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Course: Surface Pattern Design (SPD)

Module: Independent inquiry ADAD6001

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Word Count: 6077

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What are Alternative Fibre Solutions for Cotton and Wool in Wales?

Introduction

This study researches the current laws and regulations that are being put in place by the Welsh Assembly, United Nations and industrial manufacturers, regarding the current issues of global carbon emissions, and the variety of pollution created by the textile industry itself. We move on to look at the essential role materials play, from harvesting to consumer, how each has had detrimental effects on the planet.

In this study, we will look primarily at cotton and wool, along with the negative impact that traditional farming techniques have on the environment, as well as animal welfare. This study was undertaken due to the increasing demand for fast fashion, and the increasing demand for a more sustainable way. It's used to high light key issues and suggests exciting, functional alternatives, that could bring a positive shift in sustainability into the textile and fashion industry.

There are alternative fibre solutions for the textile crisis in wales, which can be outlined throughout this study.

Chapter One; consists of statistics, theories, and reports that have been released, as well as the government's aim and goal to drive the industry for the better.

Chapter Two; informs us about the horrendous impact conventional cotton brings to the industry and looks into alternative ways of recycling cotton and using organic cotton.

Chapter Three: we look back at the wool industry history in Wales, and how conventional wool is farmed, causing damage to our environment. We also learn about the positive impact that organic wool has, and how little of a market there actually is for sustainable materials.

Concluding chapter Four: we talk about one of the oldest fibres in the world, Hemp. We learn its properties and its ability to create and replace many materials used today, potentially making the world more sustainable.

Chapter 1

In late 1999, the National Assembly of Wales was established (National Assembly of Wales, 2019). The Welsh government strived to ensure sustainable development was at the heart of all decision making, setting a good example to other countries. Becoming one of the few countries to make it a legal duty to think and act in a sustainable manner.

The Well-Being of Future Generations Act 2015 became law in wales (Welsh Assembly Government, 2019). The fundamental principle of the Act is to ensure that welsh industry, strives to neutralise its carbon footprint, stating that we should “act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs” (World Wildlife Fund, N.D). The three main goals from this act which are considered to be of top priority are outlined below: -

A prosperous Wales: recognising the limitations of the worldwide ecosystem, encouraging an innovative, dynamic and low-carbon nation, to effectively utilise assets in a productive way (Future Generations Commissioner for Wales (FGCW), 2015).

A resilient Wales: encouraging the biodiverse ecological ecosystem, to modify and adapt benefiting the nation. These systems support economic, social and natural resilience (FGCW, 2015).

A globally responsible Wales: consideration is given in every decision made, developing our ecological and cultural well-being, both nationally and internationally (FGCW, 2015).

Operating a low-carbon environment is one of the sternest challenges ahead for the Welsh Assembly. In 2009, a bold statement was published aiming to tackle and reduce the critical carbon impacts that arise from the country's infrastructure. A carbon reduction strategy was introduced, and this saw a reduction of emissions by 40% in 2015, with the target of reducing emissions by a further 30% by 2021 (FGCW, 2015).

Passing the law is considered just the first step, however. The citizens of the country, all have a vital part to play, adapting and changing, protecting the environment. Our climate is in a state of emergency; achieving real change is detrimental. We must ensure the government legislation is implemented, in order, to help the world survive and thrive. Consequently, protecting our environment is a challenge but one which we must overcome, we must drastically transform our regimes and safeguard our ecosystem, co-existing with nature in order to protect our ecology.

The Sustainable Development Goals (SDG's), also known as a Universal set of Goals, are the blueprints needed for us to follow, with the aim of achieving a better and sustainable future. There are seventeen goals with one-hundred and sixty-eight targets aiming to be completed by 2030 (Ford, 2015). All seventeen SDGs are integrated, where the actions are taken in one area affect the events of another.
As Isaac Newton said in his third law, "*for every action there is an equal and opposite reaction*" (Hall, 2015).
Meaning every action taken to reduce the carbon footprint, has a positive impact on the planet. Achieving all seventeen goals needs cooperation and partnership between governments and the industry sector, as well as the consumer.

Francesca Willow, in 2018 suggests that the fashion industry is recognised as one of the worst industries for polluting our planet, being joint 5th in the world for pollution and responsible for 5.4% of the 32.1 billion tons of global carbon emissions recorded in 2015 (Willow, 2018).

Thinking about the textile industries rating is well below that of electricity and heat pollution, which accounts for 24.9%, also transportation at 10.5% (Willow, 2018). However, the fashion industry incorporates all other industries, putting an impact on its pollution ratings (Global Fashion Agenda, 2019). Issues with consistently changing trends and fast fashion, changes need to happen, as pollution seems challenging to control.
Subsequently, the textile industry is considered the second-biggest consumer of water and is responsible for 8-10% of global carbon emissions (Organic Soil Association, N.D). Suggesting, all worldwide flights and maritime shipping carbon waste is below the textile industry (Organic Soil Association, N.D).
It is estimated that fifty per-cent of clothes within our wardrobes have not been worn in more than a year (Willow, 2018). Reducing waste and choosing eco-friendly is one sustainable way to over-come fast fashion (Organic Soil Association, N.D).

Using organic materials from plants or animals such as; cotton, flax (linen), wool and hemp, are more sustainable and eco-friendlier than manmade fibres, like nylon or polyester. Making it one way to push forward the fashion and textile industry, however, overcoming this requires the population to think organic, to buy less or shop for second-hand clothes, even use what is in our wardrobes.

