A summary of wool textile information, including notes and interesting wool facts.
These wool notes belong to:

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If found, please return it to me and you will be handsomely rewarded in good karma and coffee.
# WOOL NOTES
2019

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01 THE TEXTILE OF CHOICE

Today’s fashion’s consumers are flocking to wool. The world’s leading designer label platform Not Just A Label points out that since 2008, wool has seen a consistent 50 per cent increase in annual sales from £180million to more than £270million.2

These numbers reflect the increasing demand for a fibre that looks good, feels good, is good for the people that wear it and is good for the planet that grows it.

Wool is made of keratin, the same protein substance as human hair. Like human hair, wool grows readily on sheep and is a renewable resource: the sheep are shorn usually once a year and then more wool starts to grow.

Wool will biodegrade when buried in soil, given the required levels of oxygen and moisture. Research indicates that wool fibre also biodegrades in both fresh and salt water, unlike synthetic fibres which disintegrate into micro-fragments and accumulate in landfill and our water.

On the other hand, thanks to the unique chemical structure of keratin and wool’s tough, water-repellent outer membrane, clean and dry wool fibres do not readily degrade. This allows wool products to be resilient and long-lasting in normal conditions.3

Wool’s smart structure has evolved along with sheep to produce an active fibre that naturally wicks moisture, resists odour, and reacts to changes in the body’s temperature so that you stay comfortable in all temperatures.

Wool is grown year-round, around the globe, on a blend of water, air, sunshine and grass. The eco-credentials of wool are enhanced by its long service life and suitability to be recycled.

Whether for fashion apparel, athletic wear, interiors or technical textiles, by choosing wool, you are choosing well in all senses of the word.

FUN FACT
A wool fibre can be bent 20,000 times without breaking and has the power to recover – this is why wool products last for years.1

1 Not Just a Label
2 Not Just a Label
Humans have been washing, weaving, and wearing wool since 10,000 BCE.

There are more than 10,000 sheep breeds in the world. Merino or Rambouillet for example produce fine wools used mainly for apparel. Breeds like Romney or Scottish Blackface produce coarse wools used generally for interiors such as carpets.

Merino sheep originated in Spain. In 1789 King Charles IV of Spain gave six Merino sheep as a gift to the Dutch government. These sheep found their way to South Africa, and then were sold to British army officer, politician, and entrepreneur John Macarthur, who took them to Australia.

Today Australia produces the vast majority of the Merino wool used in luxury fashion and suiting around the world.

Argentina, New Zealand, South Africa, the United States and Uruguay are also leading producers of the fine wool used in apparel.

Wool goes far beyond fashion. It can also be used to produce carpets, other interior textiles such as bedding, upholstery and insulation, and protective garments worn by firefighters and soldiers.

Staple and crimp: Each wool fibre grows outwards from the sheep’s skin. Just like human hair, wool continues to grow, even after it has been cut shorn. As the wool grows it naturally forms into groups of fibres called staples. Wool fibres grow in a distinct wave pattern, called crimp, which gives wool its springiness or elasticity.

Wool grows about six millimetres per month, but this varies with the breed of the sheep, nutrition and environment.¹

As of 2017 around 1.1 billion sheep produced just over 2 million tons of raw wool for home and clothing textiles. Wool currently accounts for 1.1% of the world’s global fibre market.

¹ Business Insider referencing The Suit: A Machiavellian Approach to Men’s Style by Nicholas Asteoungas
When was the last time you visited a farm? Chances are, you are one of the 54% of people in the world who live in a city, and maybe took a trip to a farm once or twice in elementary school.

There has been a massive shift away from rural life since the Industrial Revolution, but agriculture remains a key basis of most societies around the world.

Agriculture is a business and wool sheep farming is no exception. Like all of us, woolgrowers multitask many activities throughout the year, managing their sheep and pastures to produce plenty of wool and keep their livestock and natural resources healthy.

Farm management skills include:

1. financial skills such as budgeting and managing cash flow
2. ongoing professional development such as workshops or courses on the latest production methods and technology
3. maintaining infrastructure: fences to care for, water troughs and pumps and machinery to be checked, cleaned and repaired
4. skilful forward planning
5. staff management and development

Because farming is a business, farmers work hard to maximise the return on their investment and labour.

A farmer’s largest cost is the land. The value of agricultural land is directly linked to the availability of water, topography, natural weather patterns in the area and proximity to market.

High value land costs more and a farmer with highly desirable land will choose the crop that gives the greatest income. The top choices would be an edible crop such as rice, cow’s milk, beef, pork or chicken. The second top five choices are wheat, soybeans, tomatoes, sugar cane and maize.

Wool sheep would not be a choice for land with high value. Raw wool prices cannot compete with the market value of edible crops. Farmers are often in the business of wool sheep because it is the best option left for their type of farmland. Yet, wool sheep are still an expensive investment: in the last week of September 2018, Merino ewe lambs and hoggets averaged AU$148 per animal.

