawns surrounding homes. After a fire, leaving the wool in place can provide ground cover to help prevent soil erosion. For efficient deployment, larger rolls can be stored on spools, similar to wire, and unrolled using standard tools, while smaller rolls can be packaged for individual homeowners, similar to carpet, for convenient personal use. The product can be marketed for commercial use or sold directly to private homeowners.

The accompanying images illustrate potential applications and the product's design.

PREDICTED CONCERNS AND CHALLENGES

There may be concerns regarding the production or use of this product that warrant careful consideration:

- Slower biodegradation and dense felt may impede vegetation growth after use
- Higher density increases roll weight, possibly making moving and unrolling challenging
- Wool is susceptible to moths, rodents, moisture, and bacterial growth if not washed during the processing phase, but washing affects the natural properties this product relies on
- Use of the product may require research and development and testing with governmental agencies

References Used:

Reimagining unwashed American wool as a new mulch that conserves water, adds nutrients, and boosts crop yield

Alex Rodriguez[1], Melanie Stock[2], and Chad Page[3]

Introduction

A new market: can underutilized wool serve as an innovative surface mulch to improve crop production and reduce waste?

This study tests wool mulch to reduce water use, moderate soil temperature, and provide slow-release nutrients that increase productivity compared to traditional practices: plastic mulch and bare soils.

Methods

- **1 Site:** Greenville Research Farm in North Logan, UT.
- **3 Perennial cut flower crops**:
  - echinacea
  - eryngium
  - echinops
- **3 Mulches**:
  - unwashed wool (0.5 lb ft^{-2})
  - woven plastic fabric
  - bare soil control
- **4 crop x mulch replicates** tested in 2025 and 2026.
- **Measurements**:
  - ***96*** environmental sensors to measure water storage, plant use, and temperature.
  - **8** plant metrics to measure crop establishment, overwintering, growth, yield, and water stress.
  - **12** lab tests of wool and soil for nutrient release.

Preliminary Results

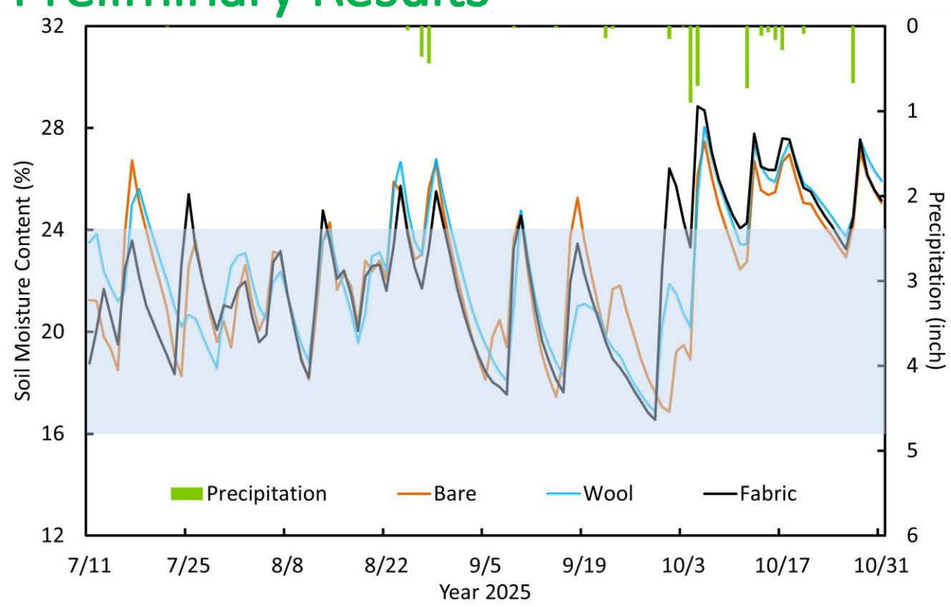


Figure 1: Soil moisture with bare soil (orange line), fabric (black line), wool (blue line), and rain (green bars). The optimal soil moisture (16-24%) is shaded blue.

Wool mulch maintained optimal soil moisture levels and used 30% less water than bare soil and fabric.

