

The Circular Way for Leather, Wool, and Silk

by Antonella Ilaria Totaro



Three supply chains for animal-based products – leather, wool, and silk – are trying to reinvent themselves, reducing their environmental impact and the use of chemicals and embracing ecosystem regeneration. Biodegradable fabrics, recycling processes, and the use of regenerative farming practices are the new trends that are rapidly taking over production and consumption in these sectors of the fashion world.

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While terrestrial ecosystems are crumbling under pressure from unsustainable patterns of production and consumption, many companies that manufacture leather, wool, and silk clothing are adopting circular business models and regenerative practices to diminish the environmental footprint of the clothes we wear.

Leather: Biomaterials and Regenerative Farming

The tanning industry is known for the impact of its productive processes, especially as the skins and hides are being transformed. Problems are mostly linked to the use, in 80-90% of existing leather products, of chrome tanning, which a study¹ by Green Cross and Pure Earth found to be one of the six most dangerous substances for human beings and

the environment, and of aldehyde tanning, with formaldehyde being considered a carcinogenic substance.

Fortunately, there is no lack of companies and start-ups in the sector that are focusing on biomaterials to replace animal-based leather. Pinatex² has developed and patented a non-woven fabric derived from pineapple leaves, while Italian company Vegea³ manufactures a biomaterial with the same mechanical, aesthetic, and sensory properties as animal leather from the oils and plant fibres found in grape pomace. Mexican company Desserto⁴ has patented cactus vegan leather, a breathable and partially biodegradable cactus-based material, which reduces water use in manufacturing by 20%. Tômtex⁵, meanwhile, is a biodegradable material made from 100% chitin derived from waste shells, fungi, and coffee grounds.

In addition to biobased materials, the sector is committed to a regenerative process of its production practices, starting with farming. The Savory Institute has developed Land to Market⁶, the world's first solution for checking the sourcing of leather and wool – and even meat and dairy products – from regenerative agriculture companies. Land to Market – following in the footsteps of Farm to Fork – aims to show the clear and tangible connection between fashion companies and the land.

Through a series of standards and soil health monitoring, Land to Market identifies both companies that, by producing in a regenerative way, are protecting biodiversity and ecosystems, and fashion companies (such as US-based Lagom Leather⁷) who purchase from these farms.

“After all the work on ‘I am a Plastic Bag’, in which I tried to salvage things that are sent to landfill, I asked myself if I could design a handbag that would never need a landfill at all,” explains Anya Hindmarch. Inspired by the circularity of nature and the idea of a zero-waste future, the Return to Nature⁸ handbag collection is the result of a search for tanneries making completely traceable leather, with pioneering tanning and finishing methods, and ways to make adjustable straps and safe handbags without the use of zips or buckles. Return to Nature handbags are thus free from chrome, heavy metals, and aldehydes

and can biodegrade in composting conditions, by 89.2% in 28 days, dissolving completely in 45 days.

The production of handbags and shoes has an enormous environmental impact⁹. In the footwear sector, Koio – a New York-based Italian leather sneaker company – aims, in the long term, to become the first luxury footwear brand to procure its materials from regeneratively managed farms. The company already has years of experience working on materials, having removed toxic tanning agents that can be dispersed through wastewater, used recycled materials for its soles and other plastic components, and launched the Koio Recycling programme which offers consumers a 50 dollar discount on a new pair of shoes when they return their used pair.

Engineered leather manufacturer Sustainable Composites¹⁰, based in Pennsylvania, is another company working to improve leather recycling practices. Co-founded by Frank Fox and Tom Tymon, two retired scientists and former managers, the company uses a chemical process to recycle leather and derive a material nicknamed “*enspire leather*”. Sustainable Composites has also secured a partnership with Timberland, with products hitting the market in early 2022.

Through its Crafted by Nature¹¹ programme, Timberland has set itself on a path to make the leather used in its products more sustainable.



Pinatex



Lagom Leather



Tomtex



Lagom Leather



The tanning industry is known for the impact of its productions, especially during the processing of leather.