The careful management of livestock, including best animal welfare practices – along with scarce land and water resources – is therefore crucial for a successful wool farming business.
04 WOOL FARM ECONOMICS

Best practice in farming depends upon an interrelation of factors:

- **Type of farm**
  - wool, meat, dairy, crops or mixed

- **The availability of fresh water**

- **Topography**
  - is the land rocky, hilly, flat, etc.

- **Laws of the land**
  - national legislation regarding animal health, water and soil management

- **Region-specific weather**
  - parasites, predator numbers and animal health are intertwined with rainfall figures and temperatures

Woolgrowers work hard to ensure their sheep are healthy, safe and have plenty of food, water and shelter all year round.

As well as looking after their sheep, producers care for the land and environment so it is protected for future generations. Woolgrowers fence off areas of bush to keep sheep out and look after waterways so rivers stay healthy. Sheep are moved between paddocks to protect the soil from erosion and ensure pasture lasts for many years.

The breed of sheep to be raised is based on the topography of the land, availability of natural resources and weather patterns specific to the area.

Sheep farms are often handed down from one generation to the next. Most woolgrowing families have been producing wool for generations. Woolgrowers are skilled farmers who look after their livestock, pasture and the environment. Most have a lifetime of experience working on farms. Often they have degrees in agriculture from university or the equivalent. They use the latest technology and the most advanced management practices.

The average farm manager has at least 15 years’ experience in a junior position before moving into a position of managing staff, infrastructure and sheep flocks successfully. As animal science and business practices change constantly, they must update their skills through continuous learning and at regular intervals.

Woolgrowers work hard to ensure their sheep are healthy, safe and have plenty of food, water and shelter all year round.

The chosen flock is then developed according to the carrying capacity of the different parcels of land within the farm. Even within a single farm there can be different rainfall patterns and topography.

Sheep graze on pasture and do not need supplemental feed unless conditions are extreme (such as drought). The size of the flock will match the carrying capacity of the land. Some woolgrowers develop a feed budget using their knowledge of pasture growth and information about expected seasonal conditions. A feed budget is a guide to how many sheep they can run at any one time and which paddock or pasture the sheep will move to next.

Constant calculations are done to prevent overgrazing of natural vegetation. Rotation grazing is the usual practice, to give natural vegetation time to recover. The profit margin on wool farming is generally insufficient to cover supplemental feed on a continuous basis.

Maintenance is an ongoing task: securing fences, removing alien vegetation, ensuring fresh water is in supply and natural shelter as needed, as well as protection from predators. Poor maintenance will result in stock losses, a reduced carrying capacity and ultimately a reduction in profitability – something no farmer wants to risk.

The average Merino ewe delivers +/-6kg of raw wool every 12 months.

At current prices, the farmer sells the wool for 12 US$ per kg (an average; the fleece’s value also depends on what part of the sheep it comes from). Thus the income for one year from this sheep’s wool is 72 US$.

On the expenses side, the purchase price for the sheep would have been approx. 150 US$ at current prices.

Other costs include regular farm maintenance, overheads, labour costs, animal husbandry and shearing costs.

A Merino ewe on average will provide good wool for 4-5 years.

For current information on wool prices, see the Australian Wool Exchange’s market reports.
CARING FOR WOOL SHEEP

Global apparel businesses are increasingly focused on sustainability and traceability, subjects which cover a range of topics including eco-credentials and the environment, animal welfare, and life cycle assessment.

Individuals and companies alike are paying more attention to the raw materials in consumer goods, and the processes that occur at each step of production.1

For wool, the main points of focus are the environment, life cycle analysis, and wool sheep welfare.

We cannot stress enough that ensuring each animal’s best welfare is in the wool farmer’s best interest.

Apart from the land, the flock of sheep is the woolgrower’s largest business investment. Everything the woolgrower does is designed to keep the flock in the best possible condition, so that the best possible wool can be obtained.

Rough handling, stress through hunger or thirst or untreated disease and illness will cause the condition of the wool sheep to deteriorate and as a result lower the quality of the wool. Much as your hair stylist can observe that you’ve been stressed from the state of your hair, stress in sheep will lead to breaks in the wool staple, which reduces the market value of the wool.

In June 2018, representatives from luxury brand leader LVMH (the group that includes Louis Vuitton, Dior, Loro Piana and Givenchy) visited Australia to meet woolgrowers and learn more about wool sheep welfare practices.

After visiting farms in New South Wales, LVMH Environmental Project Manager Cathelijne Klomp had this to say: “After visiting the three farmers, who each had different practices, we now understand that the animals’ best welfare is the objective of all the farmers, whether they are mulesing or not mulesing. They all base different justifications for their choice of practice, and they are all valuable and good reasons. Taking care of the animals is something that we really saw during our visits.”

According to the World Organisation for Animal Health (OIE), animal welfare standards should be based on sound scientific findings, and optimal animal health should always be the basis of animal welfare.

