

Dirty Fashion

How pollution in the global textiles supply chain is making viscose toxic



Contents

Executive Summary	5
Part 1 - Introduction	9
Part 2 - Viscose: the first man-made fibre	11
Part 3 - The investigation	21
Infographic: Dirty factories: how viscose factories are creating toxic pollution	22
A. China	24
1. China's viscose industry	24
2. Government pollution regulations and the role of communities	24
3. Case studies	24
B. Indonesia	32
1. Indonesia's viscose industry	32
2. Government pollution regulations and the role of communities	33
3. Case studies	34
C. India	37
1. India's viscose industry	37
2. Government pollution regulations & the role of communities	37
Infographic: Which brands are buying dirty viscose?	38
3. Case study	40
Part 4 - Stamping out dirty viscose: transparency is a crucial first step towards action	47
A. The industry today	47
B. Brands and their supply chains	48
Infographic: Where do brands stand on viscose?	50
Infographic: Taking a closer look at brands' sustainability commitments	54
Part 5 - Conclusion & Recommendations	59



This report was written by Changing Markets in collaboration with researchers and NGOs in India, China and Indonesia.

Published in June 2017.
www.changingmarkets.org

Designed by Pietro Bruni - helloo.org

Bags of semi-processed viscose labelled 'Birla' scattered around a village adjacent to PT Indo Bharat Rayon and PT South Pacific Viscose factories, West Java

(Credit: Muhammad Fajar Fauzan)



Executive Summary

This report shines a spotlight on the environmental and human health impacts caused by the rapidly expanding viscose industry. It presents evidence from the top three viscose producing countries in Asia, showing how the environment, lives and livelihoods are being ruined by the dangerous chemicals and noxious gases its production generates. The report tracks the supply chain and establishes direct links between major European and North American brands and the polluting factories investigated.

Viscose, an increasingly popular man-made fibre, prized by high street brands and high-end designers alike, is not inherently unsustainable. However, when manufactured irresponsibly it can have a devastating impact on workers and people living in areas surrounding manufacturing plants.

As a plant-based fibre, viscose is sometimes presented as a 'green choice' for consumers but, as this report shows, most viscose on the market today is in fact produced using a highly chemical-intensive process. While much has been written about the problems caused by the production of cotton and oil-based synthetics, consumers are less aware of the negative impacts of the production of viscose and other semi-synthetic fibres, which are derived from the organic compound cellulose.

Cheap production, which is driven by the fast fashion industry, combined with lax enforcement of environmental regulations in China, India and Indonesia, is proving to be a toxic mix.

The investigation: Evidence and impacts of pollution from viscose manufacturing in Indonesia, China and India

In each of the countries we visited, we found clear evidence that viscose manufacturers are dumping untreated wastewater, which is contaminating local lakes and waterways. This pollution is having a devastating impact on local people's quality of life. In some areas we visited it is suspected to be behind the growing incidence of cancer, and villagers have stopped drinking the well water for fear of the effect it will have on their family's - particularly their children's - health. The factories are also destroying many traditional livelihoods, with local fishermen particularly badly impacted.

At factories in West Java operated by Indian conglomerate Aditya Birla and Austria's Lenzing Group, we found villagers doing the dirty work for manufacturers by washing intermediary viscose products in the Citarum river, directly exposing themselves to toxic chemicals contained in the fibre and adding to the river's already considerable pollution load. Our investigators were told that no one swims in the river anymore, as was once common. In one village they visited, viscose fibres were observed hanging out to dry and viscose waste littered the ground as far as the eye could see.

At production plants in the Chinese provinces of Hebei, Jiangxi and Shandong operated by viscose manufacturing giants including Sateri, Tangshan Sanyou and Shandong Helon, our investigators

found evidence of water and air pollution, worker fatalities and severe health impacts on local residents. In Jiangxi, they found evidence that the viscose industry has played a role in polluting Poyang Lake, turning the water black, killing fish and shrimps, and stunting crop growth. Poyang, China's largest freshwater lake, is already under serious threat from desertification. It's home to several critically endangered species, including the finless porpoise, and provides critical habitat for half a million migratory birds each year.¹

