

Clothing Guide



FIBERSHED



Clothing Guide

A Menu of Actions and Options



FIBERSHED

Why a Clothing Guide?

Knowing what is in your clothing and how it came to be made has defining implications for personal and planetary health. This guide is designed to empower the decision making process of all wearers—starting with you!

We don't often ask what's in our clothing and we're not provided an ingredients list, nor are we often offered information specific to *who* made our garments. Clothing manufacturing can be a black box of information for most of us. This guide offers a set of simple guidelines to use when considering your next clothing purchase, and some deeper explanation about the fibers and dyes that compose most of what we wear. We do not cover in depth the many thousands of synthetic chemical compounds used in clothing manufacturing because we'd need a much longer book for that. This guide offers information that will help you quickly reduce impact with the clothing you already own as well as providing information that will help you create a healthier and friendly 'fiber and dye diet' going forward, as you refine your next set of clothing choices.



The Time Sensitive Nature of this Guide

If we continue business as usual, by 2050 global clothing production will account for close to one third of the carbon budget needed to keep global temperatures from exceeding 2°C (known by scientists and many nations to be a life threatening temperature increase, yet still an essential limit).¹ For most of human history, the ingredients in our clothing were simple, natural, and had no health harming implications for the maker or wearer. If we look farther back in time, clothing wasn't even a necessity for our ancient ancestors. Humans grew their own protection to withstand the elements on their bodies. Ice, rain, snow, wind, and direct-sunlight were shielded by a layer of hair that covered the body. Upon losing this layer of protection, humans have since become dependent upon a second skin.

In addition to survival, our clothing has allowed us to adorn ourselves in ways that communicate. Humans utilize clothing to commemorate a noteworthy life event—celebrations that mark a new union or a rite of passage into adulthood, an athletic event, a bountiful harvest, a celebration of the non-human spirit world. Humans have long adorned themselves in symbolic reference to the season, time, and place they find themselves a part of.

In many ways, the modern wardrobe continues to reflect these historic needs and desires. However, in today's world the modern clothing creation processes (for the lion's share of the human population) are generated by large-scale transnationally

¹ *A New Textiles Economy: Redesigning Fashion's Future* (Ellen MacArthur Foundation, 2017).

managed companies whose primary function is to sell us something. The biological sources for our garments are often cloaked and we are rarely educated well in how to make our clothing last or where it should go once it no longer functions. We have access to few to none of the very basic pieces of information that would allow us to make fair, ethical, and ecologically sane choices for what we put on our skin.

And yet, there is a beautiful counter-force at work—likened to the slow food movement; there is a transparent, thoughtful, and quality-focused community of designers, manufacturers, farmers, wearers, and menders, who are offering another set of clothing options. This clothing guide is designed to provide easy steps a person can take to align their second skin choices to perpetuate personal health and well-being for all those involved in our garment creation processes.

Four Simple Guidelines

- Wear natural fibers.
- Avoid plastic clothing.
- Choose quality garments over quantity.
- Keep clothing in use for as long as you can.

Starting with the Basics

Key Elements that Define the Impact



How You Clean

Garment care accounts for approximately 75-80% of the carbon footprint of any individual piece of clothing. This is because you typically own a garment for longer than the supply chain that created it. Clothing care has an impact, and yet, there are easy ways to drastically reduce this impact. It starts with clothing choices.

The more naturally antimicrobial the fiber within a garment, the less water and heat will be needed to wash it. Recommendations for natural antimicrobial

properties are in the fiber section of this guide. When you do wash your garments, use cold water and line dry to retain textile longevity and reduce the carbon emissions produced by typical grid energy and propane systems that power hot water and mechanical dryers.

Switching from hot to cold water washings can save approximately 1600 pounds of carbon dioxide from entering the atmosphere per year per household; that's 34 million tons that could be saved in the United States through broad-scale adoption of cold water washing.²

Use fragrance free, phosphate free, and biodegrading soaps to eliminate endocrine disruptors in our environment (which are correlated to autoimmune, cancer and metabolic disorders).

Eliminate fabric softeners all together, and instead use a ½ cup of white vinegar during the rinse cycle.

Use wool dryer balls with the clothing in your dryer to eliminate the use of polluting disposable dryer sheets and to reduce drying time by up to 20%.

Use UV light to air and clean smells from protein fibers. Wool, alpaca, cashmere, mohair and angora do not readily absorb body odor and need little washing, but when they do begin to accumulate odors you can put garments into direct sunlight for several hours. UV light is a practical tradition for cleaning clothing items that dates back as long as humans have worn these fibers.

Keeping Clothing Functional

Sixty percent of all clothing produced is disposed of within the same year it is purchased.³ This has led to global textile waste levels growing to historically unprecedented numbers—we discard a single garbage truck load of clothing per second.⁴ People are now keeping clothing approximately half as long as they did just 15 years ago. Textile production produces 1.2 billion tons of CO₂ per year; this is more emissions than international flights and maritime shipping.⁵ When you purchase a garment it's a hand-off from the supply chain partners to you—it's your turn to manage and care for your clothing item once you purchase it, with the intent to keep it from becoming someone else's problem.