The OIE is the global authority for standards on animal welfare, and its “Five Freedoms” for the care of animals are recognised internationally:

1. Freedom from hunger, malnutrition and thirst
2. Freedom from fear and distress
3. Freedom from physical and thermal discomfort
4. Freedom from pain, injury and disease
5. Freedom to express normal patterns of behaviour

An animal experiences good welfare if the animal is healthy, comfortable, well nourished, safe, is not suffering from unpleasant states such as pain, fear and distress, and is able to express behaviours that are important for its physical and mental state.

Good animal welfare requires disease prevention and appropriate veterinary care, shelter, management and nutrition, a stimulating and safe environment, humane handling and humane slaughter or killing.

ANIMAL WELFARE LEGISLATION BY COUNTRY

Each woolgrowing country has its own legally binding animal welfare legislation. As well as the above principles, best practice is defined within each country based on country-specific production systems and the wool sheep breeds.

The major woolgrowing countries – Argentina, Australia, New Zealand, South Africa, the United Kingdom, United State and Uruguay – all have strict standards for wool sheep welfare, and criminalise serious offenses.

The relevant legislation for each country can be easily found in the International Wool Textile Organisation (IWTO)’s Specifications for Wool Sheep Welfare.17

The IWTO Specifications additionally provide concise guidance on best practices for wool sheep husbandry.

COLLECTIVE INDUSTRY ACTION SUPPORTS SHEEP WELFARE AROUND THE WORLD

Reflecting the significance of wool sheep welfare to the industry, more than 600 individuals and corporations have undertaken to support an environmentally responsible, sustainable and commercially viable wool industry through signing the Dumfries House Wool Declaration.

The Dumfries House Wool Declaration was formulated at the request of HRH The Prince of Wales, Patron of The Campaign for Wool, and endorsed in September 2016 by HRH The Prince of Wales along with the woolgrowing countries which fund The Campaign for Wool.

You can join the flock by signing it.

16 OIE Terrestrial Animal Health Code, Article 7.1.1
17 IWTO Specifications for Wool Sheep Welfare.
FROM FLEECE TO FABRIC

SHEARING

Shearing usually takes place once a year and most woolgrowers employ specialist shearing teams, who travel from farm to farm shearing sheep for a living.

Although the process varies by country, using Australia as an example, a shearing team can include two or more shearers, one or two woolhandlers and a wool classer.

Shearers remove the fleece — the main fleece covering the sheep’s body — in one large piece. After the belly, leg and face wool have been removed and collected by the woolhandler, the body of the fleece comes off as one piece.

As soon as the fleece has been shorn, the woolhandler gathers up the fleece and throws it across a large table. The woolhandlers “skirt” the fleece, removing the lower-quality edges of the fleece which are kept separate from the main fleece wool. The remaining fleece is rolled and given to the wool classer.

The wool classer sorts the wool into five main categories — fleeces, necks, pieces, bellies and legs. Fleeces are also sorted into lines (groups) of similar quality. Samples are taken from all the bales in the sale lot and core tested for staple strength and length and potential yield. A pre-sale certificate is issued that lists all the results from the testing and stays with the sale lot right through to processing. (For more information on testing and traceability, see chapter 07).

SALE

Most of the world’s wool is sold by auction. Auctions generally take place every week. Here the price per kilo is determined based on demand, quality and volume on offer.

Once sold, the wool begins its journey to becoming fabric. There are several steps in this pipeline, described below.

FIRST STAGE PROCESSING

Washing – Scouring – Carbonising: The wool is cleaned, removing grease (lanolin), vegetable matter (sticks, grass), and dirt (sand, soil). Carbonising involves treating the wool with diluted sulphuric acid and placing in a very hot oven; the acid attaches to the vegetable matter and in the drying oven this becomes dry and brittle. The wool is passed through rollers which crush the dry vegetable matter, leaving only clean wool behind.

Carding – Combing: These processes prepare wool for spinning. Carding removes tangles by passing the clean wool over sets of short wire teeth to open, straighten, and separate the fibres into a uniform mass. The result is a continuous untwisted strand of fibres called a sliver. Carded fibres are generally used for producing worsted yarn. Combing separates out the fibres of the wool through long metal teeth or tines. The fibres become aligned and parallel to each other. Fibres that are too short, nells, are removed by this process. The result — a long rope of wool — can be referred to as a silver.

The silver will be shaped into a ball and this is known as wool top. This preparation is generally used in preparation for making a worsted yarn.

WOOLLEN AND WORSTED PROCESSING

Wool is a versatile natural fibre, and can be made into a wide range of woven or knitted fabrics. Depending on the length and fibre diameter (fineness) of a fleece, it can be processed through either the woolen or worsted processing system.

The worsted processing system uses the highest-quality fleeces to produce very fine yarns, which can be woven to make extremely smooth and lightweight fabrics.

Worsted-spun woven fabrics are used by fine tailors around the world for clothes such as business suits, trousers and skirts.

Worsted-spun knitted fabrics are bulkier, heavier, often wind-proof and resistant to rain. You will see these used in coats and jackets.

Woolen-spun woven fabrics are thicker, denser, incredibly versatile knits that are used for baby clothes, underwear, t-shirts and sportswear, leggings, dresses and other light-weight knitwear.