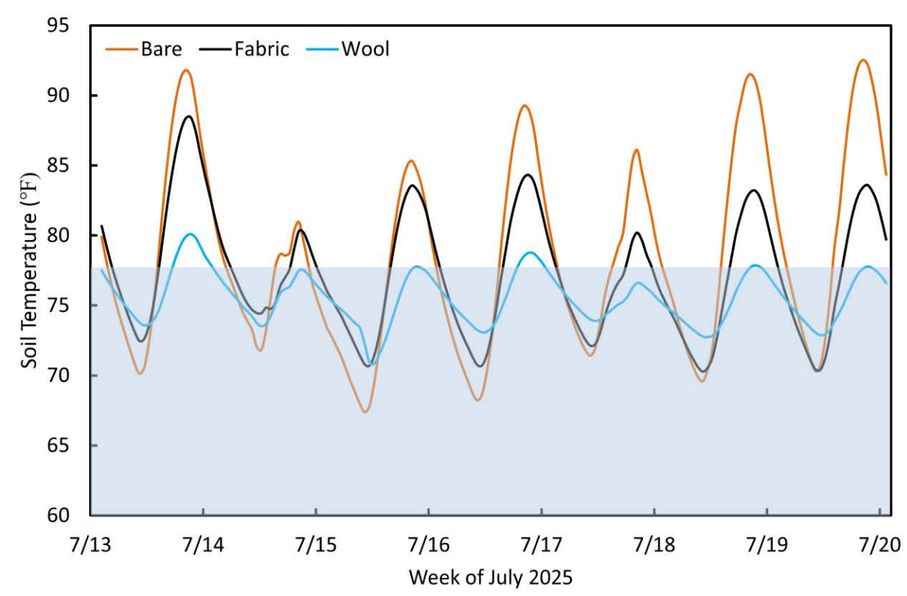


Figure 2: Hourly soil temperature under bare soil (orange), fabric (black), wool (blue) during peak heat. Optimal root-zone temperature is shaded blue.

Wool mulch moderated temperature in summer heat. The root zone averaged 10 °F and 6 °F cooler with wool than bare soil or fabric, respectively.

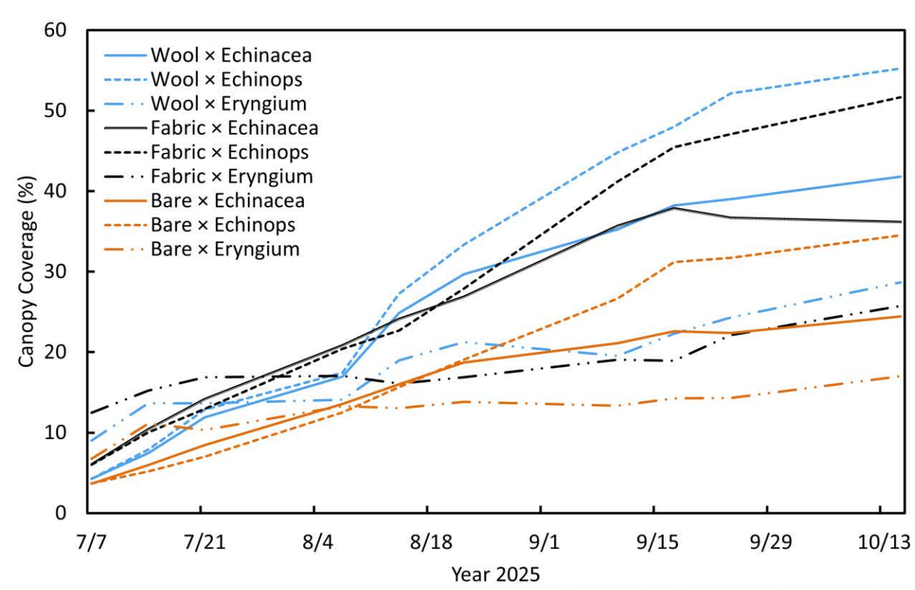


Figure 3: Canopy cover with wool (blue), fabric (black), and bare soils (orange) by crop (echinacea, solid line; echinops, dotted; eryngium, dashed) in 2025.

Within the 3 perennial crops, all canopies were 10-25% greater with wool mulch compared to fabric and bare soils.