There are many ways to keep clothing in play. Consider mending and repair, including patching, darning, hemming, over-dyeing and modifying clothing to make what you have last. If you don't have time to do it yourself, there are options at local dry cleaners and tailor shops for repair and maintenance. If you have the time to mend your clothing, we recommend the book *Mending Matters* by Katrina Rodabaugh.

2 <https://www.ase.org/resources/efficient-laundry-wash-clothes-cold-water-save-energy>

3 Remy, N., Speelman, E. & Swartz, S. *Style That's Sustainable: A New Fast-Fashion Formula* (McKinsey&Company, accessed 11 December 2017).

4 *A New Textiles Economy: Redesigning Fashion's Future* (Ellen MacArthur Foundation, 2017).

5 *A New Textiles Economy: Redesigning Fashion's Future* (Ellen MacArthur Foundation, 2017).



What You Purchase / Quantity

We're purchasing 60% percent more than we did 15 years ago,⁶ due in part to the price of clothing growing more slowly than other consumer goods. However, you might have heard the old adage, "I'm too poor to buy cheap!" It's true. The time alone spent in a mall or on a computer ordering clothes has become a major distraction, all at a moment in our human history when there are so many critically important and wonderful activities we could be committing ourselves to. The trend to purchase cheap and poorly made garments is not saving us money and

it is cluttering our homes, closets, and planet. Think about your closet as if you were paying every time you pulled out a garment and put it on. We call this 'price per wear.' A garment's real price tag is determined by how many times you wear it. A \$30 cheaply made sweater worn 10 times costs you \$3 per wear; an heirloom quality \$300 sweater worn 1,000 times cost you 30 cents per wear. You can save money by owning and wearing high-quality garments for longer and forgoing cheap impulse purchases.

What You Purchase / Quality

Approximately 70% of what humans wear today is plastic clothing and plastic fiber blended clothing that is shedding non-biodegradable fibers into our fresh water and marine ecosystems at an alarming rate through our laundering processes. In a recent study by the Bren School of Environment Science & Management, it was found that 1,174 milligrams of microfibers were released from washing one synthetic jacket one time. Approximately 40% of the plastic from our laundry systems is released into rivers lakes and oceans; this equates to approximately one million tons of plastic discharged around the world each year from our laundry.⁷ It was found that 94% of American's drinking water contains plastic microfiber pollution.⁸ Abrasion of plastic clothing (nylon, polyester, acrylic, capiline, polypropylene, spandex and elastine) produces non-biodegrading lint that has entered our air, water, and farmland.



6 *A New Textiles Economy: Redesigning Fashion's Future* (Ellen MacArthur Foundation, 2017).

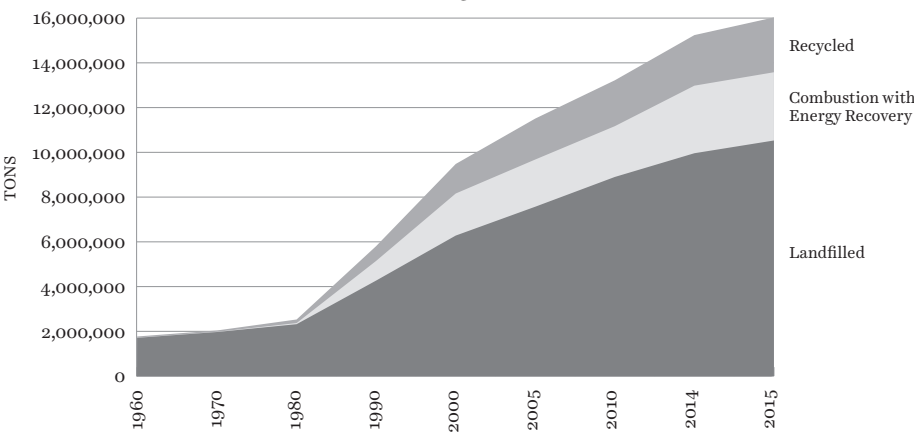
7 <https://brenmicroplastics.weebly.com/project-findings.html>

8 https://orbmedia.org/stories/Invisibles_plastics/multimedia



In our marine ecosystems, microplastic lint is killing base life forms such as zooplankton that larger marine life forms depend upon as a food source. Plastic clothing does not biodegrade, and like any other plastic object, these materials are not being recycled even close to the rate at which they are produced—recent estimates show that less than 1% of all discarded clothing items are spun into fresh textiles.⁹

Textile Waste Management 1960-2015¹⁰



1960-2015 Data on Textiles in MSW by Weight¹¹
(in thousands of U.S. tons)

	1960	1970	1980	1990	2000	2005	2010	2014	2015
Generation	1,760	2,040	2,530	5,810	9,480	11,510	13,220	15,240	16,030
Recycled	50	60	160	660	1,320	1,830	2,050	2,260	2,450
Composted	-	-	-	-	-	-	-	-	-
Combustion	-	10	50	880	1,880	2,110	2,270	3,020	3,050
Landfilled	1,710	1,970	2,320	4,270	6,280	7,570	8,900	9,960	10,530

A dash in the table means that data is not available.

