

GREEN ROCKS FIBRES

Fibre	Basic info	Eco credentials	Disadvantages	Energy consumption <small>(https://oecotextiles.wordpress.com)</small>	Carbon Footprint <small>(https://oecotextiles.wordpress.com)</small>
Cotton	50,000 million pounds of cotton is said to be produced, globally, every 30 days (http://www.nrdc.org/). Meanwhile, annual consumption is believed to be around 29 million tonnes (http://www.theworldcounts.com/counters/cotton_environmental_impacts/world_cotton_production_statistics). Global consumption of cotton products reportedly requires 256 Gm3 of water per year (Water Footprint: http://www.waterfootprint.org).	Cotton is a biodegradable natural fibre.	Cotton is very water intensive, and is said to be responsible for 18% of global pesticide use (http://www.nrdc.org). Among the top 15 pesticides, 7 are believed to be carcinogenic and 13 have reportedly been linked to bird population die-offs. Pesticides additionally run into groundwater. Genetically engineered seeds are said to reduce biodiversity, and dyes can contain heavy metals and toxic substances. Furthermore, use of child labour is common in cotton picking, in Uzbekistan for example.	55 MJ per KG of fibre	(US) 5.89 KG of CO2 emissions per ton of spun fibre.
Organic Cotton	While it's difficult to locate exact figures for organic cotton production, the Textile Exchange calculates that approximately 637,563 bales were produced worldwide in 2011-2012 (https://ota.com/sites/default/files/indexed_files/2012%20and%202013%20Organic%20Cotton%20Report.pdf). Global production has increased 5-fold over the last 4 years, says The World Counts (http://www.theworldcounts.com/counters/cotton_environmental_impacts/organic_cotton_advantages).	Organic cotton is a biodegradable natural fibre, grown without pesticides, synthetic fertilizers or genetically engineered seeds. Factory conditions are also said to be higher than those for cotton. The Global Organic Textile Standard (GOTS) certification – a textile processing standard for organic fibres, including ecological and social criteria – is highly regarded and should be sought out when purchasing organic cotton products (http://www.global-standard.org).	If organic cotton is not GOTS certified, it could still be dyed using heavy metals and toxic substances.	(US) 14 MJ per KG of fibre	(US) 2.35 KG of CO2 emissions per ton of spun fibre.
Rayon	Rayon is produced from renewable cellulosic plants such as beech trees, pine trees, and bamboo (http://www.yesitsorganic.com/rayon-modal-tencel-environmental-friends-or-foes.html). In 2009, cellulotics were said to account for about 5% of all man-made fibres (https://www.ihs.com/products/rayon-and-lyocell-chemical-economics-handbook.html).	Rayon is biodegradable	Rayon production is a water- and chemical-intensive process, and also contributes to deforestation and pollution in developing countries like Indonesia (http://www.nrdc.org/). The most popular method of production, the viscose method, generates undesirable water and air emissions. The emission of zinc and hydrogen sulphide is said to be of particular concern (http://www.encyclopedia.com/topic/rayon.aspx). To make rayon, the wood pulp is treated with hazardous chemicals such as caustic soda and sulphuric acid (http://www.greenchoices.org/green-living/clothes/environmental_impacts). Carbon disulphide, the most common solvent in typical viscose rayon production, is highly toxic to both humans and the environment. Use of carbon disulphide is typically highly dispersant; 50% of what is used is released into our air (http://www.nrdc.org/international/cleanbydesign/files/CBD_FiberFacts_ViscoseRayon.pdf). Meanwhile, clothing made from rayon tend to require dry-cleaning, which usually involves the use of the cancer-causing dry cleaning solvent perchloroethylene (http://www.nrdc.org).	100 MJ of energy/kg of fibre (http://www.greenchoices.org/green-living/clothes/environmental_impacts)	
Modal	Like rayon, modal is produced from renewable cellulosic plants, like beech trees, pine trees, and bamboo. Lenzing Modal® (Lenzing AG of Austria. It manufactures more cellulosic fibre from trees than any other company in the world) is said to be produced from sustainably harvested beech trees (http://www.yesitsorganic.com/rayon-modal-tencel-environmental-friends-or-foes.html).	Modal is biodegradable. And, because it does not need to be dry-cleaned and can be machine washed in cold water, its overall environmental impact is less than conventional viscose rayon (http://www.nrdc.org/international/cleanbydesign/files/CBD_FiberFacts_ViscoseRayon.pdf).	Modal is manufactured using the same toxic solvents as conventional rayon (http://www.nrdc.org/international/cleanbydesign/files/CBD_FiberFacts_ViscoseRayon.pdf).		
