water footprint implementation

WATER REPORT

KUYICHI
PURE GOODS

WHY WE NEED TO CARE *ABOUT WATER*

Water is one of the most important elements on our earth. We need it to survive. Not only we humans, all other animals and plants need it too. Only 3% of our water is fresh water, the other 97% is salt water that you find in our oceans. Worldwide, 92% of the global freshwater footprint is used for crop production. Non-food crops, like cotton, represent a major share of that agricultural water footprint. With our growing population and our increased consumption there is an increased pressure on fresh water resources. Water scarcity for both drinking water and industrial needs is a challenge that will continue to grow in the future.

Denim consumes a lot of water and is a possible source of pollution as well. The Water Footprint of producing one kg of cotton can range anywhere between 8000 liters (US) to 22000 liters (India), this takes into consideration not just the rainwater and water used for irrigating the crops but also the resulting pesticide and fertilizer pollution entering water bodies. To guarentee a sustainable future for the denim industry we need to start taking care of our water. From the materials we use and where we grow them to how we dye and wash them.

At Kuyichi we aim to lower our environmental impact in any way we can and that is why we dived into our water footprint. We want to know how we're currently doing and how we can improve. With the knowledge of Water Footprint Implementation we've reached valuable insights into our water use, what we can do to decrease it and what is worth investigating further. This report is the result of this journey. It does not only show our commitment to care about water. We hope it can inspire others to dive in as well.

WATER FOOTPRINT IMPLEMENTATION
BLUE, GREEN AND GREY WATER

Water Footprint Implementation (WFI) provides insights and solutions to organisations who want to assess and reduce their water footprint. They translate the latest scientific data into practice and help quantify and manage water risks. The WFI builds upon the Water Footprint Assessment developed by Arjen Hoekstra in 2002. The Water Footprint Assessment is a method for measuring the amount of freshwater consumed in the production of goods and services along their full supply chain. Combined with temporal and spatial data of water availability the Water Footprint Assessment method helps us to determine the sustainability of a production process and how to change towards better practices.

BLUE, GREEN AND GREY WATER FOOTPRINT

The water footprint of crops, such as cotton used in denim, also known as the 'virtual water content', consists of three parts: the green, blue and grey water footprint. The green water refers to the rainwater consumed. This is the natural way of watering crops. If there is not enough rainfall you have to satisfy the crops' water need with blue water through irrigation. The blue footprint is the water used from surface and groundwater. The blue water footprint shows vulnerability and contribution to water scarcity. We prefer this water to be kept where it is, in the ground and in the rivers, so we should try to limit this water usage. The grey water footprint is the amount of freshwater needed to bring pollutants down to the concentrations naturally found in the environment. In other words, it represents the water which naturally dillutes the pollutants.[1]

water footprint implementation

If the crop is only rain-fed, the blue water footprint is zero. But if the crop is irrigated, a part of the consumed water is taken from other sources to the plant (the blue water footprint) depending on the available rainfall (green water footprint). For crops the grey water footprint is the result of the amount of applied pesticides and fertilizers, mainly phosphorous and nitrogen. The water needed to bring the concentration of these pollutants back to good water quality (grey water footprint).


"The Water Footprint Assessment carried out for Kuyichi is an important step in advancing the understanding of how water footprint assessments can inform sustainability choices and improved reduction targets in water consumption for the textile and fashion sector. It sets the bar and shows other brands it IS possible to gain insight into the water use along their full supply chains. It starts with asking the right questions."
- Ioana Dobrescu
Water Footprint Implementation

JEANS
SUPPLY CHAIN

Above we show a simplified visualisation of a jeans supply chain. If you zoom in closer you would find that every step in this chain has multiple steps itself. Raw materials have very different origins and processes depending on the material type for instance and the dyeing can be done on yarn, fabric or even garment level, although for denim it's mostly done on yarn level. In the Cut-Make-Trim (CMT) you need many people in the production line, suppliers to make the buttons, rivets and zippers, or a different supplier to do an embroidery or printing. There's more to it than this chain shows

In this water footprint assessment, we've selected 3 jeans that we dive deeper into. We selected styles that differ in multiple ways from each other to give us diverse insights into our water footprint. All three styles are part of our core collection offer, already in our collection for over 3 years. They have compositions or fabrics that are used throughout the rest of our jeans portfolio as well. They're produced at Soorty Enterprises in Pakistan and SARP jeans in Turkey with denim fabrics from Bossa Denim from Turkey as well. They use different sourcing regions, dyes and technologies.