The woolen processing system:

Woolen-spun woven fabrics are thicker, heavier, often wind-proof and resistant to rain. You will see these used in coats and jackets.

Woolen-spun knitted fabrics are bulkier than worsted-spun knitted fabrics. They are used for items such as jumpers/ sweaters, scarves and socks.

www.iwto.org
Wool processing: fleece to fabric

Fleece

Scouring

Carding

Gilling

Worsted Processing

Spinning & Twisting

Drafting

Fabric Formation

Tufted Carpets

Knitwear

Woven Apparel, Carpets & Upholstery

NOTES
TRACEABILITY – A CASE STUDY

Traceability is of high importance along the wool supply chain as brands, retailers and consumers want to know where their wool comes from. All major wool growing countries offer different traceability systems. Read here how it is done in Australia.

Approximately 80% of the fine Merino wool used for clothing textiles is sourced from Australia and sold through The Australian Wool Exchange.

Every wool bale offered on auction is tested to confirm the wool’s quality and characteristics. Testing is performed with a grab sample, a sample of the wool taken from the centre of the bale.

Wool is a natural fibre and each batch will vary largely in length, colour, fineness and content.

YOUR KEYS TO TRACEABILITY

WOOL TEST CERTIFICATES

Wool is tested to international standards and according to the wool testing specifications set out in the International Wool Textile Organisation’s White and Red Books.

Wool-testing laboratories are audited annually and conform to the international standards set by their local standardisation body.

IWTO licenses laboratories around the world to issue IWTO test certificates, the “gold standard” in the industry.

Each bale of wool will be offered to the prospective buyers with an IWTO test certificate stating:

1. Test Certificate Number
2. Total bales tested, stipulating the weight of each
3. The Yield of each bale (how much clean wool will the bale deliver, after vegetable matter is removed)
4. VM = Vegetable Matter
5. LSCAN = Measuring the micron of the wool in that bale (how fine it is)
6. Mulesing Status (MS)
   - NM = The wool comes from non-mulesed sheep
   - M = Some or all of the sheep in this flock have been mulesed
   - PR = All the sheep in the flock were mulesed using a registered Pain Relief product
   - CM = Ceased Mulesing, meaning no lambs born on this property in the last 12 months have been mulesed and no new sheep are mulesed

WOOL DECLARATIONS

Nearly all wool is sold with an IWTO Test Certificate. In Australia, the IWTO test certificate will report how that wool has been declared through Australia’s National Wool Declaration (NWD) programme. South Africa has a similar system in place.

The NWD includes information provided by the woolgrower on various items, including the mulesing status of the sheep the wool came from. Traders cannot remove the mulesing status that is shown on Australian Wool Testing Authority (AWTA) Certificates.

This information flows through the supply chain in a traceable manner, via the NWD and the test certificates:

Top-makers buy wool on the basis of the AWTA Combined Certificate (a combination of the various sale lots that go into one order). This reports the mulesing status of each component lot. In this way the NWD is fed into the supply chain.

If the spinner or other later-stage processor demands the mulesing declaration information the AWTA Certificate or a summarised Mulesing Status Report is passed along the supply chain.

AWTA provides an online Certificate Verification service that can be used to check the authenticity of the report. Making false declarations in trade or commerce is an offence in Australia and the Competition Regulator will prosecute this if necessary.

STIPULATING ORIGINS

For each yarn order, the spinner needs wool that meets the demands set by the client. The spinner’s wool buyer will source wool accordingly.

It is likely that the raw wool will be sourced from different farms and possibly even different countries, and blended in the spinning process to produce the order’s specifications.

If a buyer wishes to stipulate the wool’s origin, this must be confirmed with the spinner in advance, in order to track any different batches of wool.

FUN FACT

Spain so valued its Merino sheep that until the 18th century, exporting sheep was an offence punishable by death.

Note to Self
The processing of wool, like the processing of any other textile fibre, requires the use of chemicals. Eco-friendly versions of all chemicals can be specified if required.

EARLY STAGE PROCESSING – CLEANING:

31 SCOURING: Warm water and non-ionic detergents which do not contain alkylphenol ethoxylates.

32 CARBONISING: Optional process, if the wool contains too much vegetable matter. Uses a bath of diluted sulfuric acid, a very common chemical.

SUBSEQUENT PROCESSING:

33 CARDING, GILLING & COMBING: Mechanical processes which require very little water and lubricants to reduce the friction between the fibres as they are carded and combed.

34 DRAFTING: A mechanical process in which a thick strand of fibres is reduced to a thin one, no additional chemicals used.

35 SPINNING & TWISTING: Both involve twisting a strand of wool mechanically. No additional chemicals used.

36 DYEING: The wool can be dyed at one of several stages during production i.e. fibre stage, yarn stage, fabric stage or even garment stage. The dyeing process is carried out using acetic acid, levelling agents, and synthetic dyestuff which do not need heavy metal mordants to fix them to the fibre.