9 <https://remake.world/uncategorized/are-our-clothes-doomed-for-the-landfill/>

10 EPA Facts and Figures about Materials, Waste and Recycling: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/textiles-material-specific-data>

11 EPA Facts and Figures about Materials, Waste and Recycling: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/textiles-material-specific-data>

Menu of Common Fibers You'll Find in Your Clothing

We recommend avoiding purchases of all non-biodegrading plastic clothing and plastic blended clothing. This includes garments made with nylon, polyester, acrylic, elastine, spandex, capiline and polypropylene. Each of these fibers derives from fossil carbon sources that are known to pollute our food, water and physical bodies. The science showing plastic clothing's shedding into marine and terrestrial ecosystems is extensive. Furthermore, the refinement of fossil carbon that is used to produce fuel, clothing, and a host of materials for human consumption is the cause of climate change, and this too has been known for decades—and by some scientists for centuries. However, there are wonderful alternatives to wearing fossil carbon based plastics.

When choosing natural fibers, there are many considerations to make, including one's personal value set (omnivore, vegetarian, vegan). Not all natural fibers are created equal, and yet having a fiber that can return to the soil at the end of multiple recycling efforts is critically important to the health of us all.

How natural fibers are grown defines whether they contribute to, or ameliorate the global climate crisis. Fiber farming has the ability to be done in a manner that enhances the drawing down of atmospheric carbon into the soil. This 'enhanced photosynthetic capture' is done through natural and time-honored processes that are also known to create dynamic and highly productive soils. When fiber farming is conducted to enhance organic soil carbon levels and ensure the clean recharge of ground water; and when farming is implemented by using little to no synthetic molecules to fertilize, or control weeds and pests; it can be a significant contributor to the enhancement of earth's biosphere health.

If natural fiber farming information is not readily available to you as a wearer through the brands that you purchase from, we recommend sending their customer service department a note to request that they support you in knowing who the farmers and ranchers are who grow your clothes, and asking how the brand can enhance their support of those on the land to 'carbon farm and grow fiber organically.'

Symbols Used in this Booklet



Plant-based fiber



Acceptable for vegans



Animal-based fiber



Acceptable for vegetarians



Acceptable for omnivores

Plant-based Fibers



COTTON: *Gossypium barbadense* and *Gossypium hirsutum*



Thirty percent of all the clothing that humans wear is made of cotton. Cotton is an annual crop planted in the spring and harvested in the late fall. The fiber is soft when picked and requires fairly little processing compared to other fibers post-harvest. Processing starts with separating the fiber from the seed (known as ginning); the raw cotton fiber is then mechanically

combed, spun, knit or woven into clothing. Upland and Sea Island Cottons are the two main species that are grown in the world today. Sea Island Cottons were and are traditionally grown in fertile soil (valley bottom) and provide long fiber lengths that produce high quality yarns and textiles—these are often known by their varietal name, pima or supima. Upland cotton can grow in less arable or fertile land and has a shorter fiber length—this species is known commonly by the varietal name acala cotton.

There are also lesser known and more ancient color-grown cotton varieties that exist that produce naturally green and brown cotton. These cottons are much rarer to find in finished garments, due to the industry galvanizing its machinery and dye processes for white cotton, however color-grown cottons can be sourced (list of vendors page 18). These varieties provide great beauty straight from the plant; there is little need to dye your yarns or garments when they are already nature-grown. Cotton is well loved for its softness and general ease in wearing. The fiber produces ubiquitous fabrics and utilitarian garments from denim jeans to t-shirts.

Issues to consider with cotton

Cotton is a commodity crop, and that means that cotton farmers experience price fluctuations that are determined by global markets which can generate income instability for farmers and a general liability to not being able to focus on the long-term health needs and constraints of a specific farming community or land-type. Commodification of the crop opened the door for it to become one of the first crops that Monsanto focused upon to genetically modify—you might have heard of ‘Round-up Ready Cotton’ or ‘Dicamba’ cotton. Monsanto (now known as Bayer), has engineered cotton to be resistant to various toxic proprietary herbicides. This has pushed farmers to use all-in-one combinations of genetically engineered seed and their accompanying chemicals. In the U.S. in 2015, 94% of all cotton was genetically engineered to withstand the spraying of partnered-use herbicides.

Cotton and water usage is a common conversation amongst those considering the efficacy of this fiber—it is true that there are hundreds of water-constrained communities across the globe growing this crop that performs well in hot dry conditions where irrigation water is available. Searching for clothing made of cotton that has a transparent land-based source may not be simple in all cases, but it is recommended. In communities where water use contracts are in place,

water usage is monitored and paid for by those using it, ground water re-charge is mandated, and water efficiency programs are in place to support farmers—these are the growing sites where cotton could have a chance at being grown well into the future (aka sustainable) even within our changing climate.