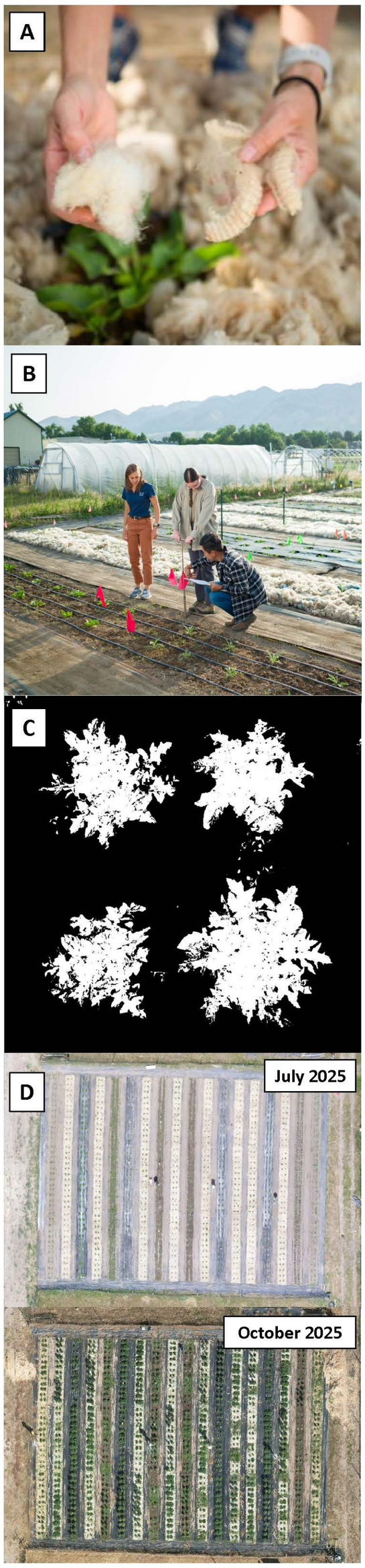


Figure 4:

A. We applied unwashed Romney White and Suffolk wool fibers.

B. Beds with bare soil (front), wool and plastic (behind).

C. Example measurement of plant canopy growth (Canopeo App v2.0).

D. Drone images of our **¼-acre field** established with **18 beds** to test **mulch x crop**. Establishment after 1-mo in **July 2025** (top) and 4-mo in **October 2025** (bottom).

Table 1: The irrigation used in 2025 by mulch type: bare soil (control), fabric (traditional mulch), and unwashed wool (new mulch), given as the average time (number of hours the system ran), volume of water (gallons applied), and frequency (number of events) with standard deviation (SD), as well as the percent difference between mulches.

Mulch	Water Used from July 11 — October 31*:					
	Hours (± SD)	% Time Savings Compared to Bare Soil	Gallons (± SD)	% Water Savings Compared to Bare Soil	Events	% Fewer Irrigation Events Compared to Bare Soil
Bare	16 (4)	—	1426 (322)	—	13	—
Fabric	14 (5)	9.8%	1432 (351)	0.4%	11	15.4%
Wool	11 (3)	30.9%	1003 (221)	29.6%	8	38.5%
Average per 4 ft x 74 ft (296 sq. ft) bed						

We thank:

USDA NIFA UDAF UtahState University

Visit our **lab websites!** Smallfarmslab.com & flowers.usu.edu

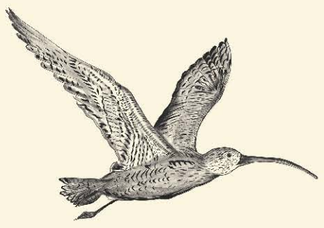
Follow us on Instagram! @usu_smallfarms

Innovating Streambed Recovery with Wool Based Materials

Streambed Restoration

- Prairie streams, both intermittent and perennial, are an essential lifeline for life in the grassland ecosystem, from western tiger salamanders to migratory birds to grazers like cattle and sheep
- The goal of stream restoration in the grasslands is to help heal the watersheds that sustain the prairie plants, wildlife, livestock, and people that call the ecosystem home by encouraging plants to grow over installed low tech structures to hold water in the system as well as slow erosion

Barriers to Pairie Streambed Restoration



- Hauling in rock for restoration structures has been a common practice for stream bed recovery, but bringing rock into a prairie system that doesn't already have rock is expensive, labor intensive, and if improperly installed can cause more erosion

Wool As a Solution

- The unique qualities of wool may make it an exceptional alternative to rock structures as the fiber is porous, so it may increase the soil's water holding capacity, add structure to soil, catch silt, and offer a slow-release fertilizer as it contains about 17% nitrogen. Researchers from Montana State University conducted a study using wool as a restoration material on severely degraded ground and found three to four times the amount of perennial plant cover grew in the test sites using wool (Arment, 2018).