At a plant operated by Birla subsidiary Grasim Industries in Madhya Pradesh, our investigators discovered a close nexus between the local authorities and Grasim management which resulted in most violations not being reported. However, it has become clear that pollution from Grasim Industries - the only big industrial complex in Nagda - is a large source of pollution for the Chambal River, a key tributary to the sacred River Ganges. Downstream villages reported dark black water with streaks of red and an intense smell of rotting radishes coming from the plant, indicating the presence of carbon disulphide. The factory also dumps huge quantities of its viscose rejects on the bank of the river which are washed away into the river during monsoons. Families are suffering cases of cancer and birth deformities, as their groundwater and soil have been contaminated by industrial pollution. Upstream, investigators reported villagers protesting against the factory's building of a dam, which has caused flooding, and plans to raise the dam height by one metre, which would lead to the submergence of agricultural lands and homes along the bank.

Big fashion brands sourcing from polluting viscose factories

Through desk research and communication with clothing retailers, we were able to establish direct links between major European and North American brands and many of the polluting factories we investigated. We approached over 40 of the world's largest fashion brands and retailers directly to enquire about their viscose sourcing and manufacturing policies and the factories they are buying from. We received responses from a third of the brands and conducted our own research to fill in the gaps where information was lacking or incomplete. Many brands have no viscose-specific policies in place and a significant number of those who responded refused to reveal their suppliers.

Among the most transparent companies were Swedish clothing group H&M and Spanish giant Inditex (parent company of high street chain Zara), both of which disclosed supplier relationships

with a wide range of viscose manufacturers in China, India and Indonesia. H&M is buying directly from six polluting factories that we investigated in Indonesia and China and is also sourcing from two factories in India. Zara/Inditex is sourcing from three polluting companies in China and one in India. Online retailer ASOS is sourcing from two polluting companies in Indonesia and India, while Tesco and M&S said they were sourcing from most major viscose producers.

Owing to the persistent lack of transparency throughout fashion supply chains the information presented in this report is just the tip of the iceberg when it comes to understanding which brands are buying from polluting factories. Because the viscose industry is so highly concentrated, it is very likely that most brands source from several of the companies we investigated. It is only when more brands start to disclose the identity of factories at each stage of their supply chain that we will know the full story of where our viscose clothing comes from, and the full impact of our high street purchases on our shared environment.

While it is encouraging that brands such as H&M and Zara are following through on their commitment to transparency, this is only a first step in the journey towards a more environmentally and socially responsible fashion industry that truly embraces sustainability. In many cases the most transparent brands are also those in the fast fashion driving seat, pushing the environmental and social impacts of the fashion industry beyond what people or the planet can sustain.

The way forward: Putting pressure on viscose producers to clean up their act

The viscose industry is so concentrated, and the major fashion brands have such considerable purchasing power, that it would take relatively little effort to pressure irresponsible manufacturers to fall into line and clean up their act. With a small group of 10 companies controlling around 70 percent of global viscose production, there is a clear opportunity for rapid and transformational change across the sector. Some of these companies are already making progress, by discontinuing the use of wood pulp from unsustainable sources, such as highly biodiverse and ancient forests. However, the processing of that wood pulp into viscose staple fibre (VSF) and filament yarn remains a 'black box' about which little has been known so far.

Viscose is sometimes billed as being the 'fibre of the future', a good and sustainable replacement for cotton and synthetics. For this to be the case, the viscose industry has a huge task ahead

of it to clean up production. Better alternatives already exist, as viscose can be produced with a reduced amount of toxic chemicals and in a closed loop system which eliminates pollution. Global demand for viscose is growing in step with the unprecedented growth in demand for clothing worldwide, boosted by population growth and the emergence of middle class consumers in China and India. Soon we will need to clothe a global population of nine billion people and to do this in a more sustainable way, viscose production needs to become as green as it is advertised as being.

Brands can play a key role in this process by demanding that viscose companies clean up their act and by offering them support in transitioning towards more sustainable production processes. The good news is that some producers and brands are beginning to embrace innovative approaches to viscose production. These now need to be taken to scale and rolled out industry-wide. Big brands can play a key role in this process by wielding their enormous power to create lasting change.

All three children of Kallu Singh, a soya bean farmer who lives near Aditya Birla's viscose plant in Nagda, India, showed signs of mental and physical deterioration between the ages of 10 and 12. The family says the water is to blame.