Organic cotton does offer many ecological and social welfare benefits by eliminating exposure to carcinogenic, mutagenic, and neurotoxic chemicals. However, organic cotton certification does not ensure that in-field labor rights are met for farm workers; most organic cotton that comes from overseas is handpicked. Fair trade and organic certifications are the highest quality combination approvals to look for on the tag if you're purchasing cotton coming from overseas. One issue that has arisen with the growth of the organic cotton textile market is that many American-based brands went overseas to acquire organic fiber more cheaply, instead of committing to the more difficult task of working to support farmers more local to themselves to build stable markets for organic cotton within the United States. As a result, less than 1% of the cotton in the U.S. is certified organic. Searching for cotton garments that marry the principles of organic farming and fair domestic treatment of our farmers, including providing long term stable pricing contracts, are key factors in defining an equitably produced cotton garment. Brands that do the hard work of supporting farmers that exist in close proximity to their corporate headquarters are the clothing companies we recommend supporting.



Hemp: *Cannabis sativa*



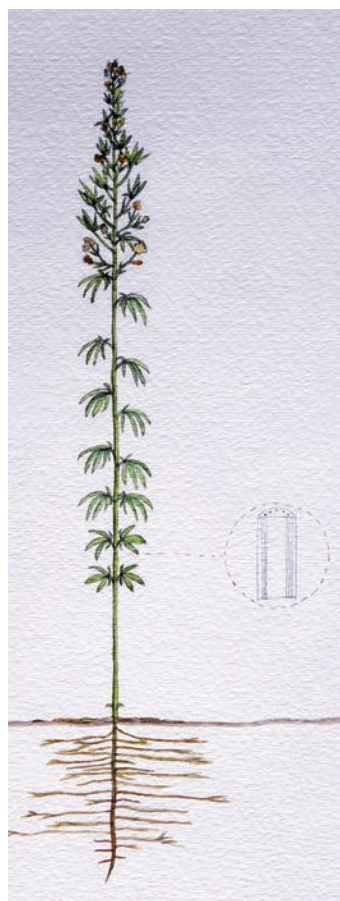
Hemp accounts for less than one percent of total fiber consumption; this low consumption rate is significantly tied to the policies that once labeled the species a schedule one drug, even though hemp does not contain significant psychoactive properties. Now that the ban on hemp has been lifted in the

United States, resurgence in its use as a textile, composite material and medicine can already be seen. Hemp is an annual crop that is planted in the early spring and harvested for fiber after the plant flowers. Hemp is naturally antimicrobial and it is an exceptionally strong fiber. The crop has little to no need for synthetic herbicides and pesticides, however non-organic hemp farmers (similar to non-organic fiber farmers growing other species) use synthetic nitrogen to boost their crop yield. This can cause nitrate contamination for ground and surface water;

nitrate contamination impacts over 1,700 water districts nation wide. Hemp does utilize external irrigation, and while it utilizes less water than cotton, the plant is not without a water footprint. Traditionally hemp was, and in many cases still is, left to lay in the field after harvest so that soil microbes can begin to decompose the lignin and pectin that is within the hemp's tall and strong stalk. This process is called retting, and has been used for millennia to naturally soften the hemp fibers. Once retted, the hemp fiber can be separated from the woody part of the plant, and in traditional communities the fiber is then spun, knit and or woven.

Issues to consider with Hemp

Most commercial modern hemp processing systems are based in China, and the water-based chemistry utilized to soften the fibers is often dependent upon the usage of caustic substances. There are projects emerging in the United States that are seeking to develop retting processes that use what is known as closed-loop chemistry (chemistry that creates no toxic effluent release into the environment); there are also experimental processes that use enzymes and even UV light. Looking for hemp products that are transparently connected to the location the crop was grown—and that tell the story of how the fiber was softened—is of great value to better understand the impact of a hemp textile.



Rayon



Wood pulp and bamboo are used to make rayon or ‘bamboo rayon,’ accounting for approximately 6% of global fiber consumption. The most common process for rayon production is known as the viscose process, which is reliant upon carbon disulfide, a compound known to cause nervous system damage. To harden the rayon yarns, the material has to sit in a bath of sulfuric acid, which is a highly corrosive substance.

The viscose process is also used to create yarns from bamboo, eucalyptus, soy or other ‘eco’ textiles. Specific to the use wood fibers however, the Rainforest Action Network has deployed a campaign highlighting concerns regarding the fashion industry *turning forests into fashion supply chains*. The organization states, “*Big name fashion brands are complicit in the pulping of pristine forests—seizing Indigenous land, driving species loss, and threatening the climate—all to manufacture a product that makes its way into the clothes we wear every day.*” Some corporations like Ralph Lauren, VF Corporation and others have started

tracing their wood pulp fibers, to ensure virgin forests aren't harmed—the question remains, *why are we wearing trees?* Modern toxic chemistry might have made this possible, but that does not mean it was a good idea. Canopy certified rayon ensures that threatened forests are protected and not used for viscose pulp.



