



To find out more about the heaviest environmental impacts in the fashion industry, please see the Clean By Design website: [www.cleanbydesign.org](http://www.cleanbydesign.org)



## Fiber Selection:

Understanding the impact of different fibers is the first step in designing environmentally responsible apparel

Ecofiber selection can make a big difference in lowering the environmental footprint of a garment. There are excellent alternatives for nearly every important fiber type.



### What are the Heavy Impacts of Fiber Production?

The production of both natural and synthetic fibers have significant, though very different, impacts on the environment. Cotton is the most notorious natural fiber; when grown by conventional means, it requires enormous amounts of pesticides and water. Downstream, large quantities of chemicals, water, and energy are required to prepare and then dye cotton fabric as well. Conventional rayon, made of cellulose from trees, is easier on the land, but chemical-heavy in the fiber-spinning phase. It also requires extensive resources at the dyeing mill. Polyester and

other synthetics rely on non-renewable resources (oil) for fiber production but are easier on the environment during dyeing and finishing at a fabric mill. See summary table comparing fiber types.

### What are the solutions?

Fibers should be chosen first by considering aesthetic and performance requirements. For some end uses there will be a large selection of appropriate fibers types (e.g. ladies fashion tops). For others there will be a narrower choice (e.g. ultra-lightweight waterproof shells).

Once an appropriate fiber type is selected, seek out low impact variants, such as organic or recycled.

### IS THERE A BEST FIBER FOR THE ENVIRONMENT?

In a word, no. "Organic" fibers are superior to conventional fibers. Recycled content is often best of all. "Natural" fibers are not necessarily better than synthetic. The attached table summarizes the differences across fiber types.

## **QUALITY: ARE ECO-FIBERS AS GOOD AS CONVENTIONAL FIBERS FROM A TECHNICAL PERSPECTIVE?**

Yes, mostly. Organic and BCI cotton are identical to conventional cotton in terms of quality and performance. Recycled cotton fabrics are generally a bit weaker and a bit hairier than virgin fiber equivalents. Organic linen and hemp are indistinguishable from conventional counterparts. Recycled wool fabrics are not as strong or smooth as virgin wool fabrics, but for many end uses they are certainly fit for purpose.

On the synthetic fiber front, you have to be a real expert to notice the difference between virgin and recycled polyester.

Be wary of replacing established fibers with completely different fiber type that is unsuited for a particular end use. The eco-credentials of Tencel are well known, for example, but you wouldn't want to make sports socks out of it as its wet abrasion resistance is not good.

## **THE BIG PICTURE:**

Eco-fiber section can make a big difference in lowering the environmental footprint of a garment or collection. However, fibers must be woven/knitted, dyed, and finished before they become fabric. All of these processes have negative environmental impact, and the size of the total production impacts is determined by the efficiency of the factories that dye and finish fabrics, as well as the fiber type. For example, although organic cotton is a natural fiber, the impacts of dyeing it are higher than the impacts of dyeing polyester.

## **FAST FASHION HAS A NEGATIVE IMPACT:**

Replacing clothing that wears out or goes quickly out of style has a big environmental impact; timeless fashion for staples in our wardrobe and production of durable apparel can play an important role in reducing environmental footprint.

"Timeless fashion" makes a lot of eco-sense.

## **NRDC recommends:**

- Determine aesthetic, quality and performance requirements to choose an appropriate fiber type first—then select the lowest impact variant of that fiber.
- Don't forget that fibers have to be spun, knit/woven, dyed, finished, made into garments, and transported. Although fiber choice is important, it is only part of a bigger picture.
- Don't bother to shoehorn low impact eco-fibers into short-lived, fast fashion garments.

Environmental Comparison of Fiber Types										
	Cotton	Organic Cotton	Viscose Rayon	Tencel	Polyester	Recycled polyester	Wool	Cashmere	Alpaca	Nylon
<b>Land impact</b>	Uses prime arable land. Significant pollution from fertilizer and pesticide	Uses prime arable land	Trees grow on marginal land with higher cellulose yields than cotton  Some brands use certified wood	Trees grown on marginal land with higher cellulose yields than cotton  Wood is certified	None	None	Sheep normally graze on marginal land and cause little damage	Goats can cause significant land damage	Alpaca graze on marginal land and cause little damage	None
<b>Use of non-renewable resources</b>	Used for fertilizers and pesticides	Very little used	Significant chemical use in wood pulp manufacture  Significant solvent use in fibre manufacture	Significant chemical use in wood pulp manufacture  Solvent used in fibre manufacture is recycled	Made from oil	Made from bottles that were originally made from oil	Very little used—a bit of sheep dip for ticks	Very little	Very little	Made from oil
<b>Water to grow/spin fiber</b>	Very high usage, although some crops are rain fed	Very high usage, although some crops are rain fed	Significant water used in wood pulp and fibre manufacture	Significant water use in wood pulp manufacture	Very low usage	Very low usage	Very low usage	Very low usage	Very low usage	Very low usage
<b>Energy to grow/spin fiber</b>	Low requirement	Low requirement	High energy requirement in wood pulp and fibre manufacture	Less energy in fibre manufacture than viscose	Very high energy requirement	Very high energy requirement	Very low—some greenhouse gases from sheep	Very low—some greenhouse gases from goat	Very low energy requirement	Very high energy requirement
<b>Dyeing and finishing impacts</b>	Very high use of water, energy and chemicals in typical processing	Very high use of water, energy and chemicals in typical processing	Significant, but less water, energy and chemicals use than for cotton	Significant, but less water, energy and chemicals use than for cotton	High temperature dyeing process but shorter process with less chemical use—overall lower impact than cotton	High temperature dyeing process but shorter process with less chemical use—overall lower impact than cotton	Intensive scouring process to remove lanolin plus chemically intensive process to achieve washability	Similar to, but lower impact than wool	Similar to but lower impact than wool	Similar to Polyester
<b>Other</b>	High pollution loading from dyeing  Untreated effluent causes major damage.	High pollution loading from dyeing  Untreated effluent causes major damage	Very significant pollution from some wood pulp and viscose factories	Much less pollution than from viscose factories but wood pulp the same		Two methods of recycling—one depolymerisation / repolymerisation and the other a lower impact, simple melting process that yields slightly inferior fibre	Recycled wool of only slightly lower quality than virgin wool is available from Italian industry	Cashmere goats are raised in very fragile areas	Alpaca are raised in less fragile terrain	Recycled nylon is becoming available