These are three logos, identifying fashion which is manufactured, using organic fibres. They have been processed through high-quality environmental and social standards, meaning conditions are safe, hygienic and protect the rights of workers (Organic Soil Association, N.D). These companies contribute to providing sustainability by monitoring and effectively using, low impact dyes, inks, and treating wastewater (Organic Soil Association, N.D).

Fig 1.1: Logo's for garments, https://www.soilassociation.org/organic-living/fashion-textiles/ [Accessed on 16th of November 2019]

Organic farming also makes a significant difference to the environmental impact, by no longer using hazardous synthetic chemicals, thus reducing the risk to the farmers' health when harvesting, and the health of the workers making the clothes (Organic Soil Association, N.D). Farmers are also protecting the welfare of their animals, by ensuring they use natural methods on growing crops; this helps to combat climate change and build a healthier land (Organic Soil Association, N.D).

The ideal world of sustainable textiles and fashion is up in the mountains, in valleys and swampy grounds. *According to Fletcher, we need to recognise the resources used in making fashion and textiles and that it plays a categorical role in sustainability* (Fletcher, 2013, p.3).

While designing new clothes, we should have empathy and consideration to the emotional bond consumers have with products, along with the physical impact our actions have on the environment and ecosystem (Fletcher, 2013). However, materials are key to manufacturing, and should be our starting point for change, with the farmers, designers, consumers and recycling involved in the industry (Fletcher, 2013).

In the early 1990s, where trend predictions began, materials such as natural and recycled fibres were the centre of interest. Starting a craze in the fashion industry to deliver sustainable fashion and textiles. Trade shows began dominating the scene, with the natural look, producing recycled statement pieces (Rauturier, N.D). These were called "eco-fashion" movements. These began with companies such as Esprit who worked with Lynda Grose, a conventional fashion designer in London, and Patagonia working with Katharine Hamnet to raise awareness on the environmental impacts of the fashion industry launching their E-collection (Rauturier, N.D).

Fig 1.2: 1900s Esprit catalogue featuring the E-collection
https://www.collectorsweekly.com/articles/could-the-clothes-on-your-back-halt-global-warming/ [accessed on 16th of November, 2019]

The early 2000s saw the rapid rise in demand for organic, Fair Trade and renewable energy and fibres (Rauturier, N.D). This has led to design innovation, by many companies, and especially young designers, to base their designs and products on alternative materials (Rauturier, N.D).

In Kate Fletcher's book 'Sustainable Fashion and Textiles' she states, *"Diversity is, as the saying goes, about not putting all our eggs in one basket. It avoids agricultural, manufacturing and fashion monocultures and its sustainability benefits flow from sharing ideas, spreading risk and decentralizing production to maximize long-term environmental, economic and social-cultural effectiveness and stability of the sector"* (Fletcher, 2013, p.4).

Suggesting collaboration is needed in all sectors of production and design, right across the board, continuously experimenting and keeping an open mind.

In the textiles industry, every day, thousands of various fibres are processed and incorporated into new fabrics, producing new styles of fashion and interior textiles (Fletcher, 2013). In today's fashion and textile industry, the diversity of materials are difficult to come across; this is possibly due to the domination of similar products, such as cotton and polyester which have a limited fibre range, accounting for 80% of the global market (Fletcher, 2013).

A sustainability-driven strategy, to include an alternative and more practical economic structure, doesn't require that we cease producing the most popular fibre, but more of wanting to allow alternative fibres to bloom in the trade (Fletcher, 2013). Simply replacing conventional cotton production with an organic alternative, such as low-chemical cotton, flax, lyocell and hemp. Similarly, by replacing polyester, with a renewable and biodegradable fibre like wool, would bring advantages to the ecosystem, reducing the number of pesticides and water used in the production (Fletcher, 2013)

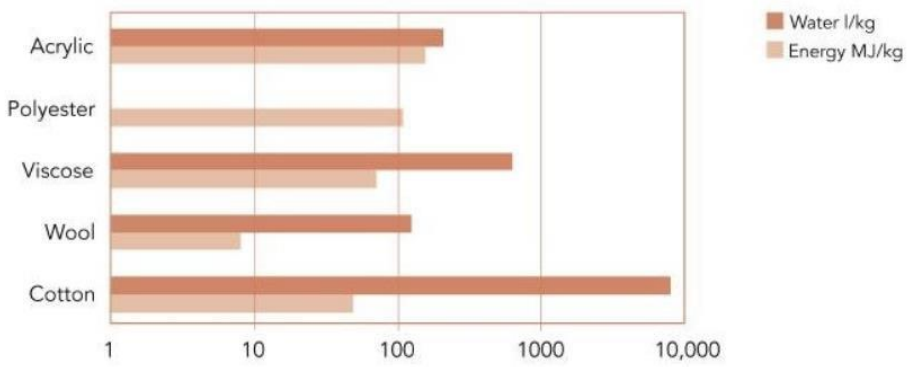

Fig 1.3: Energy and water consumption of selected fibre types, Fletcher [Accessed on 16th of November 2019]

This chapter has explored the statistics from previous global carbon emission reports. It has looked into the strategies and goals, Wales are currently putting in place, with the aim of working towards the SDGs. It has also looked at and learnt, the textile industry needs major reorganising, being the 5th worst industry worldwide for carbon emissions, but also having an effect within every other industry. It is also suggested we must design with more empathy and consider the importance of using different materials to reduce the carbon footprint of the industry. Transforming to more organic materials would have a really positive impact, ensuring those SDG goals are met by 2030**.**

Chapter 2

Cotton is a natural fibre. Primarily, grown to make cloth, but since has been integrated into so many other manmade compositions, creating flexible materials, plastics, paper products and even incorporated cotton oil into the production of food (Blake, 2013). In its raw state, cotton is used for its lightness and breathable elements and is commonly one of the most used fibres in the textile industry (Peterman, 2019). Cotton that is utilised in the industry today represents, for almost half of the fabric used, accounting for 40% (Peterman, 2019). Using cotton in textiles has many advantages, being weatherproof, having the ability to control moisture, making it comfortable to wear, by transmitting moisture away from the body and also insulating winter clothing by trapping air between the fibres and the skin (Peterman, 2019).