Flax: *Linum usitatissimum*



Linen accounts for less than one percent of current fiber consumption. Linen cloth is made from flax, a tall and thin plant that grows to maturity in 100 days and produces a bluish flower with a delicate shape. The crop has a long history of human use dating back 30,000 years. *Linum usitatissimum*, translates

to ‘most useful’ and like hemp, flax produces bast fibers—long straight smooth fibers that are durable, anti-microbial, and have a beautiful weight and drape to them when used in a textile. Technically the term ‘bast’ refers to the fibers that are produced in the plant stems as part of the phloem tissue, and are responsible for supporting the upright structure of the plant. There has been a notable resurgence in flax growing and the rekindling of flax processing knowledge as of late in the Pacific Northwest, New England, and Northern California. Artisan processing is occurring in the United States, however the highest quality linen cloth is currently produced in Northern Europe. Linen produces beautifully draping textiles that feel cooling, and thus perfect for wearing during the summer heat.

Issues to consider with Flax

Unless grown organically, conventional flax farming does rely on herbicides to kill ‘competing’ plant species in the field. Commercial non-organic flax farming also relies upon synthetic nitrogen that poses concerns for ground water, rivers, and marine ecosystems.



Tencel, Modal and Lyocell



These fibers are created in a proprietary milling system that is also fueled from tree pulp, including birch, oak and eucalyptus. The trees are harvested, shipped, milled, pulped and softened to make a cellulosic material that is extruded into yarn to make clothing. The chemistry usage for these fibers is recovered by 99% and the water in the system is recycled. The trees utilized for the pulp are from tree farms.

Other plant fibers



Lesser known plant fibers also used for clothing: pineapple, kapok, ramie and nettle.

Note on the future of biomass

There are new technologies emerging that can transform fast growing forms of biomass—the shorter leftover flax, kenaf and hemp fibers and stalks, as well as pulped recycled cotton and other agricultural biomass—into useful textiles. Keep your eye out for non-tree based cellulosic clothing in the near future. There are also plant-based stretch materials just now being commercialized that will offset the use of plastic fibers within performance wear clothing. The future of new biomass textile recipes is promising, and the most exceptional selection of these new recipes that will ensure a healthy biosphere rely strictly upon existing DNA (no genetic modification of plants or animals is necessary). Make sure to check labels carefully with new ‘biodegradable, biosphere-based’ materials to ensure that genetic recoding, editing, and recombining is not taking place in the name of our new garments.

Recycled Fibers

There are many recycled fiber garments beginning to enter the market. When looking for the best options in recycled clothing, consider if the fiber can biodegrade—recycled natural fiber clothing is a wonderful option to renew life into farmed and ranches fibers. For the best chance at having your used clothing recycled and turned into the next generation of garments, it is important to start with a purchase of a 100% natural fiber garment. Separation of polyester, nylon and other fossil carbon fibers from wool, cotton, or other natural fibers is not a scaled, accessible, or affordable technology—and thus blended textiles make recycling a challenge.

Protein Fibers



Wool: *Ovis aries*



Wool currently accounts for between 1% and 2% of fiber consumption. Grown by sheep, wool has been co-evolving with the forces of nature for many millennia; sheep were domesticated some 8,000 to possibly 10,000 years ago and have evolved with humans to be sheared (the act of shaving and or cutting the fibers).

Over this course of time sheep have been brought into microclimates across the earth—adapting and adjusting to temperature, precipitation, and topography.

The natural anti-microbial properties of wool make it exceptional material to create clothing with. Its properties are unique; wool absorbs water vapor both from the air and from perspiration through the porous coating that covers its scales—the fiber can take in 30% of its weight in water vapor without feeling damp or clammy.

Wool is also a well-known temperature regulator; energy is released when water vapor enters the fiber, and this offers warmth to both the sheep and the wool wearer. A kilogram of wool can produce as much energy as the human metabolism generates within one hour. When wool is in a dry and warm environment, the fiber produces a cooling effect as the fiber re-releases moisture.

The flame retarding qualities are also remarkable—wool has the highest ignition threshold of any natural fiber, is flame retardant up to 600 degrees Celsius and is self-extinguishing. Wool is also biodegradable; the fiber can decompose within months depending on how it is composted and or returned to the soil. Wool is known for its utility and for many it is the first choice for high performance activity, whether that activity is marathon running or shepherding the sheep. The fiber is known to be malleable, durable, and made for all seasons and all of life's activities.

Angora Goat: *Capra aegagrus hircus*



Angoras are small, curly haired goats that produce mohair at the rate of approximately $\frac{3}{4}$ of an inch per month. Mohair goats have endearing and playful personalities. The soft fiber locks from mohair goats are appreciated for their sheen, strength and smoothness, and are obtained by shearing (shaving or cutting the fibers). Kid mohair is from the young goats, and is known for its very soft properties; it is a well-appreciated fiber for use in garments worn next to the skin. Older goats produce a rougher fiber that is useful for durable goods—rugs, bridles, and horse blankets.

