COTTON AUSTRALIA

COTTON AS A CONSUMER PRODUCT

The story of a modern, sustainable agricultural industry that's helping to clothe the world. Cotton Australia's Cotton Education Kit provides current, authoritative information for all teachers and students, and includes:

- Targeted Australian Curriculum outcomes for Years 7-12, and outcomes for Years 11-12 from NSW, QLD, SA, WA, NT & ACT syllabi in each of its 10 chapters.
- Case studies and multimedia that are embedded in the Kit. Additional school resources, lessons and worksheets are found online in the Cotton Classroom.

Cotton Classroom

Cotton remains the world's favourite natural fibre, with a huge range of desirable physical characteristics including breathability, softness, non-allergenic, moisture wicking and natural comfort. Consumers have more recently switched on to the environmental and social sustainability attributes of the products they buy, with many brands and retailers focused on better understanding where and how their products are made. Environmental and social standards, traceability, transparency and the certification of raw materials and supply chains are more common features of brands' sourcing strategies, with these messages reflected in fashion brand values and messaging to consumers.

For Australian cotton, this provides a wonderful opportunity to promote decades of investment in sustainability by Australia's cotton farmers, linking their work to the end product by sharing compelling and authentic stories with consumers.

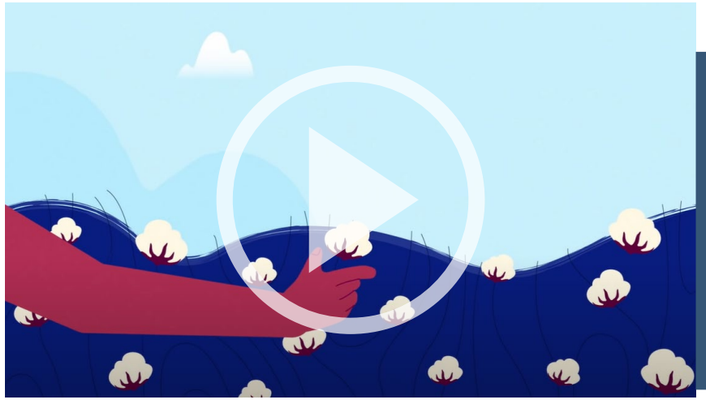
THE PROPERTIES OF COTTON

Cotton has many special properties, including:

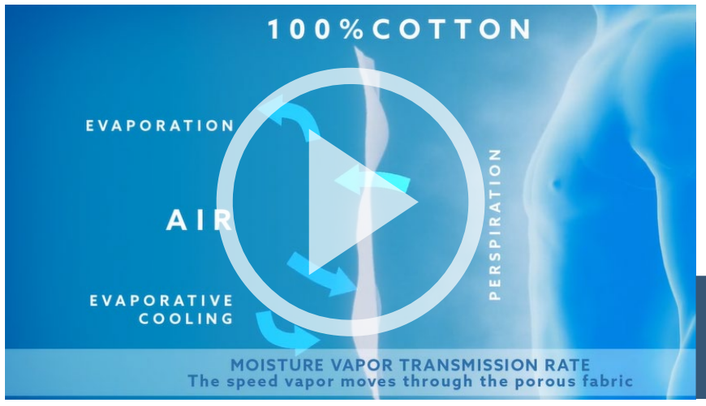
- Cotton is hypoallergenic, meaning it does not irritate sensitive skin or cause allergies.
- Cotton is very soft, which is why it is particularly favoured in underwear and garments worn close to the skin. This is achieved by tightly spinning the ends of cotton fibres into the yarn so that the fabric does not cause skin irritation or static electricity.
- Unlike synthetic fibres, cotton is a natural product that is derived from living, natural organisms rather than from petrochemicals or artificial compounds.
- Cotton is long-lasting, if cared for by the consumer.
- Cotton can be easily blended with other fibres, including synthetics such as polyester and Lycra and natural fibres like wool.
- Cotton is one of the easiest fabrics to dye, because it is naturally white in colour and very absorbent.
- Stains can be easily removed from cotton.
- Cotton is a good conductor of heat. In other words, it draws heat away from your skin to keep you cool, making it very comfortable to wear.
- Cotton becomes stronger when wet and can take up to one-fifth of its weight in water.
- Cotton's strength and absorbency make it an ideal fabric for medical and personal hygiene products such as bandages and swabs.
- Cotton is versatile – it can be blended, coated, finished, is dry cleanable, machine washable and easy to print.
- Cotton is not easily damaged by sunlight and is therefore often used in the manufacture of curtains, tents and tarpaulins.
- Cotton breathes easily because of its unique fibre structure. This attribute makes cotton more comfortable to wear than some artificial fibres that are unable to provide ventilation.