Sulphur pollution in village adjacent to PT Indo Bharat Rayon and South Pacific Viscose factories in West Java, Indonesia.

(Credit: Muhammad Fajar Fauzan)

1. Introduction

If you're reading this report fully clothed, it's likely that at least one of your garments contains viscose, a man-made fibre first produced on an industrial scale at the end of the 1800s.

Viscose had its glory days in the early 20th century, when it was more commonly known as rayon. As a material, it was highly prized for its silk-like qualities, and was in fact often marketed as 'artificial silk'.

While modern fashion designers still value viscose for its comfort and 'drapability', and most consumers have a passing familiarity with it from reading their clothing labels, there is limited knowledge outside technical circles about how it is made.

Viscose is derived from cellulose, an organic compound which is the basic structural component of plant cell walls.² Cellulose can be modified chemically for the manufacture of a wide range of products including viscose, paper, plastics, and photographic film. These processes are heavily reliant on chemical inputs and can therefore be highly polluting, as described in detail in Chapter 2 of this report.

It's possible to make viscose from the cellulose of a wide range of different plant types, including bamboo and even the pith of citrus fruits. As described in Chapter 3, some companies are exploring the development of alternative fibre sources including the use of supply chain waste as an alternative raw material input. However, it is most commonly derived from wood pulp. Rainforest Action Network estimates that 120 million trees are logged every year to make our clothing.³

Because it is made from trees, and is therefore of 'natural' origin, viscose is categorised as a semi-synthetic fibre, which sets it

apart from fully synthetic fibres such as polyester and nylon, which are derived from petrochemicals (e.g. oil).

However, the 'green' label which fibre producers and clothes retailers routinely hang on viscose, is often very misleading and ignores the chemically intensive and highly polluting methods still used to manufacture this most versatile of materials.

Viscose has had a somewhat chequered history and while popular in the 1920s, it lost favour from the 1950s onwards as a result of the growing market share of synthetics. It was only in the latter part of the 20th century that a collapse in the market for wood pulp made it economically attractive to produce, and it started capturing designers' imaginations once again.⁴

Even during its heyday, viscose rayon had a terrible reputation for the severe human health impacts of the chemicals used to produce it, such as carbon disulphide. As Dr Paul Blanc describes in his meticulously researched history of viscose, *Fake Silk - The Lethal History Of Viscose Rayon*: "Throughout most of the twentieth century, viscose rayon manufacturing was inextricably linked to widespread, severe, and often lethal illnesses among those employed in making it."⁵

More recently, concerns about the devastating impact of wood pulp production on ancient and endangered forests have resulted in high-profile campaigns by North American NGOs Canopy Planet and Rainforest Action Network, calling for a crackdown on the use of trees from these sources, with some viscose producers making commitments to clean up their act.⁶ However, no one is holding the viscose industry to account on pollution from manufacturing. This report sets out to address this by describing the missing link in the viscose production process and exploring its severe impacts on human health and the environment.

2. Viscose: the first man-made fibre

Fast fashion: an industry losing its allure

The explosion of 'fast fashion' has transformed production processes and sent consumption rates off the charts. Whereas traditionally, fashion brands would release two new collections a year (Autumn/Winter and Spring/Summer), H&M now releases up to 16, while fast fashion behemoth Zara (Inditex) is capable of producing up to 20.⁷ A recent report from global supply chain firm Fung Group explored the rise of 'ultrafast fashion', with online retailers such as ASOS now boasting a production time of just two to four weeks from concept to consumer.⁸

The effect of this is dramatic in terms of the amount of waste generated, both at the production end, and at the 'post-consumer' stage. The relentless churning out of new clothing has also gone hand-in-hand with a drastic reduction in the quality and durability of products, which in turn makes re-use and recycling of used garments problematic.