Cotton fibres included in the construction and finishing are easily manufactured into weather-resistant garments. This is applied by combining, tight dense cotton fabric with a weather-repellent finish to complete the item (Peterman, 2019). The most significant benefit of cotton for consumers is the fact it is hypoallergenic and comfortable (Rauturier, 2019).

As cotton is hypoallergenic and does not irritate the skin or cause allergic reactions, it is the first-choice fabric for baby clothing, our undergarments and also medical products such as bandages due to its softness and comfort (Rauturier, 2019). The durability of the fabric is also a benefit; cotton has a high elasticity strength, making it robust, durable and less likely to rip (Patton, 2015).

Even though cotton is a natural fibre, it can, however, be problematic to grow. It is characterised by, excessive use of pesticides, chemicals, poor working conditions, poverty for farmers and also throughout the supply chain (Brooke, 2019). Conventional cotton growing must stop, the use of pesticides to grow and maintain the cotton harms our planet (Brooke, 2019).

Kate Fletcher states '*The total area of land dedicated to cotton has not changed significantly for around 80 years, but in that time, output has tripled*' (Fletcher, 2013, p.8).

This is a massive increase in productivity, possibly the result of large quantities of fertilizers and pesticides being used, which has been well-documented in the past. In time, this will have an impact on the environment and ecosystem, causing reduced soil fertility, water pollution, and related health and welfare problems to humans and animals, from exposure to toxic pesticides (Rastogi, 2019).

Cotton agriculture has been highly associated with detrimental changes in water balance, the most infamous case being the Aral Sea, a manmade lake, where water was diverted from two feeding rivers to flush cotton plants (Fletcher, 2013). Due to

heavy use, irrigating cotton crops, the lake dried up completely, releasing forty-three million tons of pesticide-laden toxic chemicals into the air, flown around in dust clouds each year (Fletcher, 2013).

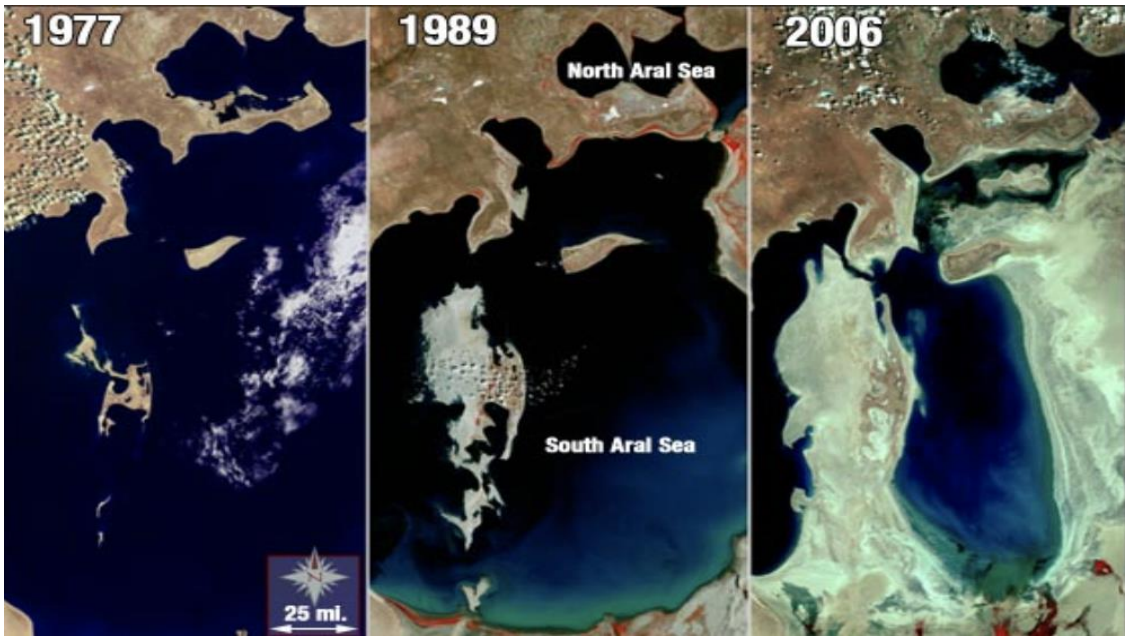

Fig 2.1: change in the Aral Sea between 1997-2006
http://www.envis.maharashtra.gov [Accessed on the 21st of November 2019]

As these pesticides are now airborne, the region around the Aral Sea has become the highest rate for throat cancer to date (Rastogi, 2019).

Consider this; the amount of water needed to irrigate crops can vary, depending on the different climates. In Sudan, 29,000 litres per Kg of water is needed, whereas in Israel, its only 7000 litres per Kg (Fletcher, 2013), Then consider, the fact this is roughly the amount of water required to produce, either a pair of jeans or a single T-shirt (Fletcher, 2013). The chemicals used on these crops, flow with the water into the waterways, poisoning the lakes and rivers along the way (Fletcher, 2013).