Cotton Incorporated is the Research and Promotion Company for cotton in USA and a not-for-profit organisation. This link provides an overview of some of the state-of-the-art research and cotton innovations they are pursuing.

The apparel industry is looking to smart clothing to appeal to consumers' desire for novelty, while also becoming more competitive in the marketplace.



TedEd: Dig into the science of how cotton transforms from seed to fibre, and how these cotton fibres are used to make everything from fabrics, to currency, and fishing nets.



Cotton Inc. breathability 3D animation.

Knitted or woven fabric can be used to manufacture bed sheets. Investigate the properties of both products to consider which you would, as a consumer, purchase.

PRODUCTS MADE FROM COTTON

For most of us, whether we are aware of it or not, cotton is very much a part of our everyday lives.

Cotton is used to produce thousands of useful products, including clothing and homewares, sheets and towels, tarpaulins and tents, pharmaceuticals, feminine hygiene products and medical supplies like bandages and x-rays, even parts of a flat screen TV.

The cotton lint from one 227kg bale can produce 215 pairs of denim jeans, 250 single bed sheets, 750 shirts, 1,200 t-shirts, 3,000 nappies, 4,300 pairs of socks, 680,000 cotton balls, or 2,100 pairs of boxer shorts.

ONE 227KG OF COTTON CAN PRODUCE

2,100 pairs of boxer shorts

215 pairs of jeans

1,200 t-shirts

3,000 nappies

4,300 pairs of socks

250 single bed sheets

PRODUCTS MADE FROM **COTTON LINT/FIBRE**

- Cotton lint is spun, then woven or knitted into fabrics such as velvet, corduroy, chambray, velour, jersey and flannel.
- On average, 67% of the world's total cotton production was used to make clothing between 2011 and 2015, with the rest used in home furnishings and industrial products.
- Well known cotton products include denim jeans, socks, towels, t-shirts, bed sheets and underwear. More unusual uses of cotton fibre include tents, car tyre cord, fishnets and book binding.

PRODUCTS MADE FROM **COTTON SEED**

- More than half the weight of unprocessed cotton (seed cotton) is made up of seed, a valuable by-product of fibre production.
- One tonne of cottonseed yields approximately 200kg of oil, 500kg of cottonseed meal and 300kg of hulls.
- Global cottonseed production can potentially provide the protein requirements for half a billion people per year and many billions of animals.
- The most common uses of cottonseed is that it is pressed to make oil for commercial cooking, and as a feed for cattle and livestock as it is a great source of energy.
- Cottonseed oil can also be used in a range of industrial products such as soap, margarine, emulsifiers, cosmetics, pharmaceuticals, rubber, paint, water proofing and candles.
- Cottonseed oil is cholesterol free, high in poly-unsaturated fats and contains high levels of antioxidants (vitamin E) that contribute to its long shelf life.

PRODUCTS MADE FROM **COTTON LINTERS**

- Cotton linters are fine, very short fibres that remain on the cottonseed after ginning. They are curly fibres typically less than 3mm long.
- Linters are used in the manufacture of paper (such as archival paper and bank notes) and as a raw material in the manufacture of cellulose plastics, for example for x-rays.
- Linters are commonly used for personal hygiene and medical supplies such as tampons, bandages, cotton buds and cotton balls.

CASE STUDY: Nothing is wasted. See how recycled textile fibres are being used as reinforcements for polymer composites.