The economic returns of fast fashion are staggering. According to Greenpeace, sales of clothing have nearly doubled from \$1 trillion in 2002 to \$1.8 trillion in 2015, projected to rise to \$2.1 trillion by 2025. The Guardian recently reported that the founder of Inditex and Europe's richest man, Amancio Ortega, has an estimated net worth of \$71.5bn. Only Microsoft's Bill Gates (\$86bn), investor Warren Buffett (\$78.3bn) and Amazon boss Jeff Bezos (\$73.4bn) are wealthier.⁹

To keep production costs down, the fashion sector has also pursued an aggressive strategy of outsourcing production from the rich countries of the Global North, to the less affluent, cheaper societies of the Global South, which offer poorly protected workers and lax environmental standards. The remorseless logic of fast fashion often places overwhelming pressure on companies in the developing world to produce faster and faster. As described here by Oxfam: "Buyers pressure factories to deliver quality products with ever-shorter lead times. Most factories just don't have the tools and expertise to manage this effectively, so they put the squeeze on the workers. It's the only margin they have to play with."¹⁰ Even the suppliers of haute couture have bought into this model, contrary to the belief that they are above the short-term thinking characteristic of fast fashion.¹¹

As a result of the globalisation of supply chains and pressure to produce clothes more rapidly and cheaply, traceability across the clothing industry is very poor – with brands often unable to provide the full picture when it comes to their supplier base. As explained in Chapter 3, this extends far beyond 'tier one' and 'tier two' suppliers, the identity of which some brands are now disclosing on a more systematic basis. In such an environment, consumers usually have no link back to the people who made their clothes, or the conditions under which they were manufactured.

This is why pressure groups and NGOs such as Fashion Revolution are increasingly calling for enhanced transparency and traceability throughout textiles supply chains. With transparency comes accountability and responsibility at the retailer end, and heightened consciousness on the part of consumers.

Viscose was the first ever man-made fibre, entering the market in the late 19th century. A highly versatile material, it is prized for its cotton- and silk-like qualities and has a wide range of applications ranging from the fashion industry to home furnishings and packaging. However, there is a dark side to its production. The toxic and endocrine-disrupting chemical carbon disulphide, still widely used in the production of viscose, has been linked to numerous severe health conditions, most notoriously its capacity to cause insanity in factory workers but also illnesses ranging from Parkinsonism to heart attack and stroke. Still in use today, alongside other toxic chemicals key to the process such as sulphuric acid, its continued presence in viscose manufacturing makes a mockery of those marketing it as a 'green' and sustainable fibre.

A. A short history of viscose production

Initially known as artificial silk or 'artsilk', viscose was developed in response to the demand for low-cost alternatives to silk. The word 'rayon' was coined in the 1920s as a marketing term. This innovative approach to textiles production was based on the use of a chemical process to transform cellulose into filaments that could be spun into a yarn and then manufactured in the same way as silk – but more cheaply.

Rayon cellulose can be made in several different ways, but viscose quickly won out as the dominant method of manufacturing. It was less explosive than a major competitor called nitrocellulose and cheaper to produce. Charles Frederick Cross, Edward John Bevan, and Clayton Beadle discovered the viscose process in the 1890s and patented the first viscose. The key ingredient in this production method was a highly toxic solvent called carbon disulphide, whose potential to cause harm and poisoning among workers was already known from its extensive use in the rubber industry.¹²

The first commercial viscose plants sprang up in the early 20th century in the United Kingdom (UK), the United States (US), France, Germany and Russia. Viscose was first commercialised as a filament for textiles, material for tyres and other rubber goods, as well as another lucrative product – cellophane. Only in the 1930s was its use extended to the production of staple fibre.^{13 14} This innovation converted long fibres into very short cut pieces, which made it possible to mix viscose with other fibres, such as cotton and wool, to produce blended woven and non-woven felt-like textiles for clothing.

Gradually, the damaging effects of viscose production on workers became more and more evident as cases of intoxication by carbon disulphide were more widely reported by researchers and clinicians in the UK, Italy, the US, and elsewhere. In the decades that followed, the hazardous technology of rayon production began to be offloaded, first from Japan to Korea, followed later by Europe to Indonesia, India and China. The late 20th century was marked by a trend of closure of older, less environmentally friendly, and less profitable plants across the UK, Europe and North America. At the same time, the industry experienced significant growth in Asia, which offered cheaper labour costs and looser environmental rules, perpetuating the chemically intensive production of viscose rayon.



In the first decade of the 21st century, China quadrupled its viscose production capacity, and now represents almost 66 percent of the global viscose market. India and Indonesia are the world's second and third largest producers.¹⁵ The industry also survived in Europe, where it is characterised by tighter manufacturing controls and new viscose production methods, which use a chemical alternative to carbon disulphide and bring manufacturing into a 'closed loop' so that the chemicals which are used do not escape into the environment and harm workers.