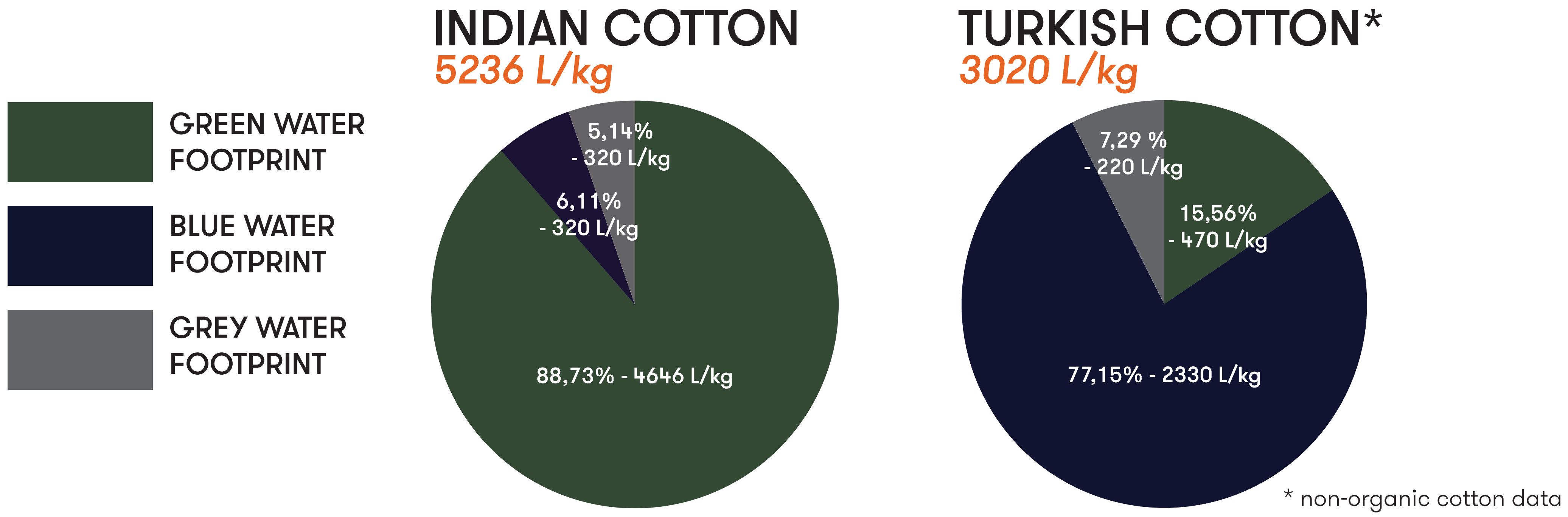
Excluded from the water footprint are overhead components like energy, transport, machinery production and drinking water. Also, we did not dive into the impact of our trims like buttons, sewing threads and hangtags. We also did not calculate the water footprint of transport or the consumer usage phase of our products.


NORA
VINTAGE BLACK
100% ORGANIC COTTON
MADE BY SOORTY
FABRIC BY SOORTY
INDIAN ORGANIC COTTON


AMY
DARK FADED
42% ORGANIC COTTON
45% MICRO-MODAL
10% T400 ECO-MADE
3% ELASTANE
MADE BY SOORTY
FABRIC BY SOORTY
INDIAN ORGANIC COTTON


NICK
CLASSIC BLUE
79% ORGANIC COTTON
20% RECYCLED DENIM
1% ELASTANE
MADE BY SARP
FABRIC BY BOSSA
TURKISH ORGANIC COTTON

WATER FOOTPRINT OF *ORGANIC COTTON*



ORGANIC VS. CONVENTIONAL COTTON

Kuyichi uses only GOTS certified organic cotton. The main differences between organic and traditional cotton lie in the farming management systems. Organic farming uses irrigation more seldom and uses no synthetic fertilisers or pesticides. Organic cotton does still use blue water for irrigation and has a grey water footprint, but it is often lower than conventional cotton. The pollutants from organic cotton are coming from the natural fertilisers used like compost and farm yard manure, mostly nitrogen which can do harm to freshwater ecosystems.

COTTON FROM INDIA

Our supplier Soorty in Pakistan sources our organic cotton mainly in India. The grey water footprint of the Indian organic cotton is taken from a study for C&A[2] for the region Gurajat and Madhya Pradesh with each 240 organic farms. It was this research that gave insights into the pollutants of organic farming. For the Blue and Green Water Footprints of organic cotton from the same states, we have used a similar research performed by WFN for C&A foundation from 2013[3]. The total water footprint of Indian cotton is 5236 L/kg (Green: 4646 L/kg, Blue: 320L/kg, Grey: 269,5 L/kg) for the growth of the cotton.

COTTON FROM TURKEY

The organic cotton for denim fabrics from our Turkish denim mill Bossa is traced back to the Soke region in Turkey. No region specific data could be found unfortunately. The water footprint of 3020 L/kg (Green: 470 L/kg, Blue: 2330 L/kg, Grey: 220 L/kg), was taken from the Water Footprint Assesment Tool[4]. This data is based on conventional cotton and for the reference period of 1997-2005, to get an accurate organic cotton water footprint of this area we should investigate further.

COTTON GINNING

The ginning process cleans the organic cotton and prepares it for spinning. The waterfootprint of ginning was taken from a research of Chico, D., et al., 2013[5] on Spanish jeans production and was set at 40 L/kg of blue water. This was only used to rehydrate dried out cotton to avoid fire risks.

ORGANIC COTTON SUPPLY CHAIN

WATER FOOTPRINT OF *RECYLED DENIM*

POST-CONSUMER RECYCLED DENIM

Kuyichi has used recycled denim in their jeans for years. The first jeans with post-consumer recycled denim was released in 2013 as part of the concept 'Deposit Denim'. Post-Consumer Recycled Denim or PCRD fibres are worn jeans that are turned into new fibres.

The collected denim are sorted based on quality and/or colour. All parts of the jeans with metal parts are cut off before the scraps are put into a shredder. This machine shreds it into smaller and smaller pieces until you have fluffy fibres left. The recycled denim fibres are really short and therefore can't be made into a strong new yarn. To make a strong new product, the recycled fibres are blended with virgin (organic) cotton fibres. This blend can be used to make a new yarn.

