

WOOL IN THE CIRCULAR ECONOMY



Over production and over consumption in the textile and fashion industries create unsustainable amounts of pollution.

Today the textile and fashion industries produce between 80-150 billion garments annually. Fast fashion results in 11kg of textiles discarded per person per year. Less than 1% is recycled into new products, and most recycling of textiles goes to lower-value applications.

To change the textile industry's method of production from a wasteful linear model towards a sustainable circular model, there is a global push – led by the European Union – to adopt a circular economy.

The circular economy is based on four principles, highlighted by the Ellen MacArthur Foundation:

1. Using renewable resources;
2. Designing out waste and pollution;
3. Keeping products and materials in use for a long time; and
4. Regenerating natural systems.

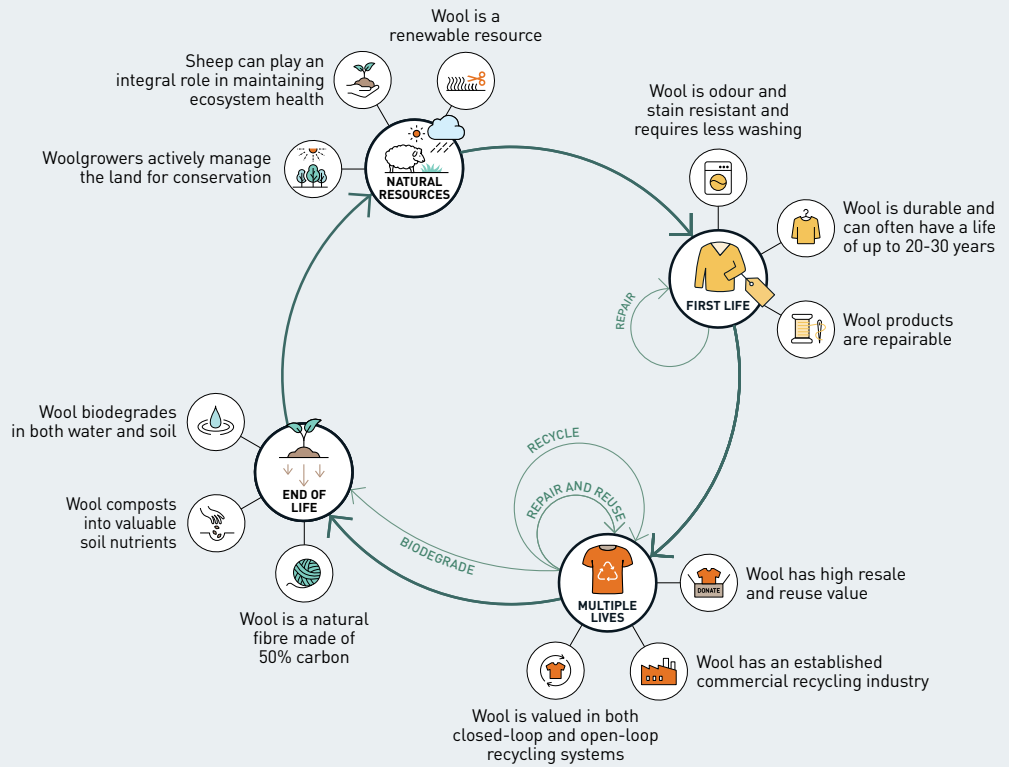
Wool offers a solution for brands, designers, and manufacturers looking to shift into a circular business model and create circular products.

A NATURALLY CIRCULAR FIBRE

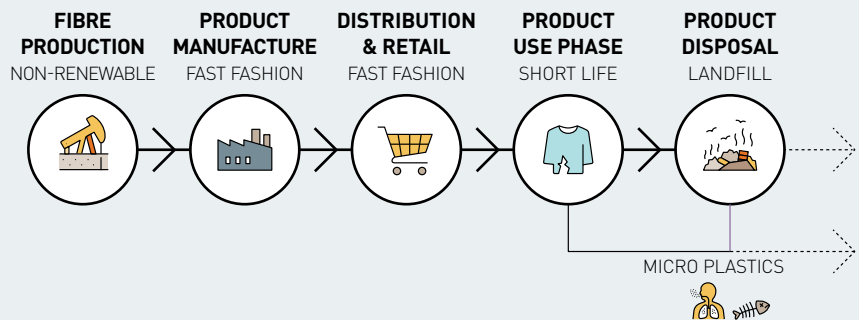
Wool is by nature a circular fibre.