In addition to leather sourced from farms that use regenerative practices and leather derived from supply chain waste flows, Timberland uses LITE Leather (an acronym for Low Impact To the Environment), which is tanned using a process powered by renewable energy, with less water and chemicals compared to traditional tanning. As well as being sourced from Gold standard tanneries certified by the Leather Working Group – which assesses the sustainability of tanneries across the world according to parameters such as water and energy use, waste disposal, worker safety, and ethics – Timberland leather also dries quickly and is stain-resistant, increasing product durability.

There is also no lack of Made in Italy excellence. Zanellato¹¹ has patented Pura®, the world's first naturally white leather with near-zero metal content, created thanks to the use of almonds and their shells mixed with an essence of cloves and Marseille essential oils. With Postina®Pura®, the Veneto-based company was also the world's first fashion company to obtain the Leather Standard by Oeko-Tex® certification for a finished product.

Be Green Tannery¹³, based in Campania, was founded in 2018 as part of the Solofra tanning district. It is the first company to have obtained the “metal-free” product certification from the Stazione Sperimentale per l'Industria delle

Pelli (the Experimental Station for the Tanning Industry, a Special Agency of the Naples Chamber of Commerce). Be Green Tannery replaces metals with natural products sourced from the food industry. Meanwhile, Sciarada¹⁴, a historic tanning company and world leader in the production of high-quality suede for footwear, leather-wear, and clothing, has launched Evolo¹⁵, a suede product made by regenerating chamois waste and reducing the use of chemical additives during processing.

Wool: More than Regeneration

Wool is a renewable and biodegradable fibre, suited to reuse and recycling. In the Ellen MacArthur Foundation's Material Circularity Indicator¹⁶, wool is given the highest score. However, “to ensure circularity, there are two steps we must focus on: firstly, design, because garments need to last as long as possible. Secondly, we have to eliminate synthetic fibres and chemicals from the process, so clothes can biodegrade in the ground at their end-of-life”. These are the words of Ruth Rands, the founder of Herd¹⁷, a sustainable knitwear company that uses the best wool from the north-west of England to revitalise traditional sheep farming for wool.

Despite the undeniable problems in the wool supply chain, there are some excellent circular companies. In Prato, Italy we find Rifò¹⁸, which manufactures locally sourced cashmere and cotton starting from 100% regenerated and regenerable fibres. Rifò has developed two types of wool-related fabrics: regenerated cashmere wool and carded wool cloth. The regenerated cashmere wool fabric is manufactured using a mechanical process developed in Prato centuries ago. It is made from 95% regenerated cashmere and 5% regenerated wool. The cashmere can be sourced from old clothes or industrial waste. The carded wool cloth, meanwhile, is regenerated and woven in Prato and is composed of 65% regenerated wool, 30% regenerated polyamide, and 5% regenerated polyester. The wool, in this case, is derived from pre-consumer industrial waste fabrics. In both cases, old knitwear and scraps are selected by colour and reduced to fibres through a carding process. The resulting material is then spun to obtain an already-coloured product that drastically reduces water consumption. In some cases, it is re-dyed to achieve brighter colours which could not be achieved solely via the regeneration process. While virgin cashmere can be regenerated for at least 3 cycles, the wool cloth is only regenerable once. The company also runs a 100% wool and cashmere clothes collection service.

“I chose wool because it's a strong and easily recyclable fibre, with great potential for making

Wool is a renewable and biodegradable fiber, suitable for reuse and recycling.

the supply chain more sustainable,” says Ellen Mensink, founder of Loop.a life¹⁹. The Dutch company’s jumpers are created entirely from recycled materials: 40-70% of post-consumer wool is mixed with industrial waste materials and, sometimes, with recycled PET to improve the colour and strength of the yarn. The fibres are locally sourced in Amsterdam, while the yarn and clothing are manufactured in Europe.

The reduction of impacts in the wool supply chain can be approached from the most disparate angles. For the latest Woolmark knitwear collection, Victoria Beckham has used the Tintoria di Quaregna natural dyeing system, which uses flowers, leaves, and berries and whose licence is owned by Woolmark. Chinese designer Uma Wang has showcased a capsule collection for autumn-winter 2021/2022 made from Australian merino wool marked with traceable QR codes – using blockchain technology – to allow consumers to check the authenticity and provenance of the product, from farm to clothing. The traceability and provenance of wool are hot topics in the sector. Every year, one billion sheep produce two million tonnes of wool. Most of it is bought by a complex

network of brokers and intermediaries, making it impossible to trace the farm from which the fibres originated.