THE WATER FOOTPRINT OF RECYCLED DENIM

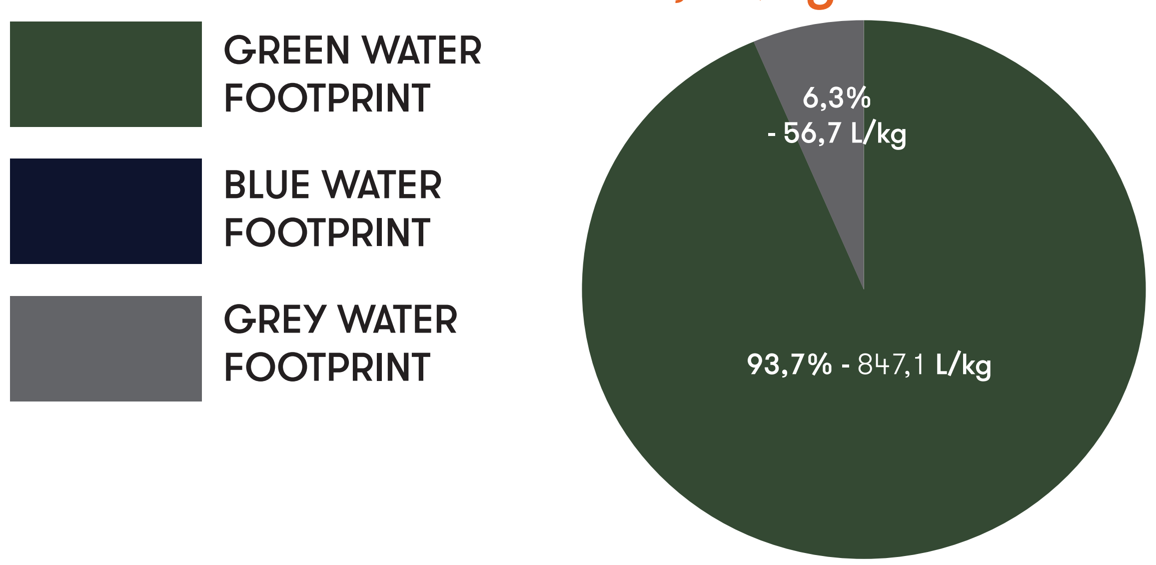
In the case of PCRD, there is no specific water use data that could be found. The mechanical recycling of denim does not involve a clear wet step and therefore we take that water use of recycled denim is minimal compared to the water use in growing cotton or producing virgin synthetic fibers. For the scope of this exercise, we take the Water Footprint of PCRD to be zero. However, the real water use will be higher.

The Water Footprint method looks at consumptive water use, which is different from LCA methods that often look at water withdrawal. For recycled cotton, we have found a value for water use equal to 635 L/kg in an LCA analysis performed by Wendin (2016)[6]. Amongst others, this research calculated the water use for the energy consumption and fuel of transport over sea. Which does not match the scope of this report. More research is needed into the recycling of materials to determine their actual water footprint.

RECYCLED DENIM SUPPLY CHAIN

WATER FOOTPRINT OF *LENZING™ MODAL MICRO*

MODAL MICRO
903,8 L/kg



LENZING™ MODAL MICRO

Lenzing is one of the leading sustainable manmade fibre producers. They make fibres from sustainably sourced wood and use a closed-loop system to produce the fibres. A water footprint assessment specifically for modal micro has not yet been carried out. However, water footprint calculations for the production of the similar fibre, TENCEL™ Lyocell from Lenzing, could be retrieved from Chico, D., et al., 2013[5]. Since the production of both fibres is close to each other we looked at the data of this research.