The inherently circular nature of wool includes: wool being a renewable raw material grown by sheep, high levels of reuse and recycling of wool products and biodegradability when the fibre's nutrients are returned to the soil for use again. This is more than just recycling; it is true circularity. Growing wool has the potential to sequester large amounts of carbon and enhance biodiversity. Additionally, the wool fibre doesn't shed microplastics, in contrast to synthetic fibres which is a significant issue for the textile industry.

Circularity in the wool supply chain



Linear model typical of synthetic textile production



FIBRE PRODUCTION



Every year, sheep produce a new fleece, making wool a completely renewable fibre. Wool is grown by the simple mix of sunshine, water, grass and fresh air. Wool grows on a sheep's body because of the proteins, lipids, and minerals naturally absorbed through their diet, much like how humans grow hair. Environmental factors including climate, day length, soil type, and feed type contribute and influence the production of sheep's wool. There is a use for every part of the wool fleece; nothing is wasted.



In contrast, synthetic fibres such as polyester are derived from non-renewable fossil fuels, which, when extracted, de-sequester carbon stored in the earth millions of years ago and release methane through leakage. It is estimated that polyester textile production accounted for 700 million tonnes of carbon dioxide equivalent (CO₂e) emissions in 2015, while in 2010, global methane emissions from coal mines were estimated to be approximately 584 million tonnes of CO₂e emissions, accounting for 8% of total global methane emissions. For more on carbon, see the [Wool and the Carbon Cycle fact sheet](#).



Synthetic polymer fibres dominate the global fibre market, accounting for an estimated 63% of all fibres produced in 2019. It is estimated that by 2030, synthetic fibres will represent 73% of fibre production, of which 85% will be polyester.

PRODUCT USE PHASE

Wool is kept for longer

How often clothes are worn is the most influential factor in determining environmental impacts from clothing. Wool garments are, on average, kept in use for longer periods of time than garments made from other fibre types.

Wool is washed less

Wool is odour, stain and wrinkle resistant. This means that consumers wash wool clothing less frequently than clothing made from other fibres, at lower temperatures and more often line dry than tumble dry, thereby saving water, energy and detergent associated with laundering.

Wool has high reuse and recycle value

The wool industry is unique in having had a **commercially profitable recycling pathway for more than 200 years**, turning old, exhausted garments into new wool products. Wool's attributes are so highly valued that, even after a garment has finished its long service life with one person, the fibre is still suitable to be kept in use via three further ways:



1st life extension – **Reuse:** Wool is one of the most reused fibre on the planet of the major apparel fibres, with wool garments often



2nd life extension – **'Closed loop' recycling:** This involves deconstructing high-value wool garments to enable new yarns to be spun and new high-value garments fabricated. Wool is the most recyclable fibre on the planet of the major apparel fibres.



3rd life extension – **'Open loop' recycling:** This is essentially 'down cycling', in which wool products are pulled apart and fabricated into cheaper non-woven products for insulation, padding, interiors etc. Wool is highly valued for these purposes because of its inherent flame resistance, and acoustic and thermal insulation properties.

PRODUCT DISPOSAL

Wool is a 100% biodegradable fibre in both terrestrial and marine environments, slowly releasing valuable nutrients and carbon back into the earth. This biodegrading does not contribute to microplastic pollution. For further information see our [Wool is 100% biodegradable fact sheet](#).

THE IMPORTANCE OF A CIRCULAR ECONOMY

Global textile production doubled from 2000-2015, as clothing use decreased (Figure 1).