Angora Rabbits: *Lepus angora*



Angora rabbits are the only species that produce angora fiber, known as the most insulating fiber generated by any animal. The most common angora breeds are German and English; both need to be provided a haircut approximately every 90 days to 4 months so that their fiber does not become matted and unhealthy for them. Some hand-spinners will sit their rabbits on their laps, gently combing and clipping their animal's fur, and then quickly moving the clipped fiber onto their spinning wheels to make yarn. Both angora rabbits and goats produce fibers that compliment and are often successfully blended with wool—adding sheen, warmth, a smooth texture, and weight to high quality yarns that produce warm, durable, and heirloom quality clothing.

Silk: *Sericum vermis*



Raising silk worms for silk production is known as sericulture and it began in China between 5,000 and 3,000 BC. There remain many different indigenous varieties of silk worms raised in over 20 countries, all of which feed on Mulberry leaves. Once mature, the silk worm spins a cocoon made of long filaments. In typical silk production the worms and their cocoons are boiled—in traditional communities the worm is eaten as a source of protein and the silk is harvested for the creation of yarn. The long filaments that come from the cocoon have a great strength and can measure from 500 to 1500 m in length, which is quite substantial given the source. There are silk creation processes that generate a fabric known as 'peace silk' that provide the silk moth the ability to escape from its cocoon to live out their life (which lasts a week or more), so that the moth can mate, lay eggs and then die. The silk cultivation process produces a fiber that is known to be one of the best materials for base-layers for skiers, back-packers, and endurance athletes who perform in cold climates—it wicks moisture and dries quickly. 100% silk and wool-silk blends are a favored material for hiking socks, base-layers and long underwear.

Cashmere Goat: *Capra hircus*



A cashmere goat produces cashmere fiber from its soft winter undercoat. Cashmere goats are combed and each goat can produce between two and four ounces of fiber per year. This is why cashmere is one of the more expensive fibers available. The goat's undercoat grows as the day length shortens, and is covered by coarse hair that grows year round. Cashmere goats are commonly raised in higher elevations and produce the most fiber when they are raised in regions with freezing winters. Cashmere fibers are insulating, extraordinarily soft and produce garments of heirloom quality.

Alpaca: *Vicugna pacos*



Suri and Huacaya alpaca are a domesticated South American camelid. After 20 years within the United States, alpaca production numbers in 2013 were approximately 178,000. The Huacaya alpaca make up the vast majority of those numbers and produce a soft and slightly curly fiber; the Suri produce a longer, silkier fiber with considerable drape. Alpaca fiber has an air bubble within it that makes it an incredibly insulating fiber, and if you've ever worn the fiber you know how warm this fiber is. Alpaca fiber—unlike wool—has no scales, and for that reason does not impact human skin the way that wool can. There is an innovative processing model in New England—known as the New England Alpaca Fiber Pool (NEAFP)—that provides domestic alpaca growers across the country a means to have their flock's fiber turned into all manner of finished goods, including gloves, hats, scarves, coats, boot inserts, knitting yarn and afghan blankets.

Other Protein Fibers



Other natural protein fibers that rarely but occasionally can be sourced from combing and or shearing processes: Qiviut (from the Musk Ox), Bison, Possum and Guanaco.

Issues to Consider with Protein Fibers

Overgrazing and the depletion of the soil where fiber animals graze can be a significant issue. In large-scale wool shearing operations, rare, yet documented, abuses of animals have been cited. However, animal abuse does not go far in the wool industry; a sheep's long term health and well-being is critically important to ranch and farm viability.

Sheep that healthfully produce wool every year create a functioning wool business; workers that violate animal welfare agreements are weeded out quickly. Based on select incidents of abuse, some groups are calling for boycotting wool altogether. This clothing guide does not recommend fiber boycotts, but instead recommends familiarizing yourself with the land-based source of the fiber you are wearing. If you have a committed omnivore or vegetarian value set, animal fibers remain as the most insulating and durable performance fibers that exist and they are essential for the survival of many who live their life in northern latitudes. Wool and protein fibers are less than 2% of global consumption and so there is ample opportunity to perfect this small but essential contribution to the fiber system.

There are currently methods for supporting ranchers and farmers to focus on soil and land regeneration and animal welfare as critical aspects of their business. Climate Beneficial™ Wool is a Fibershed verification that is regionally based and began in Northern California, and is now being replicated in the Hudson Valley of New York and in central Colorado—all farmers and ranchers involved in the program are transparently documented; their soil organic carbon levels are monitored and land management practices are verified for climate impact.

If you're wearing wool sourced outside the United States, ranchers have been able to certify under the Textile Exchange's Responsible Wool Standard. For those focused primarily in above ground environmental quality and on-farm or ranch biodiversity monitoring—the Land to Market program has recently been launched through the Savory Institute.