It has been estimated that cotton production uses twenty-five per cent of the world's insecticides and more than ten per cent of the world's pesticides each year this is an incredible amount for just one crop (Brooke, 2019). Over the years, pesticide residue has been increasingly found, in farm animals, our food, and breast milk (Dietz, 2013). These chemicals are deadly to farmers all over the world, resulting in pesticide poison and an increase in adult cancer (Dietz, 2013). According to the World Health Organisation (World Health Organization, 2004), there is up to 200,000 deaths each year in developing countries, that are caused by pesticide poisoning (Dietz, 2013). Due to the range of pesticides used and the embedded toxicities, a clinical diagnosis can be challenging to determine, additionally, whether the symptoms are a result of pesticide exposure or environmental factors, such as working in extreme heat (Dietz, 2013). Depending on the pesticide used and the substance within it, exposure can occur via inhalation, indigestion or touch

(Thundiyil, et al., 2008). To make matters worse, the United States (U.S) Fish and Wildlife Service, have identified that pesticides are unintentionally killing at least 65 million birds annually in the U.S (Dietz, 2013).

In recent years, recycled cotton, as well as pesticide free organic cotton, has been blooming. In Conjunction with more and more fashion houses and textiles brands, committing to the SDG goals, and dedicating to organic materials within their range (Rauturier, N.D).

H&M recently became the world's largest consumer of organic cotton; numerous smaller companies have also opted for the organic alternative (Dietz, 2013). However, we as customers need to do more; we are the reason landfills are full of attire and fabrics that have been disposed of, containing hardwired, hazardous fibres and pesticide residue (Dietz, 2013).

Nevertheless, this problem is being tackled in various ways; a Swedish power plant has made the decision to move from coal fuels, with the hope of being to be fossil-fuel-free by 2020 and instead have turned to recycled wood and trash as an alternatives, including clothing from H&M that would have gone to landfill (Dietz, 2013). A central H&M warehouse and retailers in the nearby town of Eskilstuna, provide the powerplant with 15 tons of clothes (Dietz, 2013). However, clothes that are considered safe to use by H&M, will not be burnt, H&M also has a legal obligation to make sure clothing that is damaged or has mould must be destroyed efficiently (Dietz, 2013).

It is in everyone best interest to look at alternative ways of using cotton that is healthier for our planet. A clothing company in Kathmandu, in September 2019 reached its goal of having a 99% sustainable cotton range (Rastogi, 2019). They sourced their range of fabrics from a mix of organic, recycled, Fairtrade and Better Cotton Initiative (BCI) (Rastogi, 2019).

Fig 2.2: Kathmandu's own material factors https://www.kathmandu.co.uk/get-to-know-us/our-footprint/responsible-materials/sustainable-cotton [Accessed on 21st of November, 2019]

Clothes and textiles that are discarded from pre- and post-consumer cotton waste, are recycled into usable cotton (Rastogi, 2019). Recycling cotton is currently a sustainable alternative, to both the conventional and organic cotton use, helping to

reduce the continuing growth of cotton waste globally (Rastogi, 2019). An added alternative to recycling cotton is called recycolor, this is an additional part of the range, where scraps of materials from cutting tables, are separated by colour and tossed into machines, breaking the textiles back into fibres (Rastogi, 2019).

As the fibres are too short to spin, they get mixed in with virgin cotton making a stronger yarn, this method produces results called recycolor and uses about 70% less water than the conventional method (Rastogi, 2019).

Rastogi declares *"Water use is the cotton's biggest environmental impact, so the water savings is the biggest win for recycled cotton"* (Rastogi, 2019).

The Kathmandu Textile company has been diligent in developing, new techniques with Repreve, a recycling polyester fabric manufacture, which turns a plastic bottle into useable fibres to incorporate recycled polyester within their range (Rastogi, 2019).