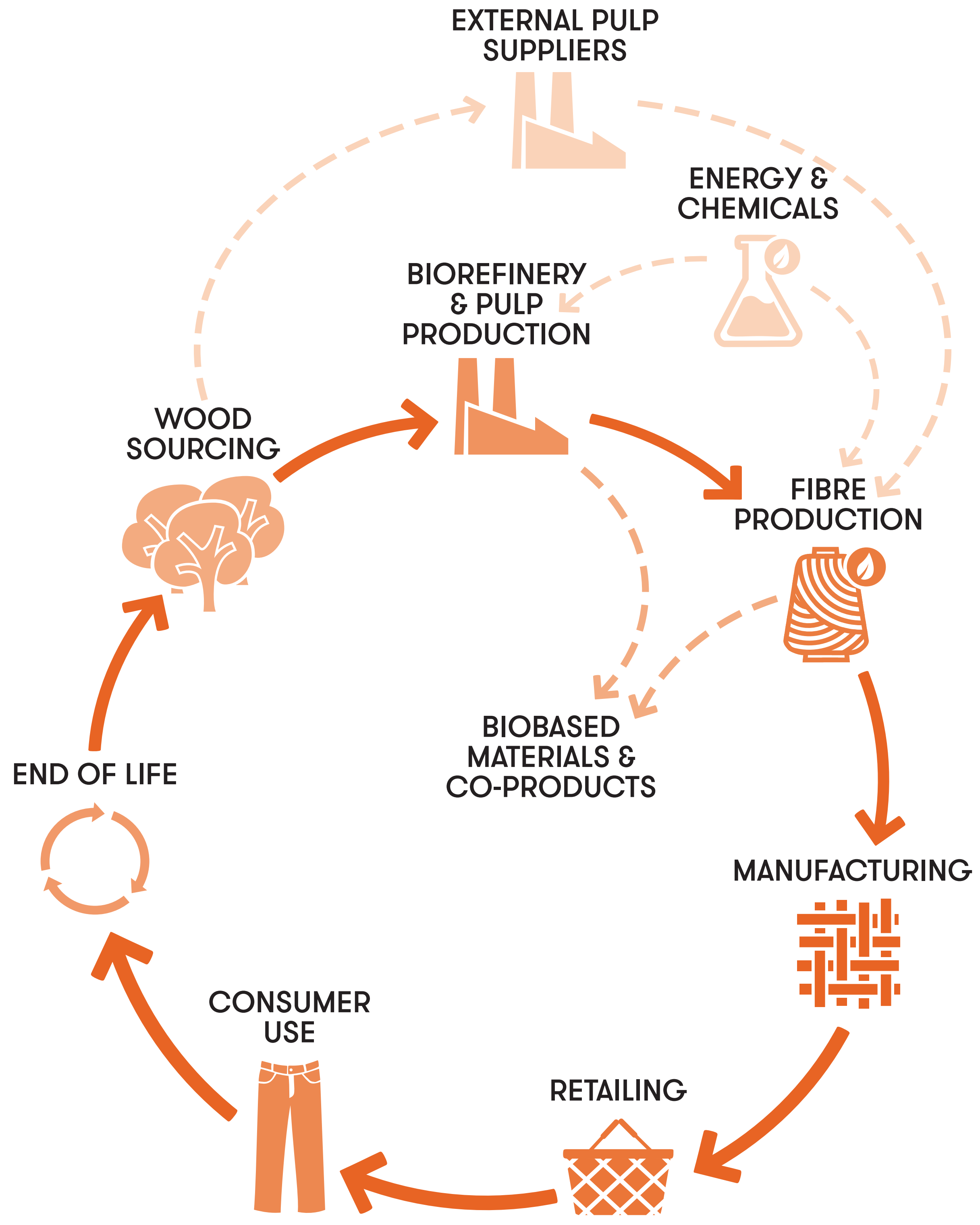
WOOD PRODUCTION

LENZING Micro Modal and TENCEL Lyocell are made from the natural material wood, beech wood mostly[7]. All wood that is used by Lenzing is sourced from sustainably managed forests mostly based in Europe. There is no irrigation or fertilisation taking place in the production of the wood. That means that wood has no blue or grey water footprint. It only has a green water footprint that is estimated to be 847,1 L/kg[7].

Manmade fibres are partially natural, made from wood, and partially not. The beech wood is turned into wood pulp, which is put in a solvent bath to transform into a honey like consistency. This is pushed through nozzles (super small holes) and spun into fillament fibres[8]. Lenzing combines the pulp and fibre production as much as possible to eliminate the drying and re-moisturing of the wood pulp and saving water. LENZING™ Modal Micro is made at Lenzing's Austrian facilities[9].

The water footprint of pulp and fibre production for Lyocell is 56.7 L/kg[5]. We use this data for the estimated water footprint of the Micro Modal since the process is quite similar. Micro Modal is made in a closed loop system and has good water treatment in place. The grey water footprint is therefore expected to be low. The data needed to calculate the grey water footprint was not available. The total water footprint of LENZING™ Modal Micro is approximately 903.8 L/kg in total (Green: 847,1 L/kg, Blue: 56,7 L/kg).

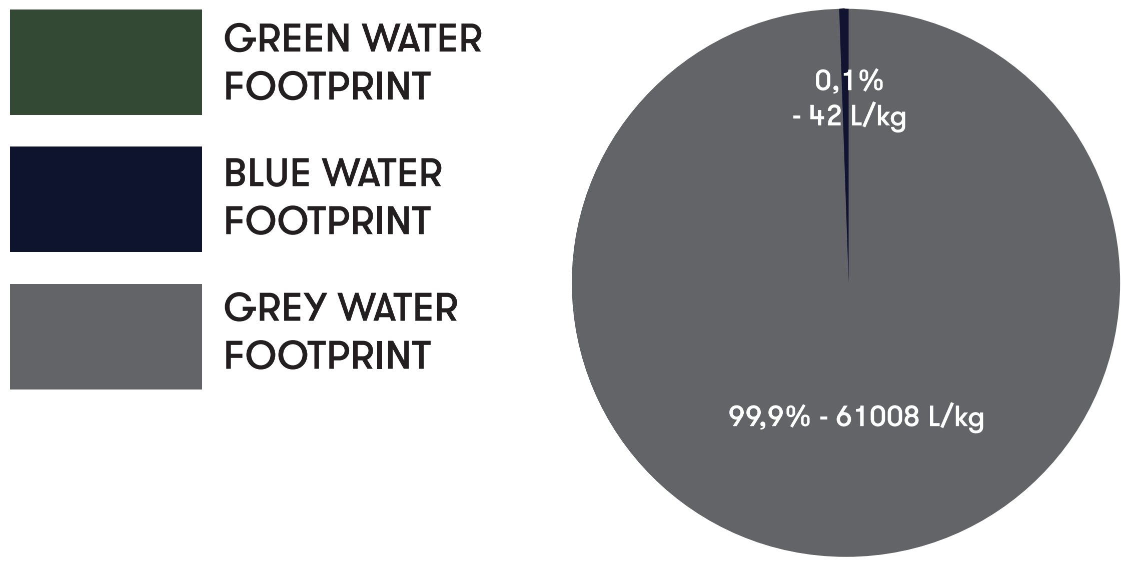
MICRO MODAL SUPPLY CHAIN*



* based on visual of LENZING

WATER FOOTPRINT OF *ELASTANE*

SYNTHETIC FIBRES
61.049 L/kg



ELASTANE VS. POLYESTER

Polyester and elastane are both synthetic fibres made from fossil oil. They have a slightly different production process, but a lot of similarities can be found. For example, both fibre monomers are produced from oil and transformed into polymers that are spun into yarn. 95% of elastane is made in a method called dry spinning, that goes through these steps in the polymerization and spinning process:

1. A prepolymer is made from oil products
2. The carbon chain is extended to make the polymer
3. The polymer is put into a solvent bath to thin the material
4. Filament fibres are made through a spinneret, a filter through which the polymer is pushed to create long fibres.
5. The fibres are heated and twisted into a yarn
6. Yarns are finished.

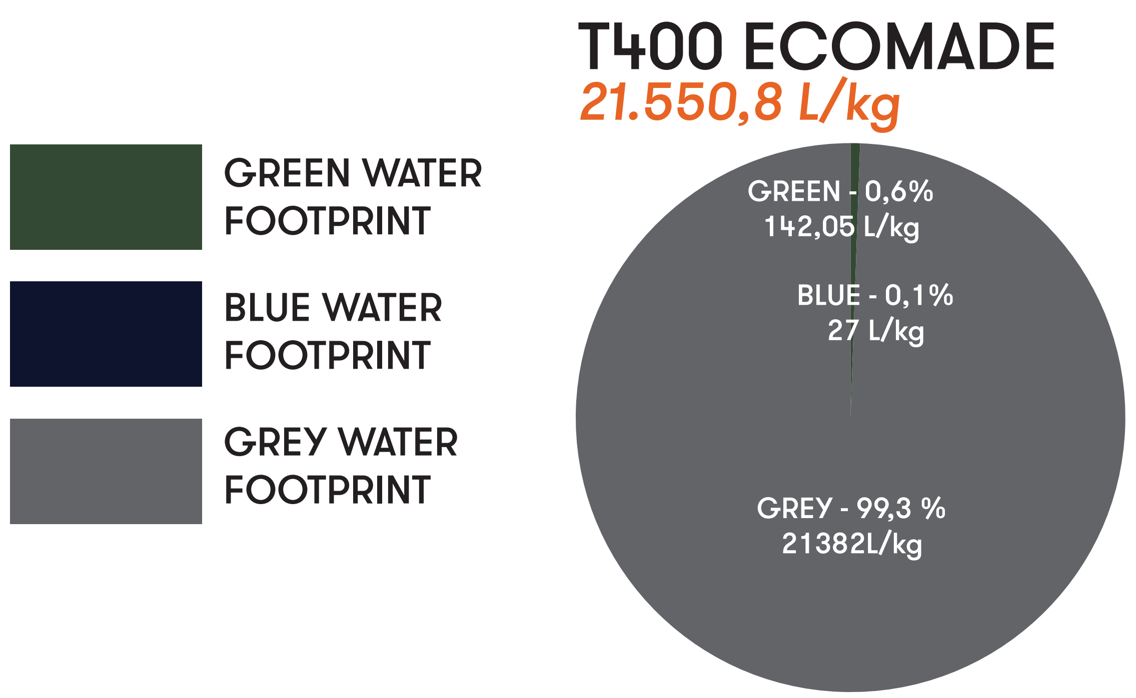
Since there are high similarities, we will use available data from polyester fibres for the water footprint from a Water Footprint Network C&A report[10.]

WATER FOOTPRINT OF VIRGIN SYNTHETICS

Synthetics do not have a green water footprint since no rainwater is used in synthetics production. The grey water footprint has the largest value and comes mostly from the oil exploration and refinery processes. The blue water footprint comes from the fibre production phases. Based on minimum and maximum values for both polyester filament yarns and staple fibres. The average of this data brings us a water footprint of 61.049 L/kg (Blue: 42 L/kg, Grey: 61.008 L/kg)[10].

SYNTHETICS SUPPLY CHAIN

WATER FOOTPRINT OF *T400 ECOMADE*



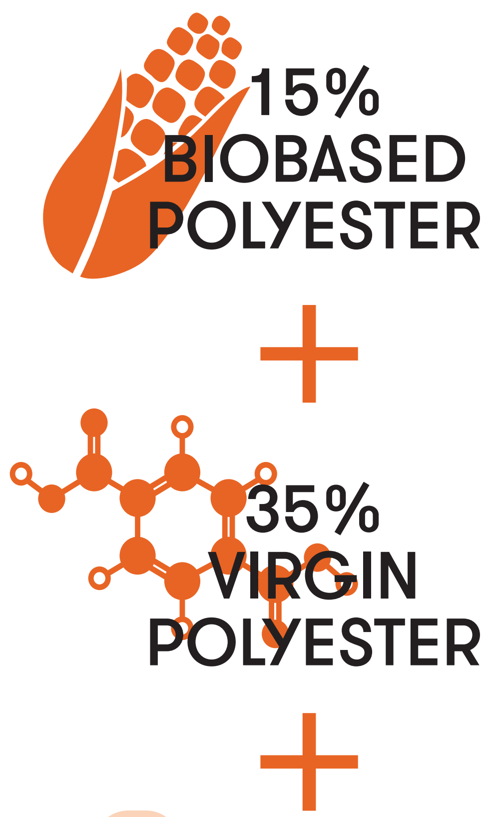
T400 ECOMADE

T400 Ecomade is a fibre made by Lycra consisting of a mix of virgin polyester, corn biobased material and recycled PET[11]. The Water Footprint of a kg of T400 Ecomade fibre was calculated using the water footprint of virgin polyester for 35% (see page 10), 50% water footprint of recycled PET and 15% the water footprint of corn production.