37 SOFTENING: Most wool products will be softened at some stage with a wax-based or silicone-based softener.

OPTIONAL PROCESSES (FOR ADDITIONAL FUNCTIONALITY):

NEW WOOL LESSONS

03 04 05 06 07

08 09 10 11

01 02

38 SUPERWASH TREATMENT: Some wool tops will be treated with a shrink-proofing process. The top will be given a two-stage treatment first with an oxidising agent to chemically etch the fibre, then a very thin film of polymer is applied which swells during domestic washing to mask the scales and prevent shrinkage.

ALTERNATIVE SUPERWASH TREATMENTS: EXP from Schoeller spinning group and Naturetexx Plasma from the Südwolle Group, using a mechanical process and eliminating chemicals.

39 FLAME-RETARDANT: Although wool is inherently flame-retardant, in some high-risk situations an additional treatment with a zirconium-based flame retardant is necessary.

WATER & STAIN REPELLENCY: Although wool is inherently water and therefore stain repellent there is sometimes a desire for higher levels of repellence in which case a fluorine-based, silicone-based, or wax-based chemical can be applied to wool during the final stages of production.
COMING AROUND AGAIN – RECYCLING WOOL

Wool textiles have high economic worth and consumers have valued this through the ages. Garments and décor items made from wool look better for longer, need less laundry, are easy to care for and often are passed from one generation to the next. Textile manufacturers in the late 1800’s established a ‘recycling culture’ in Prato, Italy and their expertise are sought after in the current circular economy business model.

To measure the environmental footprint of a textile item, it is important to do this over the full lifespan of such an item and consider the recycling capacity as well. Can this item be fully recycled, to live another life in a different form? Wool items can and often are recycled, as the yarn is viewed as highly valuable and not easily discarded of. Wool’s cradle-to-grave reality can involve two or three lives and a total active lifespan of 20-30 years.

Wool accounts for up to 5% by weight of total clothing donated by consumers. The mechanical recycling of wool textiles yields fibres of sufficient length to be carded and re-spun into yarns of pure wool or used for blends. The average wool garment is used for 2-10 years, in comparison to 2-3 years for a garment made from synthetic fibres.

Cardato
Recycled Wool IWTO
Circular Economy IWTO
**10 TREADING LIGHTLY: LOW ENVIRONMENTAL FOOTPRINT**

**Wool’s Life Cycle Assessment**

![Diagram of Wool’s Life Cycle Assessment]

**MIND THE GAP:** why LCA-based ratings don’t always tell the whole story

LCA is a tool that attempts to tell the environmental story of products across the entire supply chain, including raw material acquisition, manufacturing, use, recycling, end-of-life and disposal.

LCA has proven especially useful in helping manufacturers understand and improve the efficiency of factory processes where inputs and outputs can readily be measured.

However, lifecycle assessments are less comfortably applied in biological systems, and especially in comparison of different products such as where wool (a natural, renewable biological material) is compared against a fibre such as polyester (an oil-based synthetic fibre).

**THE COST OF CARBON**

Grass and natural vegetation act like straws, absorbing carbon from the air. Sheep turn that carbon into wool, when they eat the grass. The carbon is returned to the earth, when the wool textiles are discarded, thereby completing the natural circular process.

Man-made fibres are made from oil, harvested from carbon reserves stored underground for centuries. These are released into the atmosphere and as the resulting fibre does not biodegrade, never returns to its original form, but becomes possible pollutants for air and water resources.

The carbon “cost” is “charged” against natural fibres like wool in the land use assessment under LCA. But the carbon impact is not costed against petroleum-based fibres.

LCA underpins many footprinting tools, resulting in several weaknesses:

**Comparing fabrics without considering the whole supply chain**

Apparel ratings agencies only assess the supply chain up to fibre or fabric production and exclude the use phase and end of life.

There are important offsets for wool in the use phase and at end of life: wool is a superior fibre that lasts longer, requires less washing than other fibres and is frequently recycled – all of which should be counted.

**The use phase strongly affects overall impact**

A comprehensive survey (The Nielsen Company, 2012) established that the average lifetime of wool garments was more than 50% longer than cotton garments, and that items of wool clothing were washed less often.

A longer life and less washing mean wool clothing are washed less often.

**Assumptions about end-of-life for wool are inaccurate**

LCA studies to date assume that at the end of a wool product’s life, it is immediately disposed of in landfill, ignoring the level of reuse and recycling of wool garments/products.

Research shows a 5% donation rate of wool garments – which far exceeds wool’s 1.3% share of virgin fibre supply.

**What the ratings leave out**

One leading rating tool only quantifies four impact categories – climate change, eutrophication, water scarcity and abiotic resource depletion. What’s left out?

- Microplastics – despite growing evidence of the impact of microplastic pollution from synthetic fibres on waterways and marine life, microplastic pollution is not considered by current ratings systems
- Use phase, end-of-life and biodegradation
- The question of carbon (see box, above)

**THESE WEAKNESSES CAN LEAD TO SIGNIFICANT CONSEQUENCES**

Fibre ratings are increasingly used to determine which raw materials are included in products and to influence public policy.