Despite the known hazards associated with the traditional viscose manufacturing process, today viscose is still branded as a renewable and eco-friendly fibre by many companies. It is largely used for clothing (53 percent), but also found in home textiles (21 percent), industry (20 percent) and medical textiles (6 percent).¹⁶ Some other ongoing uses include kitchen sponges, cellulose-based sausage casings, rayon-based bottle sealants, cellophane and tyres.

B. The viscose production process

Viscose fibre exists as viscose filament yarn and viscose staple fibre (VSF). Viscose filament yarn is a spun thread ready for weaving into textiles, while VSF can be blended with other fibres and twisted to form yarn for weaving. Staple fibre can also be used on its own or mixed for non-woven applications, ranging from sanitary and hygiene products to felt-like materials. Staple fibre represents more than 95 percent of the viscose market in comparison to the slim share of filament yarn (5 percent).¹⁷

The starting material for the production of viscose is cellulose, which can be obtained from a variety of trees (e.g. pine, spruce, beech, or hemlock), bamboo or even cotton linters (fine, short fibres that stick to the cotton seed after ginning).¹⁸ Given that the raw material comes from plants and is biodegradable, viscose is often marketed as a 'natural' or 'eco-friendly' fibre. However, the process of breaking down the cellulose to transform and regenerate it into viscose fibre is highly chemical and mechanical. Viscose is therefore referred to as regenerated or man-made cellulose fibre.

From pulp to viscose

In the first stage of the viscose process, cellulose is treated with sodium hydroxide, otherwise known as caustic soda (NaOH), to extract and purify the cellulose into sheets (alkali cellulose). The sheets are pressed, shredded and then broken into fluffy white flakes or grains known as cellulose crumbs. These crumbs are aged in metal containers for a couple of days under controlled conditions with appropriate temperature and humidity.¹⁹

After ageing, the cellulose crumbs are put in air-tight rotating drums, at which stage carbon disulphide (CS₂) is added to transform the purified cellulose into cellulose xanthate, which looks like a yellow crumb. After three hours, these crumbs are again dissolved in a weak solution of caustic soda to form a highly viscous liquid - viscose - which looks like honey, and is left to ripen for up to a day.

The liquid is then pumped through the numerous tiny holes of a 'spinneret' (similar to a shower head) into a chemical bath containing sulphuric acid (H₂SO₄), sodium sulphate (Na₂SO₄) and zinc sulphate (ZnSO₂). At this point a chemical reaction takes place in which the xanthate is reconverted again into cellulose, now in the form of fine regenerated cellulose filaments. This is the rayon fibre.

Through the chemical reaction in the spinning bath, carbon disulphide and hydrogen sulphide are released. Because carbon disulphide is quite volatile, unless aggressively captured for re-use, it escapes onto the factory floor, where it can be breathed in by workers, and then out into the atmosphere surrounding the factory.

After extrusion from the spinneret, the viscose rayon fibres are still very fragile. To make them stronger, they go through a drawing and stretching process, and then enter after-treatment, where they are desulphurised, bleached, washed, and dried.

The finished threads are wound onto bobbins if the final product is filament, while for staple fibre the threads are gathered together into a 'tow' and then pass through a chopping machine.

C. Environmental and health impacts of viscose production

Today the production of fibres using the viscose process still depends upon the use of toxic chemicals - namely carbon

disulphide, but also sodium hydroxide and sulphuric acid - to treat the cellulose wood pulp. These chemicals do not necessarily remain as residues on the final product. Therefore although viscose workers have long borne the burden of risk in making rayon, regenerated cellulose causes no direct harm to consumers.