Lyocell (Tencel)	Like rayon and modal, lyocell is produced from renewable cellulosic plants such as beech trees, pine trees, and bamboo. It is often referred to as Tencel®, which is a branded lyocell fibre from Lenzig AG) said to be produced from sustainably harvested eucalyptus trees (http://www.yesitsorganic.com/rayon-modal-tencel-environmental-friends-or-foes.html).	Lyocell is biodegradable. It employs an almost closed loop manufacturing process, which means it reclaims and recycles up to 99.8% of the solvents used. The non-toxic organic solvents are not acidic and have reportedly been proved in dermatological and toxicological tests (http://www.yesitsorganic.com/rayon-modal-tencel-environmental-friends-or-foes.html#ixzz3QjRWw7d3). Meanwhile, any remaining emissions are said to be broken down in biological water treatment plants.	According to the NRDC, lyocell relies on nanotechnology to shape its fibres with a process still not fully understood for its impacts on human health (http://www.nrdc.org/international/cleanbydesign/files/CBD_FiberFacts_ViscoseRayon.pdf). The transformation of lyocell fibres into fabric and garments can also use many or the same chemicals and processes used in conventional garments, because (i) it doesn't always accept dyes well, and (ii) it has an inherent tendency to fibrillate or "pill" (http://organicclothingblogs.com/my_weblog/2005/11/tencel_sustaina.html).		

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<p style="text-align: center;">Bamboo</p>	<p>Due to the durability of bamboo plants, no pesticides or chemicals are needed to encourage the maturation process, and they require less water than trees. There are two ways to process bamboo to make the plant into a fabric: mechanically or chemically. Most bamboo fabric that is the current eco-fashion rage is chemically manufactured (http://organicclothing.blogs.com/my_weblog/2007/09/bamboo-facts-be.html) an, as such, cannot be considered eco. However, some companies are beginning to use the lyocell closed loop manufacturing process.</p>	<p>The mechanical method of manufacturing bamboo sees the woody parts of the bamboo plant crushed and then natural enzymes used to break the bamboo walls into a mushy mass so that the natural fibres can be mechanically combed out and spun into yarn. This is similar to the eco-friendly manufacturing process used to produce linen fabric from flax or hemp. Bamboo fabric made from this process is sometimes called bamboo linen. Very little bamboo linen is said to be manufactured for clothing because it is more labour intensive and costly. Some companies are also beginning to employ the lyocell closed loop manufacturing process for bamboo, where over 99% of the chemicals used are recaptured and recycled. Only trace amounts are reported to escape into the atmosphere or into waste waters and waste products (http://organicclothing.blogs.com/my_weblog/2007/09/bamboo-facts-be.html).</p>	<p>Chemically manufactured bamboo fibre, often referred to as bamboo rayon, is a regenerated cellulose fibre similar to rayon or modal. Unfortunately, most bamboo fabric that is the current eco-fashion rage is chemically manufactured by "cooking" the bamboo leaves and woody shoots in strong chemical solvents such as sodium hydroxide (also known as caustic soda or lye) and carbon disulphide in a process also known as hydrolysis alkalization combined with multi-phase bleaching. Both sodium hydroxide and carbon disulphide have been linked to serious health problems. Because of the potential health risks and damage to the environment surrounding the manufacturing facilities, textile manufacturing processes for bamboo or other regenerated fibres using hydrolysis alkalization with multi-phase bleaching are not considered sustainable or environmentally supportable. (http://organicclothing.blogs.com/my_weblog/2007/09/bamboo-facts-be.html).</p>		
<p style="text-align: center;">Hemp</p>	<p>Hemp is said to be the world's most versatile fibre. It has been mired in controversy over the years, due to the confusion with the marijuana plant. Hemp is harvested using a traditional harvester machine. The long fibres of the hemp plant are separated from the short and then washed to break down the natural glue that binds the hemp strands together. The hemp is then combed, spun, knitted and woven, completely pesticide- and chemical-free (http://en.wikipedia.org/wiki/Textile_manufacturing#Flax).</p>	<p>Hemp is biodegradable, and can be grown organically without the use of pesticides, herbicides, fungicides and fertilizers. Hemp farming is said to consume less land comparing to cotton and flax farming. It reportedly yields 250% more fibre than cotton and up to 600% more than flax (calculated based on per acre basis), and requires around 50% less water than cotton, for example. "There is no other crop on this earth which is as useful. There is no other crop that can produce the same amount of products with the same negative carbon footprint." (http://panacea-bocaf.org/hempproduction.htm). Hemp is also said to be 4 times warmer than cotton, 4 times more water absorbent and have 3 times its tensile strength (http://en.wikipedia.org/wiki/Textile_manufacturing#Flax).</p>	<p> Haven't found any thus far!</p>	<p>12 MJ per KG of fibre</p>	<p>4.1 KG of CO2 emissions per ton of spun fibre.</p>