LCA science will continue to evolve, and with it, the methods for measuring textile data must adapt.

If incomplete or out-of-date data continues to be used, there is a real risk that instead of supporting sustainable solutions, we will add to the pollution of the planet.

*For more information, visit [https://www.iwto.org/work/wool-LCA](https://www.iwto.org/work/wool-LCA)*
Contemporary Atmospheric Cycle:

- Sunlight & Carbon Dioxide
- Photosynthesis
- Plant Respiration
- Oxygen
- Animal Respiration
- Carbon Dioxide
- Methane
- Organic Carbon
- Root Respiration
- Dead organisms & waste products
- Fossilised Carbon Residues
- Soil Carbon
- Organic Carbon
All materials of animal and vegetable origin have some degree of biodegradability, meaning that they are capable of being decomposed by the action of living organisms, such as fungi and bacteria.

Wool is composed of the natural protein keratin, the same protein that is in our hair.

When wool is disposed of, microorganisms will naturally break down the keratin with enzymes and release valuable nutrients back into the earth. Essential elements such as nitrogen, sulphur and magnesium are able to be taken up by growing plants, completing the natural cycle.

Wool will naturally decompose in soil in a matter of months or years in warm, moist conditions or when buried in soil. While research has shown that processing treatments such as dyeing and antishrink treatment can result in the wool taking slightly longer to biodegrade, this is a short-term effect, typically not persisting beyond eight weeks.

Due to the unique chemical structure of keratin and the wool fibre’s tough, water-repellent outer membrane, clean and dry wool fibres do not readily degrade. That’s why under normal, everyday living conditions, wool products are resilient and long-lasting.

**CHOOSE WELL, CHOICE WOOL**

Wool does not add to landfill or microfibre pollution.

Natural fibres biodegrade naturally in a relatively short period in soils and aquatic systems.

In contrast, synthetic textiles can be extremely slow to degrade and can disintegrate to the small fragments known as microplastics or microfibres. Microplastics are defined ranging in size between 1 nanometre and less than 5mm in diameter. These fragments accumulate in the world’s oceans, lakes, rivers and other water systems, as well as landfill sites. The microplastic can be perceived by other living creatures as food, with negative consequences for these life forms and the food chain. It can lead to death through starvation for these creatures as stomachs fill with plastic instead of food.

Once in the food chain, microplastics potentially also affect human health.

A single polyester fleece garment can produce more than 1,900 fibres per wash.

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THE ULTIMATE FIBRE –
WOOL’S NATURAL
BENEFITS

WOOL IS ...

01 Natural – renewable – resilient – stain-resistant – anti-wrinkle – flame-resistant – odour-resistant – can help you sleep better (and can help babies sleep better)

02 A natural temperature-regulator: it can keep you warm, and it can keep you cool

03 Worn by soldiers, fire fighters, astronauts, athletes and mountain climbers all over the world because of its unique properties

04 Able to absorb up to 35% of its own weight in water, more than cotton (24%), nylon (7%) and polyester (1%). Wearing wool when you play sports can keep you cooler and drier by absorbing moisture from your skin as you sweat

05 Easy to care for: wool garments can be “washed” by airing, or by hanging them in a steamy bathroom. They will be fresh and ready to wear the following day

06 Protective: wool naturally absorbs UV rays from the sun

07 Loved by designers the world over for its elegance, handle and drape, colourfastness, versatility (available in a wide choice of weaves, weights, and textures), and ease (doesn’t fray, isn’t marked by pins, responds to ironing and doesn’t crush with handling)

08 Wool is perfect for innovative treatments
**BREATHABILITY**

Wool clothing is extremely breathable — wool fibres can absorb large quantities of moisture vapour (such as sweat), then move it away from your skin so that it evaporates into the air.

Wool reacts to changes in body temperature all on its own. It’s a naturally active fibre. Synthetics have been trying to replicate this quality for years – manufacturers call it “technical innovation”. But wool has always had this characteristic.

**WOOL’S ABILITY TO MANAGE MOISTURE**

When worn next to the skin, wool works as a dynamic buffer in the micro-climate between the fabric and the skin, smoothing out the humidity and temperature.

This makes us feel cooler and more comfortable whether we’re working out or running for the bus – adding to our overall sense of well-being.

Wool’s ability to manage moisture is so good that it even helps people who suffer from eczema – research shows that wearing superfine Merino wool next to the skin will reduce the redness, itchiness, and cracking of the skin that are symptoms of the condition.

A two-year study recently concluded in the United States has shown that not only does wearing superfine Merino wool help ease the symptoms of the condition, it even helps people who suffer from eczema.

**ODOUR**

Sweat itself has no odour, but if it remains on the skin, the humid environment is perfect for bacterial growth, leading to body odour.

Wool’s natural breathability helps defer the onset of sweating, which keeps the skin drier. When sweat does occur, wool absorbs the moisture but not the salts or other waste products in the sweat.