There are so many types of cotton fabric, from basket weave to batik, cable knit to canvas, denim to fleece, gingham to moleskin, velour to velvet and the list goes on. Learn about the different types of cotton fabrics and the common use of each, from clothing to home décor.

Cotton products and uses, as told by some of the Australian cotton industry's farming families.

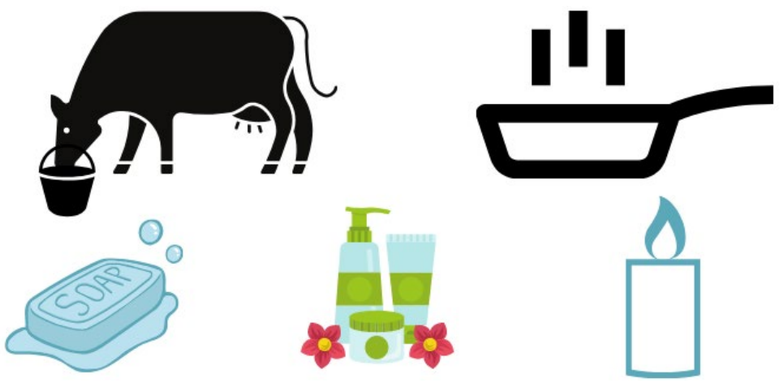
CASE STUDY: Technological Innovation in Cotton
Cotton's natural properties can be enhanced through application of new technological innovations that reinvent cotton as a true performance fibre. Cotton Incorporated scientists and researchers work tirelessly to keep cotton competitive in the apparel and home textile sectors. Much of their time is dedicated to developing cotton performance technologies for use by brands, retailers and manufacturers that do not create additional environmental burden.

COTTON **PRODUCTS**

Cotton is a natural fibre from a plant. It is produced so that the fibre can be made into products for consumers. Australia's cotton crop is carefully grown on approximately 1,500 farms mostly in NSW and QLD. Picked cotton is baled in the paddock and transported to the local cotton gin where it is ginned - a process separating lint (raw cotton fibre), cottonseed and trash.

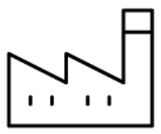
COTTONSEED

Cottonseed makes up about 55% of the haversted crop weight. Some cottonseed can be fed directly as livestock feed, particularly during drought. Kernels are flaked and crushed to produce cottonseed oil and meal. Cottonseed oil is so versatile it can be used in snack foods, salad dressings, and stir frying or baking applications. Cottonseed meal is used in animal feeds as a high protein supplement.



TRASH

Cotton is biodegradable and farmers leave stalks and roots in the ground to decompose and enrich the soil.

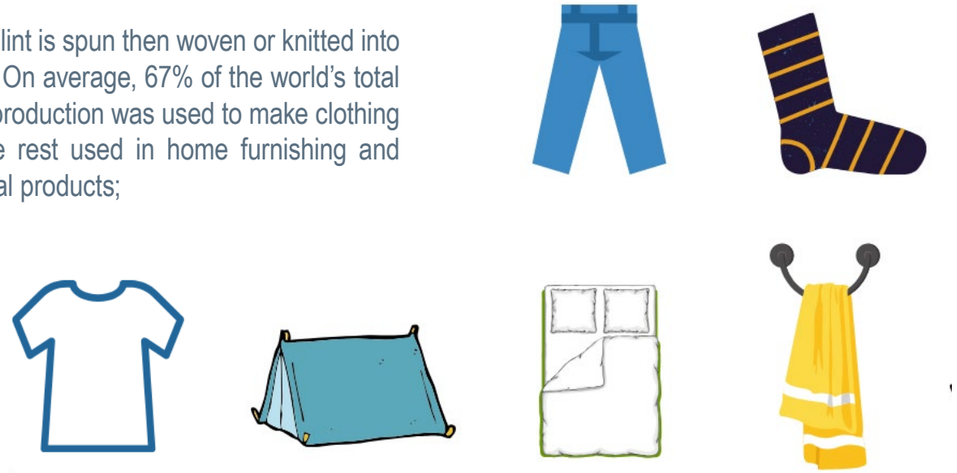


INDUSTRIAL USES OF COTTON

Commonly used in flange gaskets on pipes and tanks, insulating strips, isolation barriers, dust seal and covers, and a variety of sealing applications across all industries such as construction, power generation, agriculture and manufacturing.