“Responsible wool means that we know exactly what farms produce our wool and how the animals and the land were managed,” says Megan Meiklejohn, Sustainable Materials and Transparency Manager at Eileen Fisher²⁰, a Savory Institute Land to Market-approved company for wool. In 2018, it was one of the first brands to introduce wool certified according to the Responsible Wool Standard (RWS). “We had to reinvent our sourcing from scratch,” Meiklejohn continues. “We visited farms in South America, New Zealand, and Australia”. For some limited edition products, The North Face²¹ uses Fibershed Climate Beneficial wool²², produced by farmers that regenerate soil health through carbon-storing farming practices. Fibershed is a Californian NGO that creates regional supply chains for the development of natural fibres and dyes, focusing on fairness at the local level and land regeneration.

The world’s first zero-emission fashion brand, Sheep Inc.²³, is a London-based company that creates New Zealand merino wool jumpers derived from regenerative farms and processed in an Italian plant that uses renewable energy. CO₂ emissions are compensated through

Below:
Caption Zero waste garment made with Climate Beneficial wool fabric, grown and milled in Northern California designed by Zoh Hollinger



Fibershed, Photo Credit Paige Green



RiB



RiB

investments in environmental programmes worth 5% of the company's revenue. Furthermore, for each garment purchased, customers adopt a sheep in the farm from which the wool is sourced, receiving updates when, for example, the sheep is shorn or gives birth to lambs.

Looking at new technology, the team at the New York Fashion Institute of Technology has created Werewool²⁴, a lab-grown fibre that mimics the properties of wool. Finnish sustainable textiles company Spinnova and the VF Icebreaker® brand are developing clothing using a next-generation mix of merino wool and SPINNOVA® fibre, which can be recycled multiple times.

In terms of investments, Kering Group, alongside Conservation International, launched the Regenerative Fund for Nature²⁵ in early 2021. The fund, whose first seven beneficiaries were announced in September last year, was established to support innovative projects that restore biodiversity and help transition one million hectares of land to regenerative practices for the luxury industry, with a specific focus on fashion supply chains such as wool, cashmere, leather, and cotton.

Silk: Research and Upcycling

Even though its production has a higher environmental impact compared to other natural fabrics, silk is one of the most durable textile products and is a biodegradable natural fibre that can be regenerated and reused for medical, bio-sensory, or textile applications. It is no surprise that, for years, companies and universities have been working on research to create artificial silk. By altering the silk made by silkworms, MIT researchers have discovered that they can create a material called Regenerated Silk Fibroin (RSF), which is twice as rigid as its natural counterpart and can be modelled in more complex structures.

Another example is the production of spider

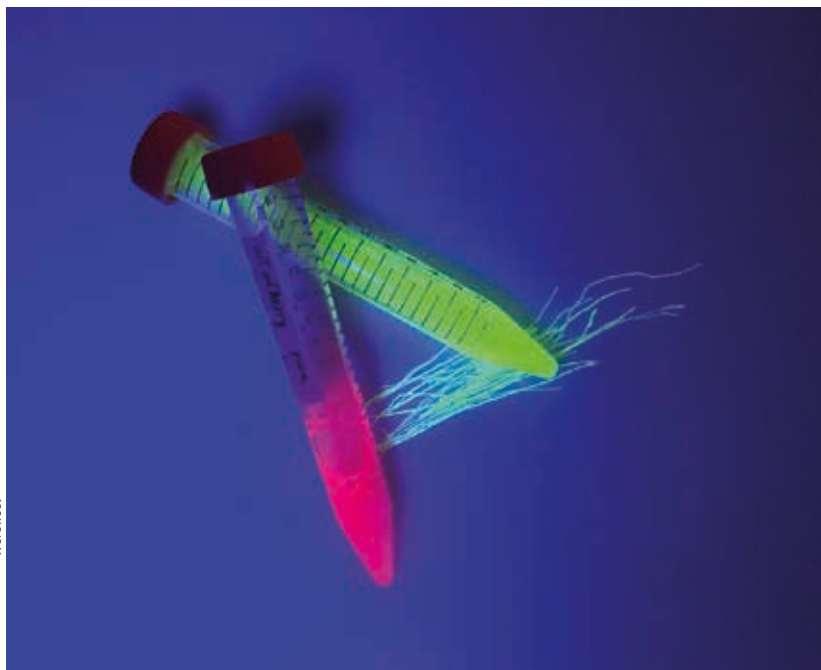
silk by Japanese company Spiber²⁶, which uses precision fermentation to programme microbes to produce synthetic silk. In collaboration with The North Face, Brewed Protein™ – a spider-silk-inspired sustainable alternative – was mixed with cellulose to make the Planetary Equilibrium t-shirt and the Moon Parka, the world's first outerwear product made from microbially manufactured fabric.