Product circularity has been identified as a solution to fast fashion pollution. The European Commission (EC) is leading the world in circular economy policy and legislation. In 2020, the EC launch the Circular Economy Action Plan (CEAP) to transition the EU to a circular economy. The textile industry has been identified as a priority sector, with the Strategy for Sustainable Textiles currently under development as an initiative of the CEAP.

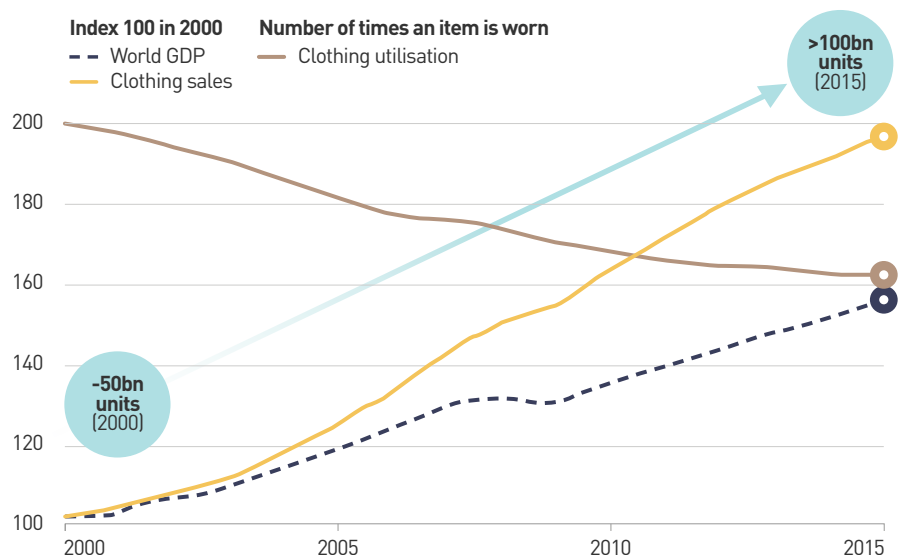


Figure 1: Growth of clothing sales and decline in clothing use since 2000.