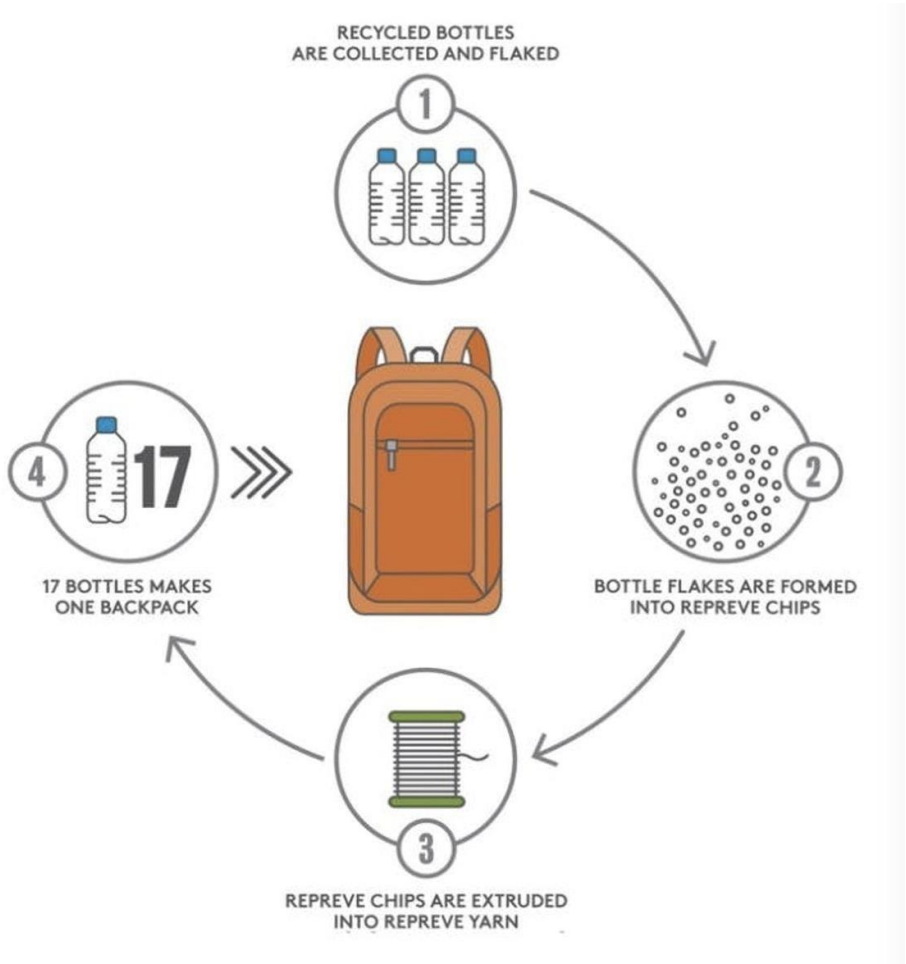

Fig 2.3: REPREVE® https://www.kathmandu.co.uk/get-to-know-us/our-footprint/responsible-materials/recycledpolyester [Accessed on 21st November 2019]

A company called *Cotton Connet* are an enterprise with a clear mission in transforming the cotton industry (Cotton Connect, N.D). They create a transparent, clear supply chain between retailers and farmers in agro-economic practices. Supporting and helping the farmers livelihood and communities (Cotton Connect, N.D). They strive to achieve the United Nations SDG goals, which including zero hunger, good health, poverty, education, by supplying farmers with training programmes and the physical wellbeing of cotton farmers and their families (Cotton Connect, N.D). Their contribution is to help those in poverty, delivering a better and healthier lifestyle for the world to become environmentally prosperous (Cotton Connect, N.D).

As conventional cotton is extremely bad for the environment, there are several exciting alternative ways that can be followed or used in order to change the global situation as it stands.

Chapter 3

Wool is a natural fibre, which is produced by animals, making it raw material. The material has been around since the introduction of free-range sheep farming in this country. In the United Kingdom, there are over sixty different breeds of sheep shepherded by over 40,000 farmers (British Wool, 2019). Farmers used to use a comb or pluck out the wool by hand before shears were invented (British Wool, 2019). The woollen industry in Wales is one of the oldest industries and most important to our heritage and culture (International Wool Textile Organisation (IWTO), 2014). Wales is known to be famous for its Welsh blankets and throw designs from early history through to modern times (Felinfach,2018). It was during the 13th century, the welsh economy invested heavily in sheep farming, through the introduction of purpose-built water-powered mills (Felinfach,2018). These mills were involved in removing grime off the fleeces, creating thicker wool that improved the process of spinning yarns (FelinFach, 2018).

The procedure for gathering wool Is shearing, categorising it by the condition, before untangling, washing and spinning the wool (British Wool, 2019). Yarn is a long continuous length of interwoven fibres, also known as thread, that is used to produce textiles (British Wool, 2019). Each year the sheep's fleece re-grows, providing one crop of wool a year, making it one of the most sustainable structure available (British Wool, 2019).

Wool has many benefits; it is soft, yet strong, durable and biodegradable. It is produced from keratin, the same protein that is in human hair (British Wool, 2019). It has been said by the British Wool company that the wool is hypoallergenic and regulates body temperature (British Wool, 2019). A two-year study in the United States by Professor Joe Fowler, assessed the effects of superfine Merino wool on the skin, basing his assessments on people who suffered from eczema (British Wool, 2019). The results of the study displayed a significant decrease in eczema symptoms (Su & Spelman, 2017).

Professor Fowler described the results, stating "*it was only when Merino wool was worn that improved quality of life scores occurred"* (IWTO, 2014).

The wool garments are breathable, comfortable and can absorb up to 30% of its own weight in liquid, without feeling wet or damp, allowing more moisture to be released, whereas cotton begins to feel damp after 15% absorption (IWTO, 2014). It is also able to support a stable temperature within the fabric and skin, keeping you warm when it's cold and refreshing when it's warm (Felinfach,2018). Because of the way it can repel moisture and allows moisture to pass through fibres, it has a natural resistance to mildews and mould, which requires moisture to survive and develop (IWTO, 2014).

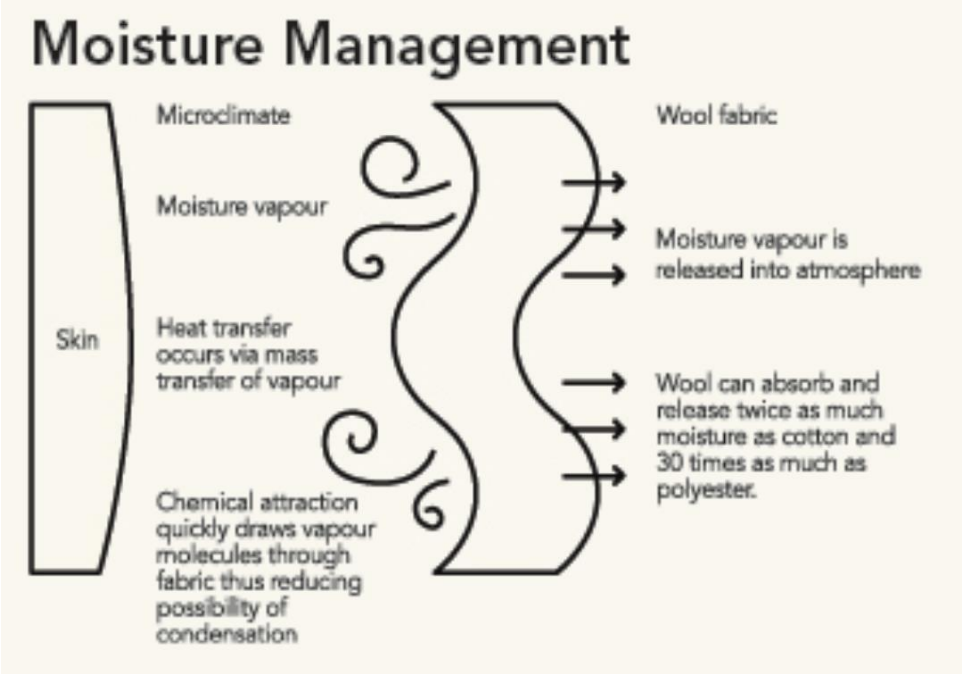

Fig 3.1 Moisture diagram https://www.iwto.org/news/wool-benefits-to-skin-confirmed [accessed on 11/12/19]