Finally, wool’s complex chemical structure easily reduces any odours within the fibre, where the bacteria that cause odour cannot thrive.

**MOISTURE MANAGEMENT**

When worn next to the skin, wool works as a dynamic buffer in the micro-climate between the fabric and the skin, smoothing out the humidity and temperature.

This makes us feel cooler and more comfortable whether we’re working out or running for the bus – adding to our overall sense of well-being.

**PRICKLE?**

The same research that shows Merino wool assists those suffering from eczema has challenged the common misconception that all wool is prickly and itchy. We understand now that the “perception of prickle” has to do with the diameter of the fibre in a garment, not the type of fibre. •

**WOOl – EASY TO LOVE**

Because of wool’s ability to lock in odour, plus its ability to retain and regain its shape in between wears, wool garments do not need to be laundered as frequently as those of other fibres.

**Why Some Fabric Feels Prickly**

Superfine/ultrafine Merino fibers

Fabric

Sensitve nerve endings

Pilling fibers

Coarse fibers

Sensitve nerve endings

Pilling fibers

Human Skin

Superfine/ultrafine Merino fibers bend easily, causing minimal or no skin irritation.

Wool helps defer the onset of sweating, which keeps the skin drier. When sweat does occur, wool absorbs the moisture but not the salts or other waste products in the sweat.

Finally, wool’s complex chemical structure easily reduces any odours within the fibre, where the bacteria that cause odour cannot thrive.

These odours are then significantly released by wool garments when laundered – or simply aired out. The garment will feel fresh again the next day.

Oudour-wearer trials conducted by the CSIRO – little balls of fluffy fibres have formed, which are known as pills. Pills can easily be removed from wool fabrics and in many cases drop off.

When washing wool use a detergent that is specifically developed for wool that has a low pH. Avoid bleaches and “biological” detergents that may have enzymes (which will consume the proteins in the wool). Aim for a warm wash/40°C and a gentle cycle (hot temperatures will not shrink wool, but agitation will cause it to shrink and felt).

The Woolmark Company has a handy Wool Care app: download it free of charge via the Apple App Store or Google Play.

**Pilling occurs in all fibres and is caused by abrasion on the fabric surface. Friction causes any loose fibres on the surface of a fabric to start becoming entangled with one another until little balls of fluffy fibres have formed, which are known as pills.**

**Sensitivity**

Some participants told the researchers that they still wear the Merino wool clothing even though the study is finished.

**FUN FACT**

Whether it’s hot, cold, humid or dry, wool garments can absorb and release moisture vapour as much as 40 times as much moisture vapour as cotton and 30 times as much as polyester.
COUNTRY CONTACTS

Argentina
FlA Federacion Lanera Argentina

Australia
Federation of Australian Wool Organisations

Belgium
International Wool Textile Organisation

Bulgaria
International Wool Textile Organisation

China
China Wool Textile Association

France
FFILC Fédération Française Industrie Lainerie et Cotonière

Germany
Deutsche Wollevereinigung

India
Sistema Moda Italia

Japan
Japan Wool Industry Association

Korea
Lesotho National Wool & Mohair Grower Association

KOSW Woolen Mills Limited

New Zealand
National Council of New Zealand Wool Interests INC

Norway
Norlia

South Africa
Cape Wools SA

Switzerland
Swiss Textiles

Thailand
Turkish Textile Employers Association

United Kingdom
British Wool

USA
American Wool

Uruguay
Secretariado Uruguayo de la Lana

INDUSTRY CONTACTS

Argentina
Australian Wool Innovation

Australia
Australian Wool Exchange

Belgium
Vitex Troyan AD

Bulgaria
Kettewell Consulting

China
NSC Schlumberger

France
IVGT

Germany
DWI Interactive Materials Research

India
Raymond Limited

Italy
Südwolle Group

Japan
Benettion Group

Korea
Città Studi Biella

Lesotho
Oswal Woollen Mills Limited

New Zealand
The Campaign for Wool NZ

Norway
Sauer

South Africa
Indorama Ventures PLC

Thailand
British Wool

United Kingdom
Interweollab

USA
Cashmere & Camelhair Manufacturers Institute

Uruguay
Cámara Mercantil de Productos de País

ANIMAL WELFARE — the humane treatment of animals to ensure their health and wellbeing.

AUCTIONEER — the person who runs the wool auction and keeps a tally of the bids until the highest bid is reached.

BIOECONOMIC — an approach to the design of products and systems modelled on natural processes, viewing materials as nutrients that will decompose naturally.

BIODEGRADABLE — a substance that will decompose naturally.

BELLY — short wool underneath the stomach of the sheep. This wool is kept separate from the fleece as it is less valuable and is processed differently.

CARBON FOOTPRINT — the sum of greenhouse gas emissions and removals of a product system, expressed as CO2 equivalents.

CRADLE-TO-GATE — a partial assessment of a product life cycle, from resource creation (cradle) to the factory gate — that is, omitting the use and disposal phases of the life cycle.

CRADLE-TO-GRAVE — assessment of a product life cycle from creation to disposal.