Understanding Color



Synthetic Dyes

Approximately 10,000 different synthetic dyes are used on our garments.¹² Today's synthetic dyes are responsible for the color of the world's textiles (minus a small percentage of naturally dyed and un-dyed garments). The most ubiquitously used family of colorants, responsible for 60-70% of the total industrial practices, are Azo dyes¹³—most are shown to be both carcinogenic and mutagenic (they disrupt the DNA in a cell).¹⁴

More than half a trillion gallons of water is used in the textile dyeing process on an annual basis and approximately 200,000 tons of dye is left unbound to the textiles and is lost to effluent.¹⁵ When allowed to enter fresh water aquatic systems, these coloring agents cause oxygen deficiencies and can heavily impact drinking and irrigation water.¹⁶ In a 2010 study, three synthetic dyes were identified in river water in various concentrations; the resulting drinking water sourced from the river contained these dyes after water treatment had occurred, showing that methods such as flocculation, coagulation and pre-chlorination were not enough to clean the water for human consumption.¹⁷

Dyes do not break down easily and resist biodegradation, and for this reason they persist in our waterways. Searching for GOTS and Blue Sign certification on your clothing is a first step in sourcing cleaner dye alternatives. There are also a host of un-dyed options (look for unbleached white or color grown cotton and wools), and if you can find naturally dyed garments whose color comes from easily renewable sources—including: black walnuts, indigo, weld, marigolds, avocado pits (this is a very short list of a host of plant species that yield natural colors)—consider these as solid options as you make healthy clothing choices.

12 Zollinger, H. "Synthesis, Properties of Organic Dyes and Pigments," in *Color Chemistry* (New York, USA: VCH Publishers, 1987), 92-102.

13 <http://www.intechopen.com/books/eco-friendly-textile-dyeing-and-finishing/textile-dyes-dyeing-process-and-environmental-impact>

14 Chung KT, Cerniglia CE. "Mutagenicity of azo dyes: Structure-activity relationships," in *Mutation Research*, 1992; 277 (3), 201-220.

15 Ogugbue CJ, Sawidis T. *Bioremediation and Detoxification of Synthetic Wastewater Containing Triarylmethane Dyes by Aeromonas hydrophila Isolated from Industrial Effluent*. Biotechnology Research International 2011; DOI 10.4061/2011/967925.

16 Hubbe MA, Beck KR, O'Neal WG, Sharma YC. "Cellulosic substrates for removal of pollutants from aqueous systems: a review." 2. Dyes. "Dye biosorption: Review." In *BioResources* 2012; 7 (2), 2592-2687.

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How to Cycle Used Garments

Keep your clothing out of landfill: If clothing ends up in the trash it becomes too contaminated for further recycling or second life uses.

Keeping clothing cycling consciously: Consider that the quality and quantity of our purchases define the nature of the second hand clothing market. More than half of our donations are currently sent overseas and our cheap clothing ‘donations’ are now flooding countries that in some cases no longer want these cast-offs. Uganda, Tanzania and Rwanda have banned all clothing and shoe donations in an effort to support the African Growth and Opportunity Act (AGOA) which aims to enliven regional economies. Keep clothing cycling in our own communities; the higher quality the garment, the more likely it will see a second life with friends, family, neighbors consignment shops, the Goodwill and the Salvation Army.

Clothing Swaps: Hosting a clothing swap at your home or local community center can be a great way to bring novelty and newness to a thoughtfully curated wardrobe—the nature of the swap is that you bring garments you are ready to part with, invite your friends to do the same, and take some time to try on each other’s clothing items and make swaps with one another. Adding a potluck dinner to the clothing swap is a great way to build community and connect us to the essential nature and connection to food and fiber.

Body Philosophy Club: Is a project of Belle Bueti, based in San Francisco—an artfully constructed project that invites the wearer into their own experience of how they feel being clothed and in this way, inviting people to slow down and consider their senses. The project provides wearers access to curated second hand garments that are found in estate sales within the project’s geography. The approach of body philosophy club is one that is enabling the movement of garments through a community in a conscious and inspiring manner.

Innovative Reuse

There are companies with innovative approaches to keeping garments and textiles in play and we applaud companies that offer their customers this service.

Coyuchi for Life Program: <https://www.coyuchi.com/subscribe>
Subscribers can return their old linens in the same box their new ones arrived in. Coyuchi then recycles, upcycles or renews them, and sends them on to a new life.

Eileen Fisher ‘Renew’ Program: <https://www.eileenfisher.com/renew>
Bring back old Eileen Fisher clothes and receive a \$5 Rewards Card for each item; the company finds the garments another home or turns them into one-of-a-kind designs. Rewards can be redeemed at any Eileen Fisher and Renew store or online at [eileenfisher.com](https://www.eileenfisher.com).