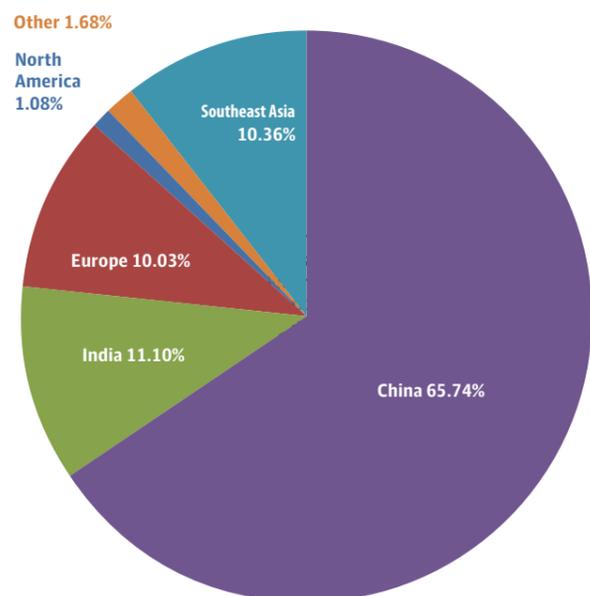
Environmental impacts of clothes manufacturing

Clothes manufacturing can be a very dirty business indeed. Pollution can occur at numerous stages in the supply chain, from the cultivation of cotton and wood to the processing of raw materials to extract fibres, and the dyeing and finishing (or 'wet processing') of fabrics before they are made up into finished garments. According to the World Bank, 20 percent of water pollution globally is caused by textile processing,²⁰ making it the second biggest polluter of freshwater resources on the planet. A full quarter of the chemicals produced in the world are used in textiles²¹ and it is also highly resource-intensive. From Greenpeace's Detox campaign²² to the investigations of China's Green Choice Apparel Supply Chain,²³ the textiles industry is increasingly coming under fire from campaigners for polluting waterways and blighting the lives of villagers in areas surrounding factories across Asia, where a significant share of clothes production now takes place.



However, the release of toxic substances at different stages throughout the production process has a significant impact on the environment around production sites, aquatic ecosystems, and the everyday life and health of communities living in the vicinity of viscose factories, and presents a significant reputational risk for viscose manufacturers.

Figure 1: Global viscose fibre capacity market share (%) by regions, 2016



Source: Global Viscose Fibre Market Research Report 2017, May 2017, OVR Chemical & Materials Research Center

D. The deadly chemicals

The most infamous toxin used in viscose production is **carbon disulphide**, a dense, highly volatile and inflammable liquid, which lies at the heart of the rayon manufacturing process.

Carbon disulphide is a powerful solvent, recognized for its potent and special toxicity.²⁴ Historically, exposure to this chemical has been linked with numerous serious health conditions, most notoriously with its capacity to cause insanity in factory workers. Scientific evidence also convincingly links occupational exposure to carbon disulphide at viscose rayon manufacturing plants with detrimental health impacts ranging from coronary heart disease at low exposure, to neurological, vascular and other effects on vision, at medium exposure. At chronic exposure over 10 to 15 years, these symptoms are accompanied by psychological and neurobehavioral disorders.

Workers exposed to high concentrations of carbon disulphide are known to suffer from neurological and psychiatric symptoms, such as anger, mood changes, hallucinations, paranoia, loss of appetite, gastrointestinal and sexual disorders.²⁵ Several reports further speak of reproductive effects, birth defects, leukaemia, chronic skin conditions,²⁶ kidney diseases,²⁷ and a correlation between carbon disulphide concentrations and the rate of miscarriages among female workers.²⁸

While maximum exposure levels have been drastically reduced in recent decades, there is evidence that even at low concentrations, carbon disulphide is still affecting workers' health. A study from 2005 conducted in a Belgian viscose rayon factory showed that even average exposure in line with national concentration standards causes tremors, finger tapping and Parkinsonism.²⁹

Workers at viscose factories are exposed to carbon disulphide mainly in the spinning department, when spinnerets are changed or adjusted, but also when the spun yarn is removed from the machine and transported to the after-treatment department.³⁰

During the spinning process, **hydrogen sulphide**, a highly toxic gas which can cause irritation of the eyes, function impairment and neurobehavioral changes is also generated as a by-product.³¹ Its presence can be recognised by its distinctive odour of rotten eggs, which often leads to complaints from people living near viscose plants. It has also been noted to cause sudden death in the workplace.³²

In addition to carbon disulphide, the viscose process requires a

large amount of **sodium hydroxide**, also known as caustic soda or lye (0.5-0.8 kg NaOH per kg fibre).³³ This chemical can be highly toxic if absorbed through inhalation, ingestion or skin contact. It is known to cause corrosion, skin burns and eye damage, and in the worst case scenario death for workers who handle it frequently and without protection.³⁴