Supply Channel and Application

- Intermittent and perennial stream restoration using low tech structures is becoming a common practice across the west for water shed recovery – the WWF Great Plains team is currently conducting a pilot project in South Dakota using 100% wool in burlap sacks for restoration structures as an alternative to using woven willow, sticks, and rocks
- WWF's Sustainable Ranching Initiative (SRI) works in partnership with a large network of ranchers and tribes in the Great Plains spanning over 1.4 millions acres, many of whom are actively participating in or interested stream bed restoration projects offered by WWF and many other conservation collaboratives

The WWF Sustainable Ranching Initiative team has the opportunity to connect a large network of land managers interested in improving their grazing lands and watersheds to wool-based streambed restoration resources. The longterm goal of the project is to make using wool in stream restoratation a common practice, connect sheep producers with a value addition to their wool, and improve current prairie stream restoration practices

Poster submitted by: **Kate Rasmussen, World Wildlife Fund**
Sustainable Ranching Initiative Speciliast

Contact:
kate.rasmussen@wwfus.org

Wool as an Outoor Sound Barrier

Reimagine Wool Digital Poster Contest

Basic Design

A conceptual design of a sustainable, woolen, outdoor sound barrier is shown in Figure 1. The design features wool as the primary sound-absorbing material. Unwashed, >25-mircon wool is desirable for this design due to its nutrient-richness and durability. The wool is packed between sturdy concrete posts, which provide structure while minimizing use of non-sustainable materials. The entire structure is bound by a wire mesh. The mesh holds the wool in place while providing an interface to support the outer layer, foliage. A viny groundcover, such as ivy (Figure 2), has been chosen as the outer layer of the sound barrier for its durability, environmental benefits, and sound-absorbing potential

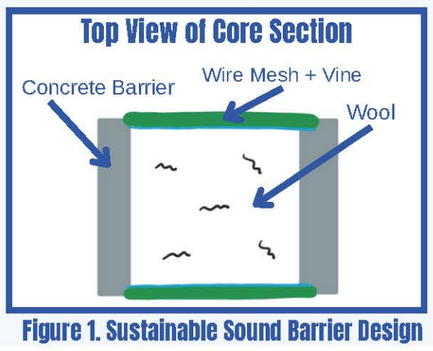


Figure 1. Sustainable Sound Barrier Design

Figure 2. Ivy

Viability

When designing a sustainable sound barrier, two of the most important criteria to consider are: Does the design absorb sound well? Is the design sustainable? Let us explore these criteria further:

Ability to Absorb Sound

- Materials that absorb sound well are often porous, or composed of many small spaces where air, liquid, or sound waves can pass through (2025, *Porous)*.
- When sound waves enter a porous substance, the waves collide with the many walls.
- With each collision, sound waves lose energy to friction (Ghermezgoli, 2020). Thus, porous substances are excellent at dampening sound (Figure 3) (2024, *Atelier*).

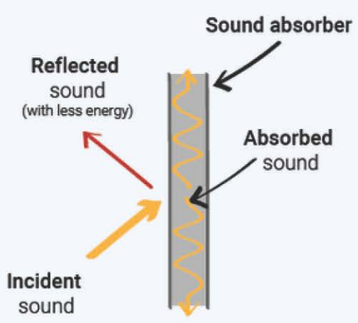


Figure 3. Sound Absorption

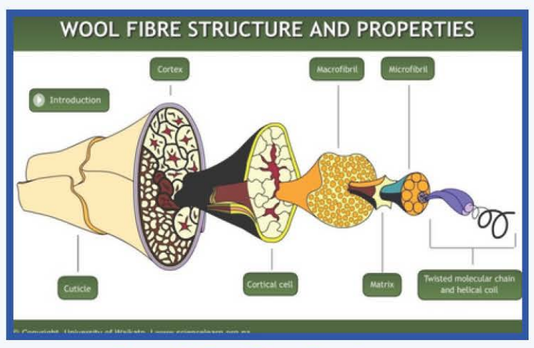


Figure 4. Wool Fibre Structure

- As seen in Figure 4, wool is composed from crimping and layering of many different components. This makes wool a very porous material, well suited for absorbing sound (2018, *Wool*).
- Dense foliage also creates a complex macroscopic network that is good at dampening sound (RHS, 2025).