The North Face ‘Clothes the Loop’ Program: <https://www.thenorthface.com/about-us/responsibility/product/clothes-the-loop.html#>
Bring any used clothing or footwear (any condition, any brand) to a North Face store and they will give you \$10 off your next purchase of \$100 or more.

Patagonia ‘Worn Wear’ Program: <https://wornwear.patagonia.com/trade-it-in>
Bring in good condition Patagonia clothing and receive a store credit that can be used in Patagonia retail stores, on WornWear.com and Patagonia.com. Patagonia will also repair damage due to wear and tear for a reasonable fee.

Book List

This clothing guide is an only a brief introduction to a healthy fiber and dye diet and clothing use conversation. If you're interested in going deeper into this world of fiber, natural dye, textiles and garments, the following resources may be of interest.

Exposé:

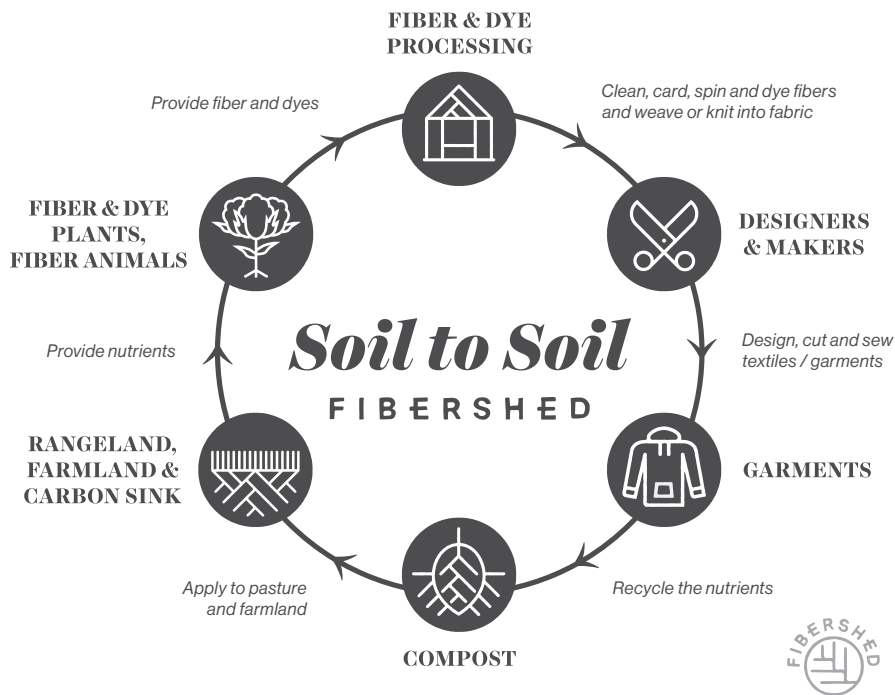
- *Clothing Poverty: The Hidden World of Fast Fashion and Second-hand Clothes*
by Andrew Brooks
- *Fibershed: Growing a Movement of Farmers, Fashion Activists, and Makers for a New Textile Economy* by Rebecca Burgess with Courtney White
- *Overdressed: The Shockingly High Price of Cheap Fashion*
by Elizabeth L. Cline
- *To Die For: Is Fashion Wearing out the World*
by Lucy Siegle
- *Wear No Evil; How to Change the World With Your Wardrobe*
by Greta Eagan

DIY:

- *The Art and Science of Natural Dyes: Principles, Experiments, and Results*
by Joy Boutrup and Catharine Ellis
- *Botanical Inks: Plant-to-Print Dyes, Techniques and Projects*
by Babs Behan
- *Fix Your Clothes: The Sustainable Magic of Mending, Patching, and Darning*
by Raleigh Briggs
- *Harvesting Color: How to Find Plants and Make Natural Dyes*
by Rebecca Burgess
- *Mending Matters: Stitch, Patch, and Repair Your Favorite Denim & More*
by Katrina Rodabaugh
- *The Modern Natural Dyer: A Comprehensive Guide to Dyeing Silk, Wool, Linen and Cotton at Home*
by Kristine Vejar
- *Natural Color: Vibrant Plant Dye Projects for Your Home and Wardrobe*
by Sasha Duerr
- *Print, Pattern, Sew: Block-Printing Basics + Simple Sewing Projects for an Inspired Wardrobe*
by Jen Hewett
- *Weaving Within Reach: Beautiful Woven Projects by Hand or by Loom*
by Anne Weil

Soil-to-Soil: A Healthier Future

This diagram depicts a soil-to-soil textile fiber and dye system. Through the work of Fibershed, the non-profit organization based in Northern California, and in concert with our many partners, we are collectively working in our own community and with grass roots organizers throughout the U.S. and abroad to develop these soil-to-soil systems, so that together we can work swiftly to ameliorate climate change, provide job opportunities for economically ailing communities while serving the needs of the wearers who are focused on the nexus of personal and planetary health.





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Illustrations by Amanda Coen; Soil-to Soil diagram by Andrew Plotsky

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