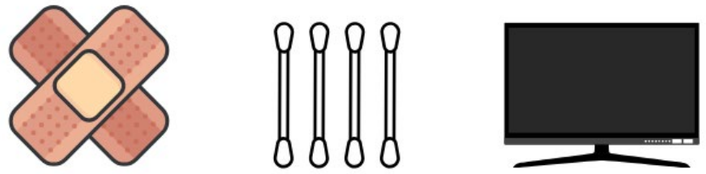
COTTON LINT/FIBRE

Cotton lint is spun then woven or knitted into fabrics. On average, 67% of the world's total cotton production was used to make clothing with the rest used in home furnishing and industrial products;



COTTON LINTERS

Cotton linters are fine, very short fibres that remain on the cottonseed after ginning. They are curly fibres typically less than 3mm long.



CIRCULAR ECONOMY

Cotton as a natural fibre can be reused, recycled or upscaled. It is a strong, resilient fibre that is long-lasting.

CIRCULAR BUSINESS MODELS **FOR FASHION**

The fashion industry is considered to be one of the most polluting industries on the planet, with textile waste one of the major issues. Around the world we now consume about 80 billion new pieces of clothing every year—400% more than we were consuming just two decades ago.

Globally, an estimated 92 million tonnes of textiles waste is created each year, and the equivalent to a rubbish truck full of clothes ends up in landfill sites every second. By 2030, it is expected more than 134 million tonnes of textiles will be discarded per year. (Source: Global Fashion Agenda)

Fast fashion business models, clothes made from materials that don't break down, and consumers buying more clothes and textiles than they need are all part of the problem. Fashion labels and textile businesses are looking to new ways of doing business that can reduce the industry's environmental footprint, with circularity at the core.

"The current fashion system uses high volumes of non-renewable resources, including petroleum, extracted to produce clothes that are often used only for a short period of time, after which the materials are largely lost to landfill or incineration," says Chetna Prajapati, who studies ways of making sustainable textiles at Loughborough University in the UK.

"This system puts pressure on valuable resources such as water, pollutes the environment and degrades ecosystems in addition to creating societal impacts on a global scale."

WHAT IS A **CIRCULAR ECONOMY?**

According to the Ellen MacArthur Foundation, "A circular economy is a systemic approach to economic development designed to benefit businesses, society, and the environment. In contrast to the 'take-make-waste' linear model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources."

The three key principles of a circular economy are:

- Design out waste and pollution;
- Keep products and materials in use;
- Regenerate natural systems.

Leading brands, retailers and manufacturers are increasingly focused on these principles, as a means to reduce fashion's significant impact on the natural environment globally.

One garbage truck of textiles wasted every second: report creates vision for change.

CASE STUDY: A new textiles economy – redesigning fashions' future. This report outlines a vision for a system, delivering long-term benefits for a new textiles economy based on the principles of a circular economy.