RECYCLED POLYESTER

There was no data available for the water footprint of recycled PET bottles. There is a washing phase in the recycling process of PET. We assume that the wastewater is treated according to standards and returned to the same catchment. In this case the WF of recycled PET is near zero. In some cases, the process water can be treated and reused within the washing steps of the recycling process[12], improving the process even more. The water footprint is assumed on 0 L/kg for this exercise, but the actual water footprint can be higher.

T400 ECOMADE SUPPLY CHAIN



BIOBASED POLYESTER

The biobased part is a polylactic acid made from corn starch. The corn starch is converted into sugar (dextrose) and then fermented into lactic acid. The fibre is both renewable and biodegradable. Since no water data on biobased polyester could be found, only the farming process of the corn is calculated and set on 1222 L/kg[13] (Green: 947 L/kg, Blue: 81 L/kg, Grey:194 L/kg)

TOTAL FOOTPRINT

If you calculate the water footprint per kilo in the weighted percentages of the T400 fibre you get a total water footprint of 21.550,45 L/kg of which 0 L for the recycled PET, 183,3 L for the biobased polyester and 21.376,15 L for the polyester (Green: 142.05 L/kg, Blue: 85 L/kg, Grey: 21381.9 L/kg).

WATER FOOTPRINT OF *PROCESSING*

For the water footprint of processing the raw materials into garments we took information from a previous LCA study[14] that was performed for Kuyichi. This LCA study was performed by Julie van Luit in 2020 and looked into the production process of two pairs of Kuyichi jeans based on data from Kuyichi suppliers. We use these values as an average of processing of Kuyichi denim. No grey water footprint values were calculated in processing, because of lack of data and since the suppliers use good wastewater treatment beyond local standards and in line with Zero Discharge of Hazardous Chemicals wastewater guidelines.

SPINNING

Spinning is the process of converting raw materials into a thread. The fibres are fed to a machine that spins it into a yarn. Each yarn can have different thicknesses and compositions.

The average value of the water footprint was calculated at 9,16 L per kg[14] of yarn. This amount can differ depending on thickness and composition as well.

DYEING

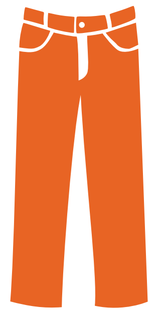
Denim is almost always yarn dyed; the yarn is dyed before it is woven. Bundles of yarn go through several (indigo) dyeing baths and are rinsed afterwards. It's a highly water and chemical intense process.

The waterfootprint of dyeing is estimated at 22 L per kg for dyeing. For the rinsing after dyeing 11 liter per kg. Totalling up to 33 L per kg[14] for the dyeing process.

WEAVING

The dyed yarn is woven into a denim fabric with a twill weave. Afterwards it goes through a fabric finishing process such as singeing, desizing, scouring and mercerization.

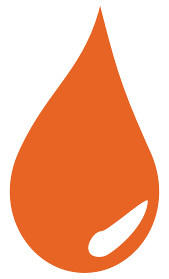
18 L per kg[14] is used in the weaving process of the fabric.



CUT-MAKE-TRIM

The denim fabric is cut into pattern pieces and sewn together by multiple people in the production line. The jeans is finished with buttons and other trims, but this is often done after washing.

In the CMT process there is fabric wasted. On average 16%, as taken from a research of Šajn, 2019[15]. To account for this waste 16% is added onto the finished jeans weight.



FINISHING

After the jeans is put together it is treated with several processes to get the 'worn-in' look. The washes are measured with the Environmental Impact Measurement tool of Jeanologia[16].

The EIM score gave us a water use of 7,5 L for Nora, 1,92 L for Amy and 24 L for Nick, compared to an average of 70L per jeans, as given by Jeanologia.

THE WATER FOOTPRINT OF *KUYICHI JEANS*

[(%composition*WFmaterial 1) + (%composition*WFmaterial 2) + (%composition*WFmaterial 3) + (%composition*WFmaterial 4) + WFspinning + WFweaving] * Weight (incl. 16% waste weight) + WFdyeing + WFwashing = Total WF