As mentioned, wool is excellent for regulating the temperature of our bodies and helps to maintain skin conditions. Wool also can be beneficial not only as a garment but as interior furnishings, being a fabric that's breathable, it can also improve indoor air quality, sleep and provide comfort (Felinfach,2018).

Wool has its benefits; however, it also provides devastation to the planet, just like the cotton production, pesticides are used in the farming of wool. Nevertheless, wool quantities are considerably lower (Fletcher, 2013). In the Pulse of Fashion Industry report; the production of wool is ranked 5th, on their list, above acrylic, polyester and nylon, due to its high greenhouse gasses (Global Fashion Agenda, 2017).

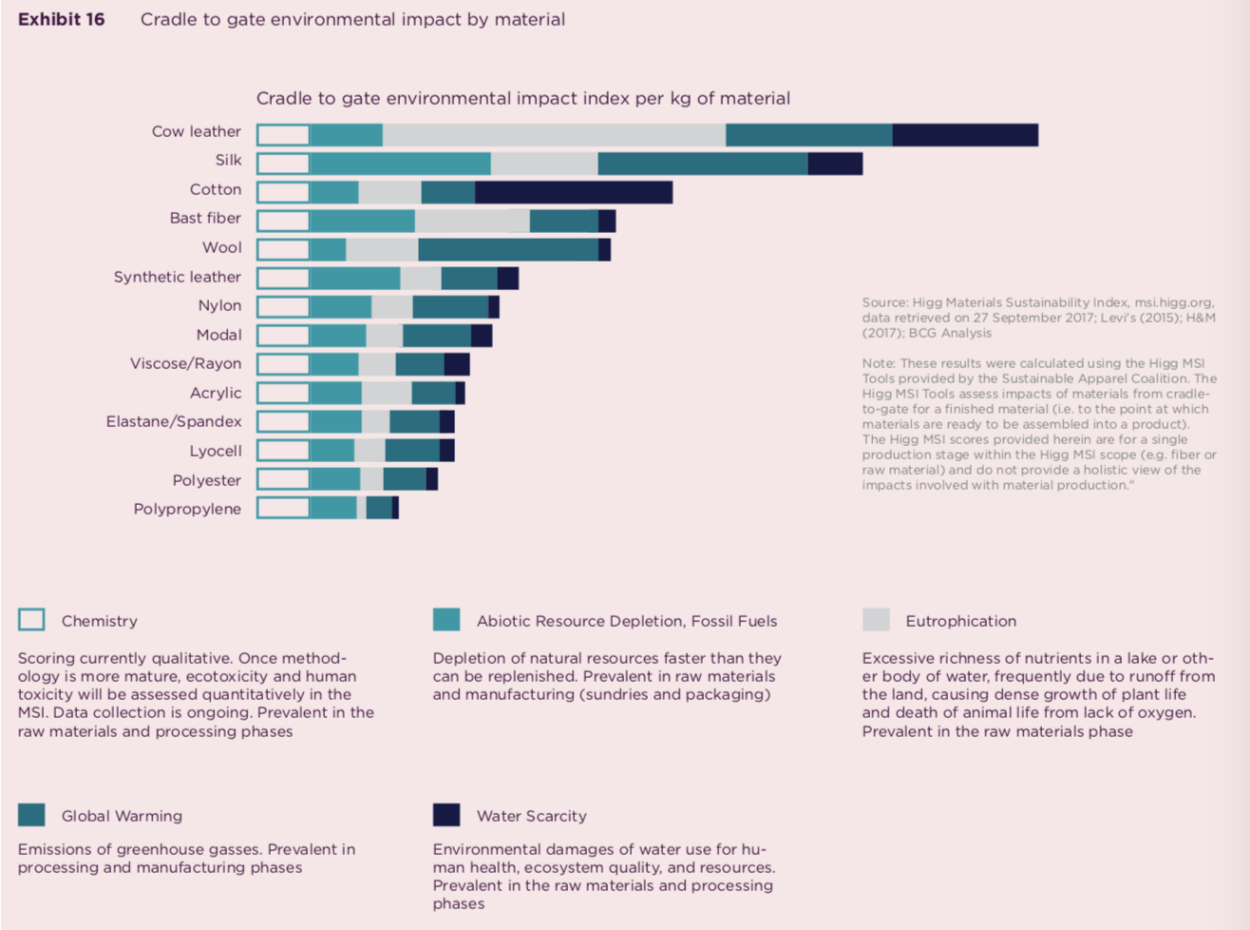

Fig 3.2 environmental impact table http://globalfashionagenda.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf [accessed on 11/12/19]

The cost of farming sheep, for wool production, is damaging our other natural resources. Providing grazing lands for flocks, leads to increased soil salinity, the increase in sheep flocks means land needed is cleared by cutting down the trees (Allen, 2019). As well as cows, sheep also release methane gas into the atmosphere and have contributed to the increase in greenhouse gasses that have occurred over the last 200 years (Allen, 2019).The quantity of manure also increases due to flocks that are grown to meet the demand of the wool industry, in the UK as well as Australia and New Zealand (Allen, 2019).