Make fashion circular animation from the Ellen Macarthur Foundation

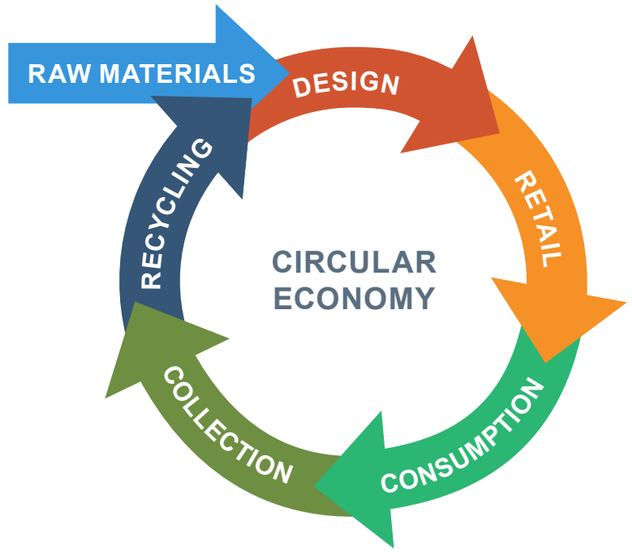
LINEAR ECONOMY

WHERE DOES **COTTON FIT?**

Cotton has a natural place in the circular economy. Cotton is biodegradable, renewable and recyclable and it doesn't have the microplastics problem associated with synthetic fabrics. It is also able to be regenerated on cotton farms that have sustainability programs in place, such as the myBMP program in Australia.

Choosing cotton is one way for brands to minimise the harmful impact of fashion on our rivers and oceans and at the same time, support more than 300 million families and their communities who rely on cotton for their livelihoods.

Cotton Australia is working with brands, not-for-profit organisations, universities and businesses to help find solutions to the textile waste problem here in Australia, with the ultimate goal of turning textiles into products that can be used back on the farm. The Cotton Converts group is aligning problems with solutions for textile waste by encouraging collaboration and partnerships between organisations with similar goals.



MICROPLASTICS

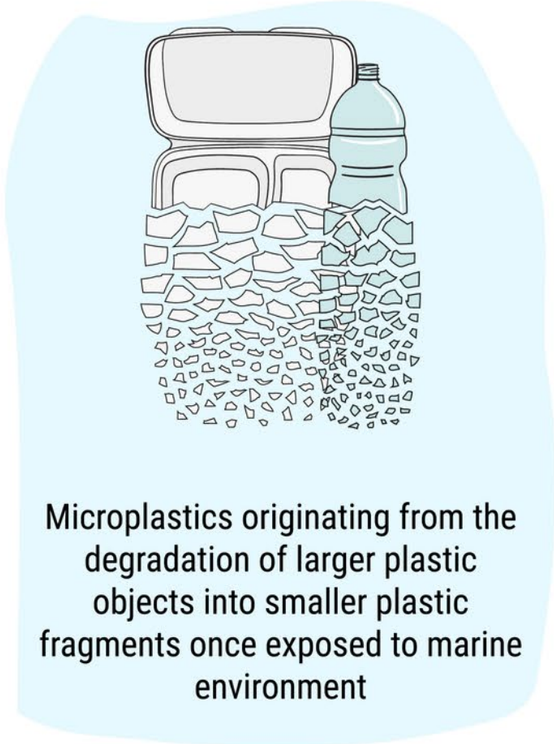
Microplastics are plastic particles less than five millimetres in diameter. They can occur from the degradation of large plastic waste (secondary) or from primary sources including:

- The scrubbing agents in personal care products (microbeads, shower gels, creams etc.);
- The abrasion of large plastic objects during manufacturing, use or maintenance (such as the abrasion of synthetic textiles during washing).

PRIMARY MICROPLASTICS

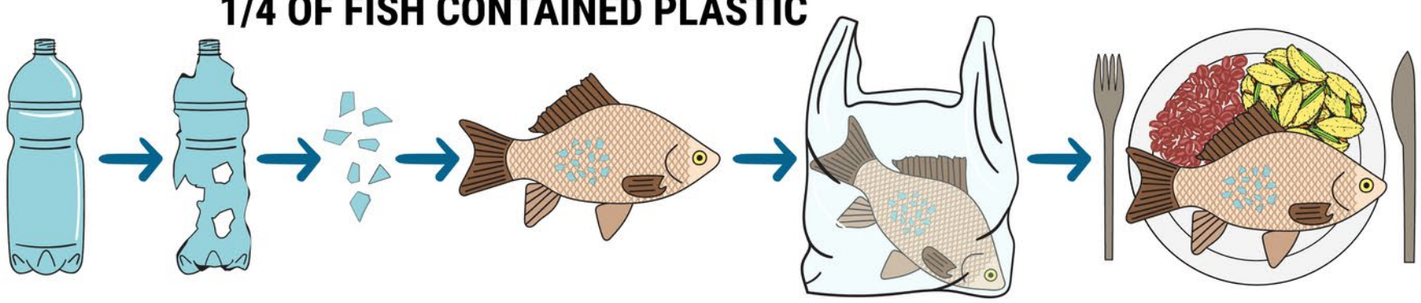
Microplastics directly released into the environment in the form of small particulates from cosmetics, synthetic textiles, tyres use and city dust