<p style="text-align: center;">Flax</p>	<p>Flax is a bast fibre, which means it comes in bundles under the bark of the <i>Linum usitatissimum</i> plant. The plant flowers and is harvested to produce flax linen (true linen always comes from flax fibres). It grows naturally and requires less water and fewer pesticides than cotton. The plant is said to be gentle on the land and easy to incorporate into modern crop rotation cycles (http://en.wikipedia.org/wiki/Textile_manufacturing#Flax)</p>	<p>Flax is biodegrade. The whole plant can be used, thus leaving no waste. Very little energy is required to process flax, and the yarn is inherently strong, which reduces the need for starching during spinning and weaving. Few or no fertilizers and/or crop protection products are being used compared to other crops. Flax does not require irrigation during the growing process. Meanwhile, the water retting process is being increasingly replaced by environmentally friendly dew-retting on the field (http://en.wikipedia.org/wiki/Textile_manufacturing#Flax).</p>	<p>One of the most critical environmental steps in the production process of flax linen is the washing, bleaching, dyeing and finishing of the fabrics. A lot of water is also used to clean and dye the fabrics. See here for detailed information on how it is made: http://www.decktowel.com/pages/how-linen-is-made-from-flax-to-fabric</p>		
<p style="text-align: center;">Silk</p>	<p>Silk is controversial: it's a natural fibre, which biodegrades, but is extracted by killing silkworms. However, it's increasingly possible to purchase peace or Tussah silk, which is obtained without harming the worms. The processing of silk is similar to that of cotton.</p>	<p>Silk is biodegradable. And while normal silk is mired in controversy, peace, or Tussah silk, can be eco-friendly. It's produced from the silkworms that feed on the leaves of dwarf oak leaves. The worms are allowed to emerge from their cocoons before the silk is taken. The broken cocoons are then repaired using a spinning process. It is important, however, to ensure that natural dyes are used, for the silk to really be eco.</p>	<p>Conventional silk production is a headache for many, due to the inhumane methods employed. When a silkworm emerges from its cocoon, which is made up of a single silk thread often up to a mile long, it breaks the thread. To avoid this, the cocoons are submerged in boiling water, which kills the silkworm before it can break free. Thousands of silkworms are needed to make just a small piece of silk, meaning billions must meet this grisly end. Not only that, but silkworms feed on a lot of mulberry leaves, the trees of which require herbicides, pesticides and fertilizers, and water. Furthermore, silk production processes are VERY energy intensive. They include: scouring, where the silk is washed in water of 40 degrees for 12 hours to remove the natural gum; drying, either by steam heating or centrifuge; softening, by rubbing to remove any remaining hard spots, and dyeing (http://en.wikipedia.org/wiki/Textile_manufacturing#Flax).</p>	<p>(India) Around 1,800 MJ per KG of fibre (Cumulative energy demand. In comparison, cotton is around 250 MJ per KG) (http://www.bacsa-silk.org/user_pic/file/Vollrath_Life%20Cycle%20Assessment%20%28LCA%29of%20silk%20%202%20MF+GT.pdf)</p>	<p>(India) 120 KG of CO2 emissions per ton of spun fibre (http://www.bacsa-silk.org/user_pic/file/Vollrath_Life%20Cycle%20Assessment%20%28LCA%29of%20silk%20%202%20MF+GT.pdf).</p>

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<p>Wool</p>	<p>Wool is obtained from sheep and certain other animals, including cashmere and mohair from goats, alpaca wool, qiviut from muskoxen, angora from rabbits, and other types of wool from camelids. While it is a natural fibre, controversy surrounds the way it's procured from the animals. Global wool production is said to be around 1.3 million tonnes annually, of which 60% goes into apparel (http://en.wikipedia.org/wiki/Wool).</p>	<p>Wool is biodegradable. While there is controversy surrounding normal wool with regards to animal welfare and manufacturing processes, organic wool is said to come from sheep fed with organic livestock feed (at least during the third gestation period). Synthetic hormones, insecticides and genetic engineering are not allowed on these sheep. And synthetic pesticides are not allowed to be used on the pastures on which the sheep graze. In addition, the sheep farmers are not permitted to over-farm on the land which their sheep graze (http://www.all-recycling-facts.com/eco-friendly-clothing.html).