Sustainability

- Raw wool is an underutilized resource, making it highly sustainable (Beck, 2023).
- Thick, raw wool requires minimal processing before being incorporated into the design, increasing its sustainability.
  - The durability of >25-micron wool is desirable for an outdoor product.
  - Raw wool is naturally porous, nutrient rich, moisture regulating, and insulating, making it ideal for supporting the growth of ivy, the outer layer of the design (2024, *Wool*).
- The foliage on the exterior of the barrier works to absorb sound, while simultaneously providing habitats, purifying air, and increasing aesthetic appeal (Sanders, 2023).

Significance

Urbanization has been steadily increasing across the globe for the past 50 years (Ritchie, 2025).

- This has led to increased economic development but has also caused excessive noise pollution.
- Noise pollution poses severe threats to human health, such as hearing impairment and cardiovascular disease (Ghermezgoli, 2020).

Outdoor sound barriers are a common method of reducing noise pollution caused by urbanization. However, these barriers are often not sustainable. They are mostly comprised of man-made materials, like concrete and stone wool.

There has been a major public demand to switch to environmentally friendly alternatives when possible. This is due to the rapidly heating climate caused by human emissions (2025, *Causes*).

Wool has many of the same properties as modern materials used in outdoor sound barriers, but is much more sustainable (Figure 5)

- 1 ton of concrete produces approximately 0.9 tons of CO_2 (Grier, 2025)
- Roughly 12 tons of CO_2 are produced for every ton of stone wool (Windfield, 2025).
- 0.021 tons of CO_2 are produced per ton of wool (Foster, 2023).

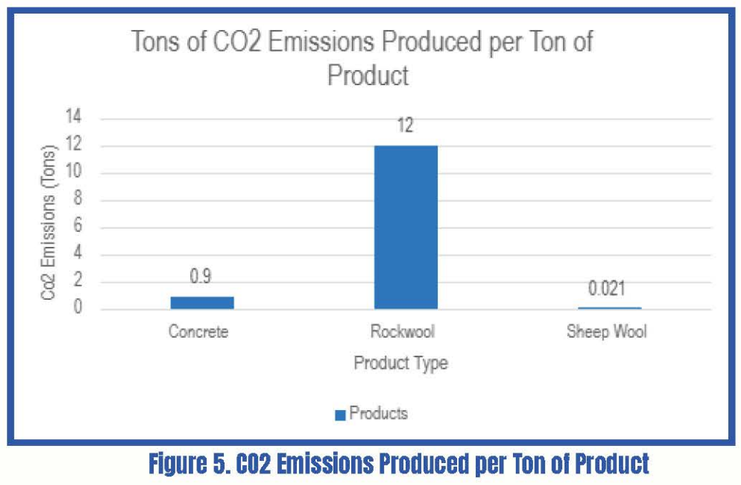


Figure 5. CO2 Emissions Produced per Ton of Product

Economic Impact

Modern outdoor sound barriers contain a material called stone wool. Stone wool is produced by a complex melting, spinning, and packaging process (Figure 6) (2022, Power*)*. This process is labor-intensive and produces many harmful emissions. Sheep's wool, alternatively, is an underutilized resource world-wide. 150 tons of wool are thrown away each year (Beck, 2023). By taking advantage of this natural resource, money can be saved in labor and materials costs, while significantly reducing environmentally harmful emissions.