SECONDARY MICROPLASTICS



Microplastics originating from the degradation of larger plastic objects into smaller plastic fragments once exposed to marine environment

1/4 OF FISH CONTAINED PLASTIC

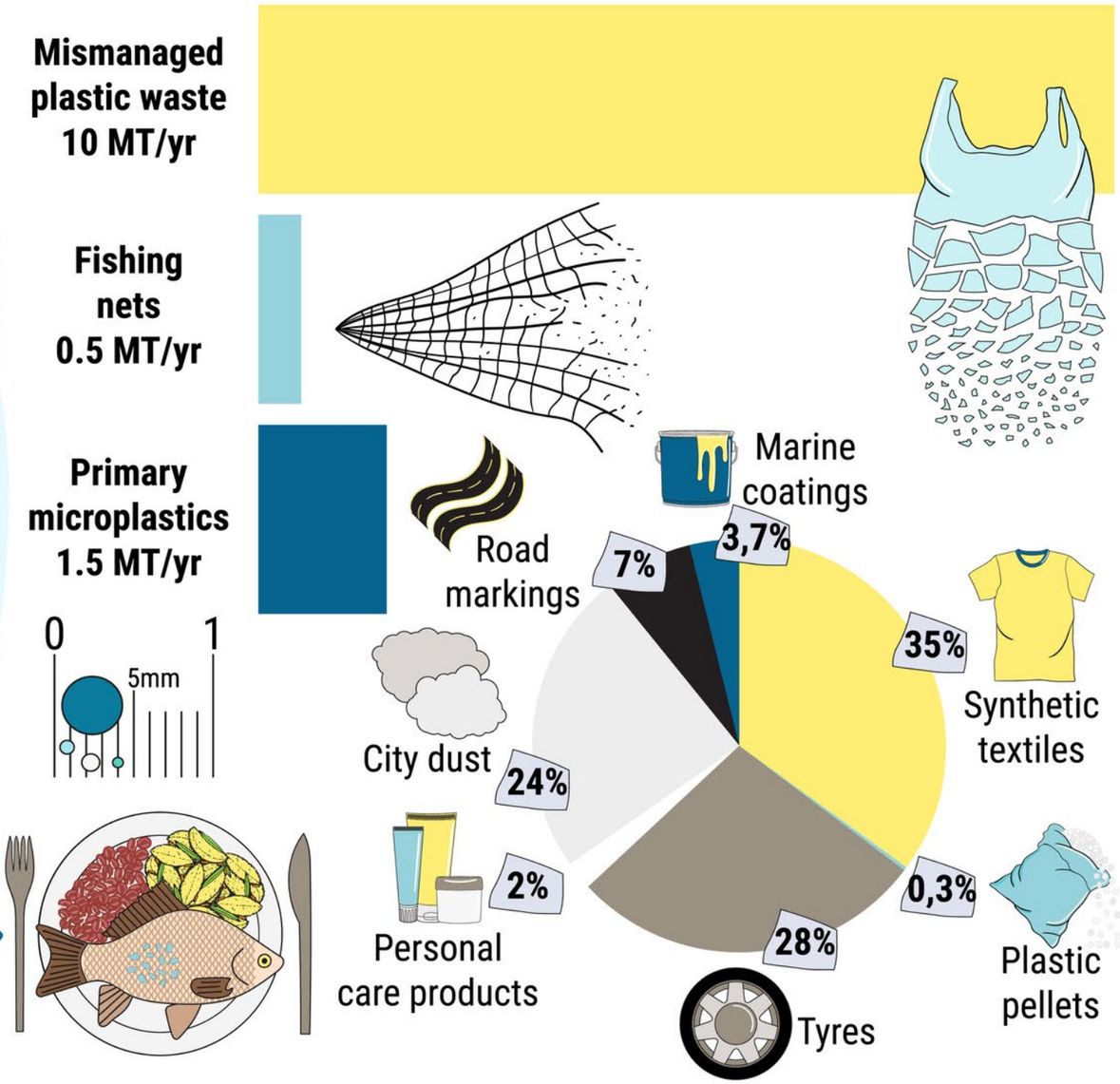


THE EXTENT OF THE PROBLEM

According to a recent study by the International Union for the Conservation of Nature (IUCN):

- 9.5 million metric tonnes MT of new plastic waste enters the ocean each year;
- Between 15 and 31 per cent of all the plastic in the oceans could originate from primary sources.

GLOBAL RELEASES OF MICROPLASTICS TO THE WORLD OCEANS



INDUSTRY RESEARCH
INTO THE PROBLEM

A literature review carried out by Patagonia and the University of California, and published in the report 'Microfiber Pollution and the Apparel Industry' revealed that:

- Finished apparel products contain large quantities of chemical substances from processing and finishing steps in garment manufacturing, many of which are released from garments during consumer washing.
- Wastewater treatment plants receive large amounts of microfibers daily. While most of these microfibers are removed, a significant amount is still released into the local environment.
- Analysis of global water and sediment sampling data indicates that microfibers are ubiquitous in aquatic environments. Recent evidence supports microfiber pollution pervading terrestrial environments and the atmosphere as well.
- Aquatic organisms throughout the food chain consume microplastics and microfibers both directly and indirectly. Within the food chain, these particles have been found to cause physical and chemical impacts, resulting in starvation and reproductive consequences in species.
- Microplastics and microfibres have also been found in marine species directly consumed by humans, the effects of which are unknown.
- They have also been found in abiotic ocean products such as sea salt.

The report recommended the apparel industry investigate the effects of garment construction, washing machine type and fabric composition, use of recycled polyester and biodegradable synthetic textiles, and the possibility of re-incorporating fibres shed in the consumer washing phase in garment manufacturing.

SOURCE/LINK: Textile Exchange Preferred Fibre Materials Market Report.

The facts on plastic are sinking in. Understanding the depth of the plastics problem.