The most significant issue harvesting wool is the cruelty to the animals that go on. The violence on sheep during the sheering process has been documented across the world including the UK, where workers were recorded physically harming the animals, by throwing them around, leaving open wounds from shears (Allen, 2019). Shearers are paid by the volume of sheared sheep, not the hour, encouraging a fast-paced work environment with no regard for animal welfare (People for the Ethical Treatment of Animals (PETA), 2019).

Conventional wool production, see sheep confined and overfed, leaving them vulnerable to pests such as lice and flies (Allen, 2019). These conditions result in farmers using more than 14,000 pounds of pesticides through large dipping tanks to treat sheep and to combat the pests and parasites (Lackman, 2005). The most common treatment used on sheep is moderately toxic to humans and highly toxic to fish (Allen, 2019). Some of these pesticides can be water-soluble, with heavy rain, the pesticides run-off into the water streams and rivers, contaminating our groundwater (Lackman, 2005).

According to the Organic Trade Association: "*pesticides used in sheep dips have consistently been linked with damage to the nervous system in workers that have been exposed to them in the United Kingdom. Even low-dose exposure over the long term has been conclusively linked with reduced nerve fibre function, anxiety and depression. Long-term exposure to sheep dip has also been linked to reduced bone formation.*" (Organic Soil Association, N.D).

After the wool has been harvested, the manufacturing process includes harsh purging agents and bleaches to clean and whiten the wool. This also includes other harsh chemicals that are used in finishing the fabric, such as chemical dyes and mothproofing (Lackman, 2019).

Alternatives to conventional wool, there are few more sustainable practices that can provide good quality wool, without the negative impacts. It is still important to remember that all types of wool are natural, renewable and biodegradable. First, looking at organic wool, this is one of the many fibre options available within the diverse world of wool. Organic wool that is certified means the use of chemicals is prohibited during the harvesting and manufacturing of the raw material (IWTO, 2014). Indicating no chemicals are used to treat pests, flies, or any internal parasites, reducing the toxic risk to farmers. Allowing sheep to graze simply freely, reduces the issue of pest and parasites as these are more common in contained small dirty environments (Allen, 2019). Complying with animal well fair, as well as reducing the chemical contamination in the groundwater systems, is an achievement of the SDGs. The sheep are fed organically grown food and left to graze freely on untreated land (Fletcher, 2013).

The welsh wool history is essential to our history; at its peak, there have been over 300 woollen mills within Wales. However, after WW1, the industry went into decline (FelinFach, 2018). In the current day, the woollen industry is showcased in the National Wool Museum of Wales. The museum not only exhibits traces of history in the industry but also has working mills, producing blankets and tapestry blankets still to this day, which are sold in the on-site shop.

A venture that was put in place called the Organic Wool Wales project, with support from Organic Centre Wales (OCW) and Better Organic Business Link (Morris, 2015). Their aim was to develop a Market demand for welsh organic wool, aiming to showcase and promote the potential of welsh wool to producers, designers and consumers worldwide (Morris, 2015). This was a practical project called Shear Waste, which commissioned a full, finished woven wool fabric made with shear waste organic fibres, farmed in wales and processed in the UK (Morris, 2015).

Textile designers and makers, interesting in working with natural and sustainable materials, were recruited, to participate in the Organic Welsh Wool Fabric Collection, using the recycled organic fabric provided (Morris, 2015). The outcome of this project was showcased as a collection, in a range of events around Wales and England throughout 2013 (Global Fashion Agenda, 2017). Their work showed a tribute to the potential of outcomes using natural, sustainable produce, locally sourced organic wool including the quality and standard of designer-makers work (Global Fashion Agenda, 2017).

From wool, there are other eco-friendly vegan replacements that can be used instead of conventional wool. Those include Organic Cotton, Hemp, Bamboo and Woocoa (Camilli, 2019).

Chapter 4

An alternative fibrous material, called Hemp (Cannabis sativa), is a raw material that is growing more popular by the day (Camilli, 2019). Hemp is one of the oldest fibres worldwide but was by passed making room for cotton, polyester, fossil fuels and other products generating a cost-effective income (Rauturier, 2019). Currently manufactured hemp makes paper, rope, cloth and fuel, it is a cousin of marijuana, but without the mind-altering THC substance (Rauturier, 2019). Growing worldwide, it uses very little water, requires no pesticides and is biodegradable, up to 30% of the plant is fibre (Parlotta, 2019). However, almost every part of the plant is used, producing a far superior fibre, to that of other natural compositions, giving it a double dividend. It would provide a reduction in the manufacturing, ecological footprint by around half if it is grown to replace cotton in textiles and wood used in the paper industry (Parlotta, 2019). The outer fibre layer on the stalk could produce textiles and rope, while its dense, hardcore could possibly be used as a substitute for creating paper and also could be used in construction (REF). While the seeds which are high in protein, fibre, omega-3 fats and other nutrients can be used for consumption (Parlotta, 2019).

Although hemp is still used in some countries, such as China and Europe, however, it is banned in many countries, because of its narcotic properties and varieties of the low psychoactive compound
Tetrahydrocannabinol (Drury, 2018). The extraction of plant fibre and its association with environmental problems are similar to those of the fibre flax (Smith, 2018). Achieving decent quality fibre, using traditional hand methods for harvesting and processing, still used in china today. However, this does mean the costs of labour are higher, making it uneconomical for most countries. Subsequently, it could solve the unemployment problem in many other countries (Fletcher, 2013).