The chemical bath to harden the viscose contains **sulphuric acid**. This clear, colourless, oily liquid is very corrosive and can result in adverse health effects from inhalation, such as a burning sensation, and shortness of breath. Evidence suggests that occupational exposure to sulphuric acid mists in combination with other acid mists can be carcinogenic.³⁵

For every kilogramme of viscose produced, about 20-30g of carbon disulphide and 4-6g of hydrogen sulphide are emitted. The ventilation discharge from viscose plants can reach several million m³ per hour, resulting in the contamination of factory surroundings with high concentrations of carbon disulphide and extending its detrimental impacts to local communities, which also suffer from related illnesses.³⁶

D.1 Water pollution

The viscose production process is carried out with strong alkaline or acidic water conditions, so poor treatment of wastewater can have a significant localised impact on water bodies such as lakes and rivers surrounding factories. Indeed, because water has been an important resource for viscose manufacturing, industrial facilities have typically been sited adjacent to rivers and linked to their pollution. In China, the total discharge of wastewater from viscose factories is about 100m³ per tonne for staple fibre and 300m³ per tonne for viscose filament.³⁷

Pollutants characteristically found in wastewater from viscose production are sulphuric acid, sulphates, sulphur and sulphides. There can also be some metals present, namely zinc salts (zinc sulphates and zinc sulfonate cellulose) because these can be additives in the viscose process. Inadequately treated wastewater can also contain a lot of organic material, which can lead to high levels of chemical oxygen demand (COD). High levels of COD mean less dissolved oxygen available for aquatic organisms, such as fish, resulting in their death.³⁸

These pollutants present a high hazard for acute aquatic toxicity, meaning a single exposure incident can result in severe biological harm or death to fish or other aquatic organisms.³⁹ This severely impacts wildlife as well as local communities' ability to access

The fashion industry's water footprint: addressing a major risk

According to the World Economic Forum, water crises are the biggest threat facing the planet over the coming decade. Nearly all of the world's most productive farm regions – California's Central Valley, the North China Plain, northern India, and America's Great Plains – are overdrawing their water assets.⁴¹ If current consumption and pollution trends continue, demand is expected to outstrip supply by 40 percent within 15 years, forcing governments to spend \$200 billion per year on upstream water supply.⁴² Agriculture and industrial uses of water are big contributors to both water consumption and water pollution, which is why water should be high on the agenda of major companies and investors.⁴³

According to the recent Pulse of the Fashion Industry report, the fashion sector is already a major water consumer with nearly 79 billion cubic metres per year – enough to fill nearly 32 million Olympic-size swimming pools – and its water use is set to increase by 50 percent by 2030.⁴⁴ Some of the world's main cotton-producing countries, as well as the countries where most textiles production and processing takes place, are located in areas that are already suffering from high or medium-to-high levels of water stress. Water should therefore be of critical importance to the fashion industry.

While a large share of fashion's water footprint comes from growing crops, around 14.4 percent of an apparel retailer's total water footprint relates to manufacturing. An estimated 17 to 20 percent of industrial water pollution comes from textile dyeing and treatment and an estimated 8,000 synthetic chemicals are used throughout the world to turn raw materials into textiles, many of which will be released into freshwater sources.⁴⁵ According to the Nordic Fashion Association, viscose, modal and lyocell fibres consume a significant amount of water during their industrial processing: between 100m³ per tonne for lyocell and up to 500m³ per tonne for viscose and modal.⁴⁶