NORA VINTAGE BLACK - 3957,5 L

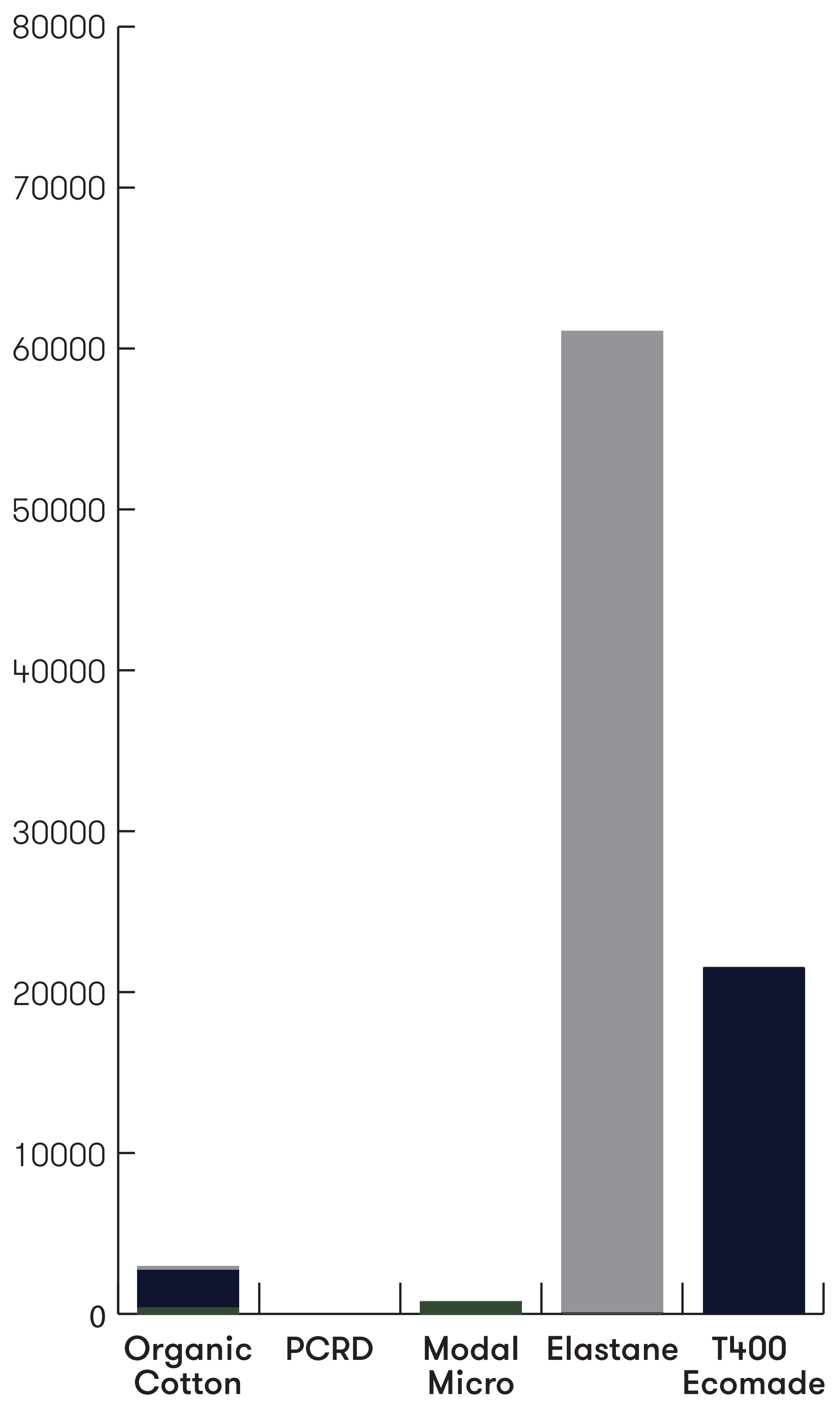
The Nora Vintage black is entirely made from organic cotton and made by Soorty. The product weight of Nora is 640 grams, and 742.4 grams if you count the 16% added weight for waste creation in the process. Nora's final Water Footprint amounts to approximately 3944.84. It directly becomes apparent that the biggest water footprint is due to raw materials, processes only account for 1-3% of the total footprint.

AMY DARK FADED - 4433,8 L

Amy is a denim that uses a blended fabric, made from both natural, man-made and synthetic materials. In the case of the Amy Dark Faded model, it is important to note that even though the use of T400EcoMade is a more sustainable alternative to elastane or pure polyester from both a carbon footprint and a water footprint perspective, it is interesting to see that it has a water footprint 4 to 25 times higher than cotton or modal. Using just 10% of T400 ecomade and 3% elastane, each contribute as much to the total WF as 42% organic cotton. Remarkable is the low water footprint of the Lenzing Modal. While it makes up 45% of the total model composition, it only contributes with 6% to the total water footprint.

NICK CLASSIC BLUE - 2671,0 L

Nick Classic Blue is made of one of our core fabrics, that we use in multiple denim styles. The Atlantico fabric, made by Bossa. The organic cotton is the big water user in this style. The elastane uses a lot of water in relation to the other fibres, since it accounts for 20% of the water use, while only accounting for 1% in composition. The actual water footprint of Nick Classic Blue will be slightly higher, since we could not find accurate information on the water footprint of recycled cotton.