WOOL IN THE CIRCULAR ECONOMY

SOURCES

- Over production and consumption in the and fashion industries create unsustainable amounts of pollution.
<https://www.sustainyourstyle.org/old-fast-fashion>
- Today the fashion and textile industries produce between 80-150 billion garments annually.
<https://www.sustainyourstyle.org/en/whats-wrong-with-the-fashion-industry#anchor-environmental-impact>
<https://sharecloth.com/blog/reports/apparel-overproduction>
- Less than 1% is recycled into new fibres for the clothing industry, and most recycling of textiles goes to lower-value applications.
- To change the textile industry's method of production from a wasteful linear model towards a sustainable circular model, there is a global push – led by the European Union – to adopt a new circular economy.
European Environmental Bureau. 2021. Wardrobe Change - Recommendations for the EU Strategy for Sustainable Textiles from environmental and civil society organisations. Lauds Foundation.
- The circular economy is based on four principles, using renewable resources, designing out waste and pollution, keeping products and materials in use for a long time; and regenerating natural systems.
The Ellen Macarthur foundation (2013) Towards a circular economy vol. 1 page 8
- Wool is grown by the simple mix of sunshine, water, grass and fresh air. Wool grows on a sheep's body because of the proteins, lipids, and minerals naturally absorbed through their diet, in much the same way humans grow hair
Reis P.J. (1988) The Influence of Absorbed Nutrients on Wool Growth. In: Rogers G.E., Reis P.J., Ward K.A., Marshall R.C. (eds) The Biology of Wool and Hair. Springer, Dordrecht. https://doi.org/10.1007/978-94-011-9702-1_13
- Environmental factors including climate, day length, soil type, and feed type all contribute and influence the production of sheep's wool.
Wynn Peter (1999), The environment of Sheep, The University of Sydney, Australian Wool Education Trust -BIOL-800-050-200 - accessed 05.08.21 <https://www.woolwise.com/educational-resources/crc-for-premium-quality-wool-resources/wool-biology-2/theme-wool-biology-wool-growth/>
- In contrast, synthetic fibres such as polyester are derived from non-renewable petrochemicals and fossil fuels, which, when extracted, de-sequester carbon stored in the earth millions of years ago. It is estimated that polyester textile production accounted for 700 million tonnes of carbon dioxide equivalent (CO2e) emissions in 2015.
Kirchain, R., et al., Sustainable apparel materials (2015), p.17
- in 2010, global methane emissions from coal mines were estimated to be approximately 584 CO2e emissions, accounting for 8 percent of total global methane emissions.
U.S. EPA, 2011. DRAFT: Global Anthropogenic Emissions of Non-CO2 Greenhouse Gases: 1990–2030 (EPA 430-D-11-003), www.epa.gov/climatechange/economics/international.html.
- Synthetic polymer fibres dominate the global fibre market, accounting for an estimated 63% of all fibres produced in 2019. It is estimated that by 2030, synthetic fibres will represent 73% of fibre production, of which 85% will be polyester
Truscott & Pepper (2020) Preferred Fiber & Materials Market Report. Textile Exchange
- Consumers wash wool clothing less frequently than clothing made from other fibres, at lower temperatures and more often line dry than tumble dry, thereby saving water, energy and detergent associated with laundering
Laitala K, Klepp IG (2016) Wool wash: technical performance and consumer habits. Tenside, Surfactants, Deterg 53:458–469. <https://doi.org/10.3139/113.110457>
- &;
Laitala K, Klepp I, Kettlewell R, Wiedemann S (2020) Laundry care regimes: do the practices of keeping clothes clean have different environmental impacts based on the fibre content? Sustainability 12:7537. <https://doi.org/10.3390/su12187537>
- **Reuse:** Wool is the one of the reused fibre on the planet of the major apparel fibres, with wool garments often preferentially donated or sold for extended life. According to a Nielsen wardrobe study, 50% of wool and wool blend garments are donated to charity, family, friends or sold
The Nielsen Company. Global Wardrobe Audit—All Countries; Prepared for Australian Wool Innovation by The Nielsen company; The Nielsen company: New York, NY, USA, 2012.
- &;
The Nielsen Company. Global Wardrobe Audit & Laundry Diary; A report prepared for Australian Wool Innovation Ltd.; The Nielsen Company: Sydney, Australia, 2019; p. 173.
- **'Closed loop' recycling:** This involves deconstructing high-value wool garments to enable new yarns to be spun and new high-value garments fabricated
Russell S., Swan P, Trebowicz M., Ireland A. (2016) Review of Wool Recycling and Reuse. In: Fangueiro R., Rana S. (eds) Natural Fibres: Advances in Science and Technology Towards Industrial Applications. RILEM Bookseries, vol 12. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-7515-1_33
- **'Open loop' recycling:** This is essentially 'down cycling', in which wool products are pulled apart and fabricated into cheaper non-woven products for insulation, padding, interiors etc
Russell S, Swan P, Trebowicz M, Ireland A (2016) Review of wool recycling and reuse. In: Fangueiro R, Rana S (eds) Natural Fibres: advances in science and technology towards industrial applications: from science to market, 1st edn. Springer Netherlands, Dordrecht, pp 415–428
- Wool is a 100% biodegradable fibre in both terrestrial and marine environments, slowly releasing valuable nutrients and carbon back into the earth This biodegrading does not contribute to microplastic pollution. For further information see our Wool is 100% biodegradable fact sheet.
Collie. S, Brorens. P, Hassan. M, Fowler, I. (2021) Biodegradation behavior of wool and other textile fibers in aerobic composting conditions. Submitted for publication
- &;
Collie. S, Brorens. P, Hassan. M, Fowler, I. (2021) Marine biodegradation behavior of wool and other textile fibers. Submitted for publication
- Since 1975, the global production of textile fibres has almost tripled
Tecnon OrbiChem (2021) World Synthetic Fibres Database – Strategic Market Overview
- Euromonitor International Apparel & Footwear 2016 Edition (volume sales trends 2005–2015); World Bank, World development indicators – GD (2017)*