DUAL-PURPOSE — breeds of sheep used to produce both wool and meat.

ENVIRONMENTAL IMPACT — any change to the environment, adverse or beneficial, wholly or partially resulting from an organisation’s activities, or from any part of the life cycle of products or services.

EWE — mature female sheep over the age of two years.

EUTROPHICATION — excess of nutrients, mainly nitrogen and phosphorus, in water or soil.

FIBRE DIAMETER — the thickness of a single wool fibre.

FLYSTRIKE — a condition in sheep where blowflies lay their eggs into soiled wool. Fly larvae hatch and burrow into the flesh of the sheep. In severe cases sheep can die from flystrike.

FLEECE — the main wool covering the sheep’s body. The fleece usually comes off in one large piece, by shearing.

GREETING — removing wool by shearing around a sheep’s bottom to prevent flystrike.

DECOMPOSE — to break up or separate into simple parts.

DRENCHING — treating sheep with pesticides to prevent intestinal worms.

EWE — female sheep over the age of two years.

FIBRE DIOAMETER — is measured in microns (about 3–4kg kg each) from a sale lot that can be inspected by potential buyers before auction.

GRAZING — feed directly on growing grass, pasture or forage crops.

GREATLY WOOL — “Raw” wool, before it is cleaned.

GREENHOUSE GASES (GHGS) — gases in the earth’s atmosphere, both natural and originating from human activity, that absorb and emit radiation from the sun, leading to warming of the earth’s surface.

HOGGET — a young sheep, about 1-16 months of age.

LAMB — a young sheep from birth until about 10-16 months (when the first two adult ocicins appear).

LANOLIN — a natural grease, which covers the wool fibre, often used in cosmetics.

LIFE CYCLE — consecutive and interlinked stages of a product system, from raw material acquisition/creation to final disposal.

LIFE CYCLE ASSESSMENT (LCA) — compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its life cycle.

MERINO WOOL — wool sourced from a breed of sheep called Merino.

MICRON — a millionth of a metre and the unit of measurement used to describe wool fibre diameter.

MULESING — surgical removal of a breed of sheep called Merino.

MULTIPLYING — removes wool by shearing around a sheep’s bottom to prevent flystrike.

GRAB SAMPLE — samples of wool (about 3–4kg kg each) from a sale lot that can be inspected by potential buyers before auction.

GRAZE — feed directly on growing grass, pasture or forage crops.

NATURAL FIBRE — fibre derived from an animal or plant such as wool, cotton, hemp or linen.

NATURAL OR NATIVE PASTURE — natural ecosystem of indigenous or naturally occurring grasses and herbs on which livestock and wildlife graze.
NECKS AND PIECES — short lengths of wool shorn from around the neck and legs of the sheep.

PASTURE — plants that are managed by farmers for livestock production.

PROTEIN — a nutrient found in wool, but also in all body cells. Protein is important as part of a healthy diet to build and repair all our body cells.

RAM — uncastrated male sheep.

RENEWABLE FIBRE — a fibre that comes from a source that can be replaced or regrown, such as animals (sheep, goats, rabbits) or plants (cotton, trees and flax).

ROTATIONAL GRAZING — a system of grazing that moves stock from paddock to paddock as pasture gets low.

RUMINANT — an even-toed, hoofed mammal, usually with a stomach divided into four compartments; these include cattle, sheep, goats, deer, giraffes, antelopes, and camels.

SALE LOTS — a group of bales from a single producer that is of similar quality.

SHEARING — removing the wool from the sheep using specially-designed handpieces or shears.

SCOURED WOOL — greasy (raw) wool that has been cleaned Glossary to remove any dirt, lanolin (grease) and vegetable matter (plant material).

SCOURING — process of washing wool in hot water and detergent to remove fats, waxes, dirt, oil, and other impurities.

STAPLE LENGTH — the distance from one end of a tuft of wool to the other.

STOCKING RATE — the total number of sheep in a given area at any one time.

SUSTAINABLE FARMING — farming that protects natural resources while producing food and fibre for consumers.

SYNTHETICS — fabrics that have usually been manufactured using petrochemicals, such as nylon and polyester.

VACCINATING — producers give sheep medicine to protect them against diseases like tetanus, cheesy gland, pulpy kidney, sheep measles, Ovine Johne’s Disease and black leg.

VEGETABLE MATTER — plant seeds, sticks and twigs found in wool prior to cleaning.

WOOL — the textile fibre obtained from sheep (Ovis aries aries). Wool is sometimes used synonymously to describe fibre from other animals such as cashmere from goats, mohair from goats, and angora from rabbits.

WOOL BROKER — a wool broker acts on behalf of a wool producer, or group of producers to sell their wool.

WOOL SHEEP — domestic, ruminant mammals of the species Ovis aries aries.

WOOLLEN PROCESSING — uses shorter fibres, less stages and produces a thicker yarn than worsted processing.

WORSTED PROCESSING — uses longer fibres, more stages and produces a finer, high-quality yarn than woolen processing.