</p>	<p>Normal wool, i.e. non-organic, is a natural fibre. However, there are many issues over the treatment of animals to procure the wool, including: mulesing in sheep, which sees strips of skin and flesh carved off the backs of lambs' legs and the areas around their tails (without pain medication) to prevent flystrike (look it up); overcrowding; and severe injuries from shearing (the shearers are mostly paid by volume not hour) or from fur being ripped out. Not nice :/ Not only this, but wool straight off a sheep – "greasy wool" – contains a high level of lanolin, as well as dead skin, sweat residue, pesticides, and vegetable matter. Before the wool can be used for commercial purposes, it must be scoured. This can involve a bath in warm water or be an industrial process involving detergent and alkali. In commercial wool, vegetable matter is often said to be removed by chemical carbonization. In less-processed wools, it may be removed by hand (http://en.wikipedia.org/wiki/Wool).</p>	<p>63 MJ per KG of fibre</p>	<p>The carbon footprint of a 264.85g woolly jumper made from New Zealand merino wool averages about 1.667 kg CO2 equivalent at the point of purchase by a consumer, implying a carbon footprint of around 6 kg per kg of finished woollen product (http://en.wikipedia.org/wiki/Wool).</p>
<p>Ramie</p>	<p>Ramie a natural fibre, which belongs to the nettle family. It requires minimal amounts of water, and no pesticides or herbicides to thrive. Ramie yarn is naturally white, making bleaching unnecessary and allowing it to take dyes very well. (http://ecosalon.com/fibre-watch-an-ancient-textile-is-making-its-way-back/).</p>	<p>Ramie is biodegradable and doesn't require bleaching. Several textile companies such as Habu Textiles and Telio use hand-processed ramie, and because the fibre is biodegradable, the two combine in making ramie fabrics closed-loop (http://ecosalon.com/fibre-watch-an-ancient-textile-is-making-its-way-back/).</p>	<p>Ramie requires chemical processing to de-gum the fibre (http://en.wikipedia.org/wiki/Ramie). On a larger scale, the fibre is also mostly processed chemically (http://ecosalon.com/fibre-watch-an-ancient-textile-is-making-its-way-back/).</p>		
<p>Recycled polyester</p>	<p>While it's got the word "recycled" in it, don't be fooled, since most of the recycling processes are environmentally unfriendly. Plus there's a limit on how many times polyester can be recycled before it ends up as landfill (http://www.natural-environment.com).</p>	<p>As all it's doing is prolonging the time before it heads to landfill or is incinerated, I'm still not convinced there are any.</p>	<p>There are two types of recycling, mechanical and chemical. Mechanical recycling is accomplished by melting the plastic and re-extruding it to make yarns. However, this can only be done few times before the molecular structure breaks down and makes the yarn suitable only for the landfill where it may never biodegrade, may biodegrade very slowly, or may add harmful materials to the environment as it breaks down. Chemical recycling means breaking the polymer into its molecular parts and reforming the molecule into a yarn similar to the original. The technology is very costly and almost non-existent. As such, most recycling is done mechanically. Furthermore, recycling traditional polyester downgrades the quality of the polyester, meaning the plastic can only be used to make lower quality products. Second generation plastics can be recycled a second time, but after this, it will become unstable and unusable for further recycling. Another consideration in recycling PET (polyester is created by refining crude oil and breaking it into chemicals to create the polyethylene terephthalate (PET) polymer) is antimony. This chemical, which is present in 80 – 85% of all virgin PET, is converted to antimony trioxide at high temperatures – such as are necessary during recycling, releasing this carcinogen from the polymer and making it available for intake into living systems. Dye uptake is also said to be inconsistent, resulting in a high level of re-dyeing, and as it's hard to achieve white, chlorine-based bleaches are often used (http://textileexchange.org/node/959). Once the fibres are woven into fabrics, most fabrics are rendered non-recyclable (https://ecotextiles.wordpress.com/2009/07/14/why-is-recycled/).</p>	<p>(Unrecycled polyester) 125 MJ per KG of fibre</p>	<p>(Unrecycled polyester, US) 9.52 KG of CO2 emissions per ton of spun fibre.</p>
<p>Recycled nylon</p>	<p>Like polyester, nylon fibre is made from petroleum. It's said to be harder to recycle nylon than polyester, and the processes involved are still environmentally unfriendly and bad for our skin.</p>	<p>As all it's doing is prolonging the time before it heads to landfill or is incinerated, I'm still not convinced there are any. Here is some information on the dangers of manufacturing and disposing of nylon: http://schoolworkhelper.net/nylon-background-dangers-disposal/</p>	<p>Patagonia, a company heralded for its use of recycled materials and environmentally friendly approach to apparel writes of recycled nylon: "In 1993 we were the first outdoor clothing manufacturer to adopt fleece made from post consumer recycled (PCR) plastic soda bottles into our line. Twenty years later however, we're still searching for a similar success story with recycled nylon. The challenge lies ahead of us, and we're committed to discovering the best methods to recycle nylon fibre, but it appears this evolution will take many years." (http://www.patagonia.com/us/patagonia.go?assetid=37606)</p>	<p>(Unrecycled nylon) 250 MJ per KG of fibre</p>	