NORA
VINTAGE BLACK
WEIGHT: 640 GRAM
+ CUTTING WASTE: 742 GRAM
3957,5 LITER
GREEN, BLUE & GREY WATER
GREY 5,1%
BLUE 6,1%
GREEN 88,7%
MATERIAL CONTRIBUTION TO FOOTPRINT
ORGANIC COTTON 100% - 3886,65 L
PROCESS CONTRIBUTION TO FOOTPRINT
PROCESSING 2%
RAW MATERIALS 98%
% OF TOTAL PROCESSES
FINISHING 18,5%
SPINNING 16,7%
WEAVING 32,9%
DYEING 31,9%
AMY
DARK FADED
WEIGHT: 574 GRAM
+ CUTTING WASTE: 666 GRAM
4433,8 LITER
GREEN, BLUE & GREY WATER
GREY 62,3%
GREEN 35,6%
BLUE 2,1%
MATERIAL CONTRIBUTION TO FOOTPRINT
ELASTANE 28% - 1219,5 L
ORGANIC COTTON 33% - 1475,3 L
MODAL MICRO 6% - 271,1 L
T400 ECOMADE 33% - 1434,9 L
PROCESS CONTRIBUTION TO FOOTPRINT
PROCESSING 1%
RAW MATERIALS 99%
% OF TOTAL PROCESSES
FINISHING 5,8%
SPINNING 18,5%
WEAVING 36,3%
DYEING 39,4%
NICK
CLASSIC BLUE
WEIGHT: 745 GRAM
+ CUTTING WASTE: 864 GRAM
2671,0 LITER*
GREEN, BLUE & GREY WATER*
GREEN 12,4 %
GREY 26,2%
BLUE 61,4 %
MATERIAL CONTRIBUTION TO FOOTPRINT*
ELASTANE 20% - 527,6 L
PCRD 0% - 0 L
ORGANIC COTTON* 80% - 2089.1 L
PROCESS CONTRIBUTION TO FOOTPRINT
PROCESSING 3%
RAW MATERIALS 97%
% OF TOTAL PROCESSES
SPINNING 12,8%
DYEING 21,1%
FINISHING 40,7%
WEAVING 25,4%
* BASED ON NON-ORGANIC

CONCLUSION
WHAT TO DO NOW?

The world average water footprint of a pair of jeans is estimated at 8000l/pair, considering the jeans weigh 800 grams and are made of 100% conventional cotton. The water footprint of cotton changes depending on the region, the growing conditions and farm management. We therefore see large differences in WF of a pair of jeans, depending on the cotton sourcing.

This report makes a couple of things clearer for us as a brand. First of all, our focus on materials, choosing organic and recycled fibres and favouring natural and man-made over synthetic clearly is a good choice when it comes to water use. The impact of synthetics on water have become even more clear to us. Not only do synthetic fibres carry the risk of microfibres ending up in our oceans, but they use and pollute a lot of water in the production process as well.

We'll continue to work on improving our material portfolio, focusing on more recycled and man-made fibres, while also increasing our insights in where our cotton is farmed and what that implies for the water footprint of the organic cotton. We'll discuss cotton sources with our fabric mills and check if we can get deeper insights in the actual water footprint at the farm level. This would allow us to work with the farm level supplier on further reducing the water use where possible.

The impact of garment processing is small in comparison to the water use of raw materials, but we do have to be cautious about the chemicals and water use in wet processing steps like dyeing and washing. Especially in the case of jeans, since indigo dyeing and the washing are known for their chemical impact. We are happy we work with suppliers that have already managed to reduce their water footprint in these stages and are pushing to reduce this even further.

We will both work on continuing to eliminate hazardous chemicals in these processes, using technologies that reduce water consumption (such as better dyeing techniques, laser, ozone and e-flow technology) and keep checking if the wastewater treatment at our suppliers is up to the standards. The collaboration with Water Footprint Implementation gave us deeper insights in water use throughout our supply chain and gives us new angles to look at this important part of reducing the total footprint of our pure goods. We're really happy with the insights we gained.

THANKS TO
AND LIMITATIONS

THANKS TO

Thanks to the extensive work of the Water Footprint Implementation team and in particular Ioana Dobrescu. They dug deep to find all the information that was needed to compose this report. We'd also like to thank the work of Julie van Luit for her thesis for Kuyichi in 2020. And last but not least, the people at our dear partners Bossa and Soorty who were willing to share their data with us to get deeper insights in our production chain.

LIMITATIONS

- Water footprint of cotton production in India comes from previous WFN research on organic cotton farms in two Indian states where organic farming is most prevalent. Kuyichi sources its cotton from a mix of organic farms across India and therefore the actual WF value could be slightly higher or lower, but not significantly so as the samples used in the WFN study are sufficiently representative.
- Water footprint of cotton production in Turkey is an average value for conventional cotton production with the reference period 1997-2005. The actual WF value of the cotton produced in the farms in Soke, where the farms supplying Kuyichi are located, could be lower or higher. To determine if the difference is significant, a further detailed assessment should be performed at farm level.
- Recycled materials (suc as the PET in the T400EcoMade and the PCRD) have here been assumed to have a WF equal to 0. Methodologically, the WF of a recycled material would include at least the water consumed in the recycling process. For recycled cotton, we have found a value for water use equal to 635 l/kg in an LCA analysis performed by Wendin (2016). However, this value expresses all water use and not consumptive use, and thus is not consistent with the WF method. It also looks at fuel production for transport, etc. More research is needed into the recycling of materials to determine their water footprint.
- The LCA data on the dyeing water use for the models Nora and Amy could not be timely retrieved. We did obtain a full water footprint of the processes combined which was close to the total of the processes which we obtained from Bossa. We have used in this case the same value as for Nick Classic Blue, which was retrieved via the supplier (Bossa).
- It should be noted that large differences could occur when applying the WF method and the LCA method for estimating water use. An earlier LCA that was performed on the Nick Classic Blue gave a lower water use value.

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