WHAT ABOUT **COTTON?**

As the issue of microplastic pollution has become a key topic for the textile industry, Australia's Cotton Research and Development Corporation in partnership with Cotton Incorporated, funded a study to examine this issue for cotton as opposed to other fabrics.

The study was conducted by the North Carolina State University and examined how many microfibers were generated from laundering different fabrics, and their subsequent biodegradability.

It found that cotton and rayon (viscose) fabrics release more of these minute, problematic fibres during laundering than polyester textiles; but it was also found that in a wastewater treatment situation, the biodegradation of natural textile fibres is markedly more rapid than that of synthetics.

After 220 days in an aquatic environment, the cotton had 74% degradation, rayon 61% and polyester had just 6% degradation.

The biodegradation results indicate that natural-based microfibres such as cotton and rayon can be degraded during the wastewater treatment process and in natural aquatic environments. Even though the polyester fabrics released less microfibres than the other fabric types tested, these microfibres are expected to persist in the environment for long periods of time.

CASE STUDY - Ellen Macarthur Foundation : Textiles and clothing are a fundamental part of everyday life and an important sector in the global economy. This learning path explores how the principles of the circular economy can be applied to the fashion industry, beginning by covering why the fashion industry of today is not fit for purpose. Following that, it examines the vision for a new textiles economy through three focus areas that are critical to realising this vision:
1. New business models that increase clothing use.
2. Safe and renewable inputs.
3. Solutions so used clothes are turned into new.
Finally, you will learn about the opportunities that exist for innovative business models that can be employed by the fashion industry, including clothing rental, increased durability, and boosting clothing care.

CottonWorks-Recycled cotton is not a new concept to the textile and apparel market, but as manufacturers, brands, and retailers continue to evaluate their supply chain footprint, the interest in recycled cotton has grown.