Bombyx²⁷, meanwhile, is a 6-year project developed under the umbrella of the PSGHL, a clothing production hub in China, to create a vertical supply chain that increases the demand for better silk production methods. Bombyx aims to combine traditional sericulture techniques with regenerative agriculture, new technologies, and research to produce ethical and sustainable silk.

Replicating regenerative farming practices, UK-based Bamford²⁸ has transformed its supply chain by eliminating intermediaries and sourcing the materials for its new collection from a Chinese company that uses responsible practices like crop rotation and intercropping to increase biodiversity and sequester more carbon in the soil. The mulberry plants for the silkworms are grown in an ecosystem that promotes nutrient balance in the soil and protects them from plant diseases and sudden climate change.

Cambodian NGO Golden Silk²⁹, established in 2002, has incorporated the Khmer tradition

Silk is among the most durable fabrics, and is a natural, biodegradable fiber that can be regenerated and reused for medical, biosensor or textile applications.



Werewool



Spinnova



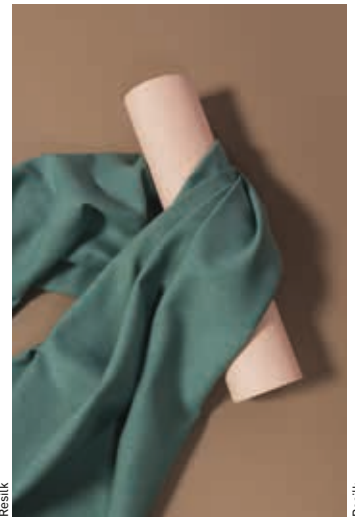
Golden Silk



Resilk



Resilk



Resilk

of conservation and minimising waste into the production of silk. The circular economy pervades the activities of this small rural community, one of the last remaining sites where golden silkworms are farmed, despite them being less productive than the more common white variety – 300 to 400 mommes (the unit of measurement for silk) per pod, compared to 1,400 mommes for white silkworm. Golden Silk's craft manufacturing, in addition to preserving tradition and supporting women's employment, is powered by solar

panels, does not use water to irrigate the plants, and reuses uneaten mulberry leaves, the worms' excrement, and plant waste to produce compost with which to feed the mulberries.

Finally, Italy's know-how performs strongly in silk recycling, particularly in Como's textile district. 2nd life is an upcycling and circular fashion project by Ratti³⁰, organised in 3 phases. 2nd Life Fibres, in collaboration with German company Freudenberg, transforms reused and/or recycled silk into an innovative insulation material, light and breathable padding useful for casual clothing and sportswear. 2nd Life Print upcycles unsold garments, which are reprinted, re-dyed, and put back on the market, while 2nd Life Hydro relates to the design of an industrial process that restores the performance and water-resistance of sports jackets, lengthening their lifespan and allowing for reuse.

Mantero³¹ has developed Resilk®, a fully Made-in-Italy traceable project, certified by Global Recycled Standard (GRS) and designed to regenerate silk fibre and create innovative fabrics with new decorations, unique for their softness and warmth. Created to reduce waste and find a use for surplus fabrics, the project was developed in Partnership with Ecotec® by Marchi & Fildi. ●

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