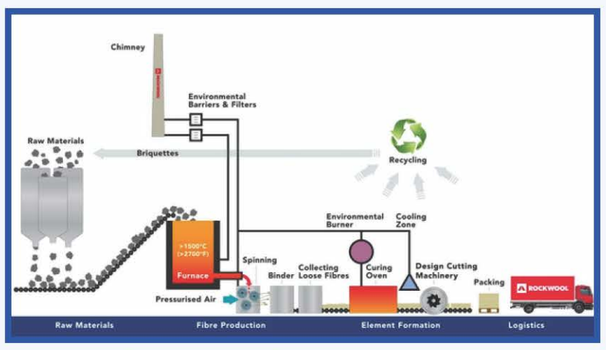


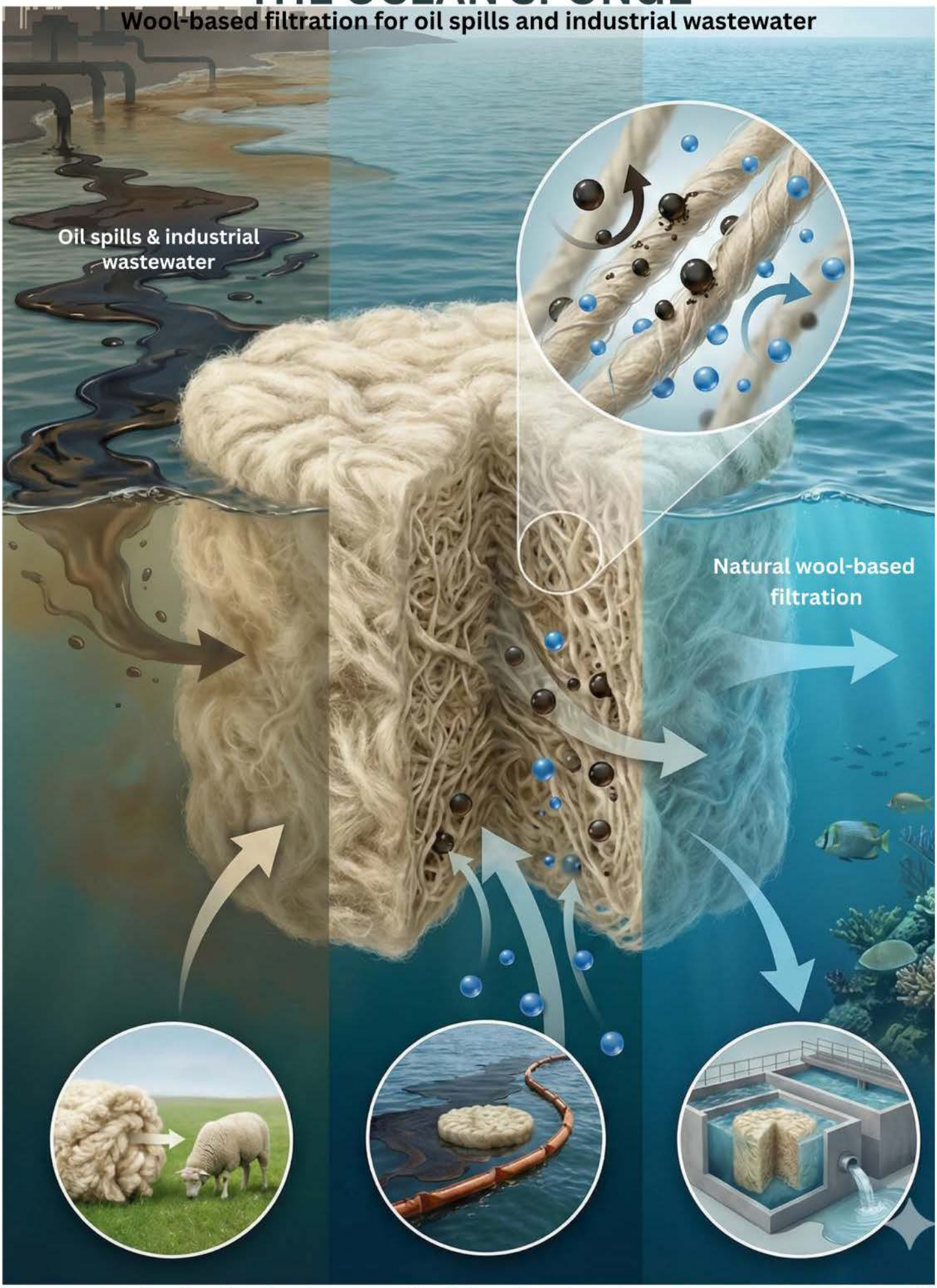
Figure 6. Production Process of Stone Wool

Concluding Thoughts

While a modern, concrete sound barrier may be a little bit more effective and durable than a woolen sound barrier, a woolen sound barrier is significantly more sustainable. A woolen sound barrier takes advantage of one of the most underutilized resources, wool, reducing pollution, and making our world a quieter, healthier, place to live.

THE OCEAN SPONGE

Wool-based filtration for oil spills and industrial wastewater



Coarse wool selectively absorbs oil while allowing clean water to pass through.