Waste and Recycled Textiles as Reinforcements of Building Materials.

COTTON UP
GUIDE TO SOURCING SUSTAINABLE COTTON

CASE STUDY - Cotton Up: Despite the global market growth of sustainably grown cotton, it is still a niche product. For 2016/17, the total volume of sustainable cotton was estimated to be 15% of global production. Explore this guide that helps brands, retailers and others to source cotton in sustainable ways, so we can continue to enjoy its benefits in the future.

THEMES AND AUSTRALIAN CURRICULUM
OUTCOMES FOR SECONDARY SCHOOL

The Cotton Education Kit has been linked to the Australian Curriculum for Years 7-10, and targeted outcomes for Years 11 -12 from all state & territory curriculums across Australia. A list of themes is provided for teachers as a quick guide to assist linking the content to their unit of work or syllabi in their state or territory.

A full list of the individual syllabuses that have been mapped against the Cotton Education Kit can be found in the Cotton Classroom.

Cotton Classroom

CHAPTER NINE THEMES

- The Properties of Cotton
- Cotton Products
- Products Made from Cotton Lint/Fibre
- Products Made from Cotton Seed
- Products Made from Cotton Linters

CHAPTER NINE
CURRICULUM OUTCOMES

Curriculum	Course	Chapter 9: Cotton as a Consumer Product
Australian Curriculum	Year 7 Economics and Business	ACHEK017 (consumers and producers)
	Year 7 Design and Technologies	ACTDEK029 (evolution of products) ACTDEK032 (fibre production)
	Year 8 Design and Technologies	ACTDEK029 (evolution of products) ACTDEK032 (fibre production)
	Year 9 Economics and Business	ACHEK041 (competitive advantage)
	Year 9 Design and Technologies	ACTDEK044 (production and marketing of fibre)
	Year 10 Design and Technologies	ACTDEK044 (production and marketing of fibre)
New South Wales (HSC)	Agriculture Life Skills (2018)	ALS11 ALS13 ALS5
	Industrial Life Skills (2018)	ITLS5
	Textiles and design (2013)	P3.1 P5.1 H4.2
	Textiles and Design Life Skills (2018)	TDLS2 TDLS3 TDLS5 TDLS9
Victoria (VCE)	Product Design and Technology (2018)	Unit 1: Sustainable product
Queensland (QCE)	Agricultural Science (General) (2019)	Unit 3: Topic 3
	Design (General) (2019)	Unit 1 Topic 2: Design process
	Fashion (Applied) (2019)	Elective 2.2.7: Textiles
Western Australia (WACE)	Economics (ATAR) (2018)	Unit 1: The Market
	Plant Production Systems (General) (2017)	Unit 2: Economics, finance and markets Unit 3: Economics, finance and markets Unit 4: Economics, finance and markets
	Plant Production Systems (ATAR) (2017)	Unit 2: Economics, finance and markets Unit 3: Economics, finance and markets Unit 4: Economics, finance and markets
South Australia / Northern Territory (SACE)	Design, Technology, and Engineering. Stage 1 (2020)	Material solutions: Clothing and textiles
	Design, Technology, and Engineering. Stage 2 (2020)	Material solutions: Clothing and textiles
Tasmania (TCE)	Design and production (2016)	Area 1: Design and producing solutions (Includes textiles)
ACT (ACT SSC)	Design and Textiles A/T/M/V (2020)	Design Aesthetics Design for Purpose
	Economics (2017)	Unit 1b: Economics
	Economics (2017)	Unit 1b: Economics

KEY **LINKS**

- Cotton Australia.
- 360-degree digital film of a cotton farm, the latest addition to Cotton Australia's suite of educational resources informing city and country residents about the Australian cotton industry.
- Google Arts & Culture
- Australian Cotton
- Cotton Research and Development Corporation
- Cotton Seed Distributers
- CottonInfo
- Primezone: Primezone provides teachers and students with access to the latest quality primary industries education resources

COTTON AUSTRALIA