Fig 4.1: https://www-dawsonera-com.ezproxy.uwtsd.ac.uk/readonline/9781849772778 [Accessed on 3rd of December, 2019]

Morris Beegle, co-founder and president of WAFBA (We Are for Better Alternativehemps), is an earth advocate. He became an entrepreneur in the hemp and cannabis business in 2012 and has been in long-time entertainment (Parlotta, 2019). He's very passionate about Hemp and its benefits, setting his own company up called No-Co Hemp Expo (Parlotta, 2019). Working in conjunction with a merchandising company called Tree-Free-Hemp, to produce a variety of products using hemp such as paper, CD sleeves to custom made guitars (Parlotta, 2019). Morris Beegle is very desirous about, replacing the unsustainable agricultural practices within the industry, with hemp becoming the steward of today's agriculture and protecting the future.

Beegle states that *"Industrial agriculture is one of the greatest drivers, maybe even the biggest, of climate change"* (Parlotta, 2019).

Currently across the globe, less than a million acres of hemp is growing. Beegle predicts that over the next 5-20 years, these figures will rapidly expand, with currently no way of stopping it (Parlotta, 2019).

Students at the Colombian Universidad de Los Andes in Bogota crafted a wool-like material from hemp, coconut fibres and mushroom enzymes (Sullivan, 2018). The students involved in the crafting of this new material were awarded, in a 2018 Bio design Challenge competition, endorsed by PETA (Smith, 2018). The advantages of this new material, is no animal cruelty, making the vegan market approve it, but also it is hypoallergenic like I've mentioned before, this means that the fabric is good for our skin, and has very minimal risk of allergic reactions. This new material Woocoa is still in prototype mode (Sullivan, 2018). However, it is developing new strategies to be brought into the industrial world successfully. The material is made mainly from hemp and coconut fibres, which are then treated with mushroom enzymes, also known as 'white rot', fungi (PETA, 2019). Helping to degrade the fibres lightly, making them softer, this is all done without the use of harmful chemicals and pesticides. This eco-friendly, bio fabricated material can help prevent sheep from being subjected to cruelty while being sheared and kept in confined spaces (PETA, 2019).

Hemp is a regenerative crop that's organic and more sustainable than any other and has the ability to replace almost all cotton and plastic globally, as well as wool, with less impact on the Earth (Parlotta, 2019). Buying and wearing organic fabrics has had a positive impact on ours and the health of the planet. Hemp is the only fibre that is seen to have genuine environmental friendliness; however, its association with marijuana production needs better controlling.

Conclusion

This essay has considered the laws in Wales surrounding the welsh carbon footprint, aiming to reduce the issue for future generations by encouraging and embedded sustainable way of living. Working with international and national companies, to provide a low carbon environment. This is set out to achieve through following the seventeen universal SDG goals.

We have also looked at the negative impacts of the fashion industry, which is considered to be one of the biggest pollutants in the world. However, it was also seen that electricity and heat industry and the road transportation industry, have a high carbon footprint, with high ratings shown in the report. Even though these industries are high, the fashion industry is still highly contributing to their carbon emissions.

To reduce the textile carbon footprint, suggestions were made to use organic materials, or recycled goods. Which not only will reduce the carbon foot print, but supporting the organic farming industry, would help them live a healthier lifestyle by not using dangerous pesticides. To achieve this, it would require the general public to consider change in their day to day routines, considering what they buy in store and how they intend to dispose of unwanted items.

We learn that conventional cotton is one of the biggest issues for the fashion industry, being the most problematic to grow. With many issues beginning with

farming that impacts the environment. It is responsible for the drying of Aral Sea due to the high levels of water used to clean a cotton crop. It's also estimated that cotton is responsible for 25% of the world's insecticides used, and these chemicals are toxic to the farmers, causing cancer, and the animal kingdom, especially millions of birds.

To tackle this problem, the likes of H&M and Kathmandu have taken the textile industry into the next generation by using organic alternative. H&M have also been involved with trying to reduce the fossil fuels that get burnt in a power plant in Sweeden, and replacing the fossils with textile waste from H&M. This alternative prevents this fabric waste from making landfill. And also saves fossil fuel resources.

Kathmandu has also developed techniques to work around the conventional cotton, bu including organic cotton in their range, as well as working with REPREEVE on a ‘Rycolour’ cotton recycling solution.

In the United Kingdom it has been noted that there are over 60 breads of sheep. Wool is a natural fibre, and has been used in the industry since the 13th century, making wales famous for it welsh blankets and traditional patterns. It's also been seen in studies that wool is good for the skin conditions, keep our body temperature regulated and hypoallergenic. Making it a valuable material for our wellbeing.

However conventional wool brings negative impacts to our environment. With high volume demands for the fibre, and the conditions farmers work in, are influential in the way they abuse sheep. When shearing the wool, farmers are paid by volume not by the hour, giving them an incentive to go fast, and not care about animal welfare.

Conventional wool also has a huge number of sheep kept in confined spaces, usually surrounded by their own faeces, attracting pests and pesticides. This is the reason they then dip and soak the sheep in several toxic chemicals that eventually make their way to our water systems.

The alternative to this conventional wool is simply organic wool. We learn there is only a small market for organic wool, but the benefits are too high to ignore. With organic wool, sheep are allowed to graze freely, with no violence when shearing and also absolutely no chemicals used.

We learn new alternative methods to comply with the SDGs, trying to be more sustainable in the textile industry. Specifically, how the hemp plant can have a huge impact in making the industry a better place. We learn that this fibre has almost no negative impacts on the environment, and also learn that it can be used to replace many damaging materials in the world, two of them being cotton and wool.

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