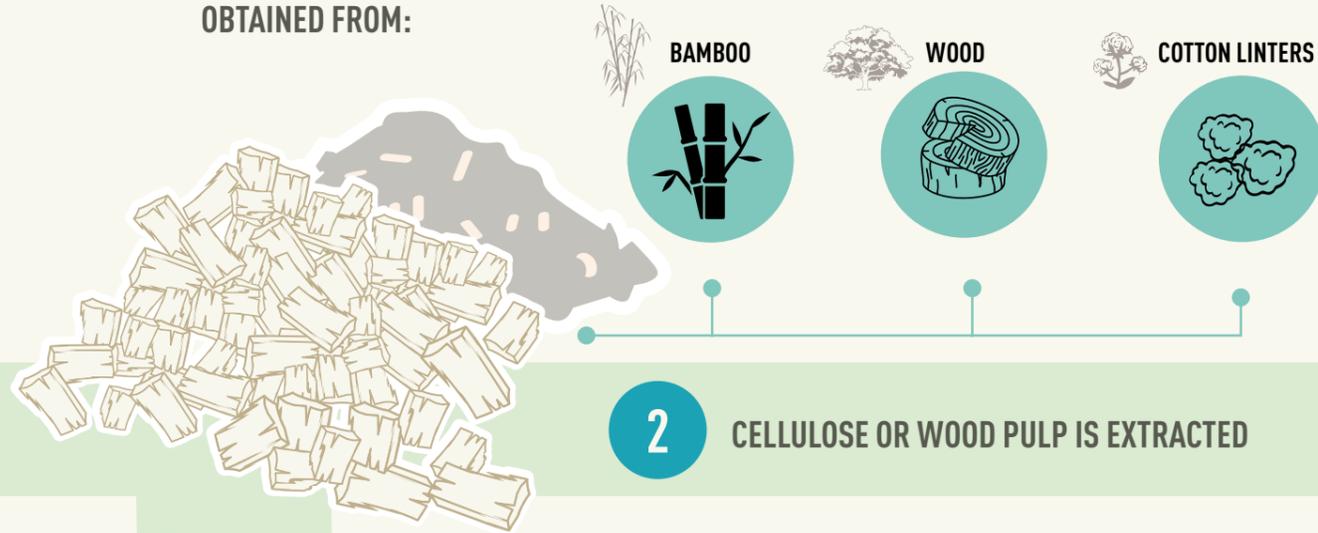
1kg of viscose production requires 640 litres of water.⁴⁷ However, this is still low in comparison to cotton. According to WWF, it can take 2,700 litres to produce the cotton needed to make a single t-shirt.⁴⁸ In addition, despite occupying only 2.4 percent of the world's cropland, cotton accounts for 24 percent of the world's insecticide use and 11 percent of all pesticides – toxic chemicals that get washed into waterways and enter ecosystems.⁴⁹ It is much more difficult to find information about the chemical impacts of the production of other fibres, such as viscose, or synthetic fibres, such as polyester.

On average, the global water footprint of a UK household's clothing exceeds 200,000 litres a year – enough to fill over 1,000 bathtubs to capacity.

Companies are starting to recognise that ignoring water issues presents significant risks to their business. For example, 68 percent of 174 companies listed on the FTSE Global 500 Equity Index have stated that water poses a substantive risk to their business, and many of them have already experienced the detrimental impacts of water shortages.⁵⁰ In 2011, for example, Gap was forced to cut its profit forecast by 22 percent after drought cut into the cotton crop in Texas.⁵¹ On the other hand, there is also increasing realisation that reducing water use and pollution presents significant opportunities for innovation. As one good example, Levi's recently worked with one of its Chinese suppliers to make 100,000 pairs of jeans using 100 percent recycled water.⁵²

VISCOSE PRODUCTION PROCESS

1 THE STARTING MATERIAL FOR THE PRODUCTION OF VISCOSE IS CELLULOSE, OBTAINED FROM:



3 VISCOSE PRODUCTION: VISCOSE IS PRODUCED BY PROCESSING PURIFIED CELLULOSE

A. CELLULOSE IS TREATED WITH SODIUM HYDROXIDE / CAUSTIC SODA (NaOH) to extract and purify the cellulose and form sheets of alkali cellulose.



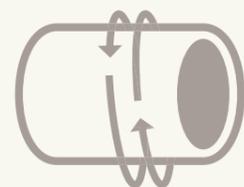
B. PRESSING, SHREDDING
Turns sheets into cellulose crumbs



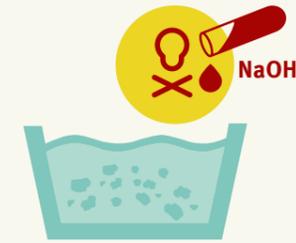
C. AGEING
These crumbs are aged in metal containers for a couple of days



D. XANTHATION:
Cellulose crumbs are placed in air-tight rotating drums and **CARBON DISULPHIDE (CS₂)** is added to transform the purified cellulose into cellulose xanthate, which looks like a yellow crumb.



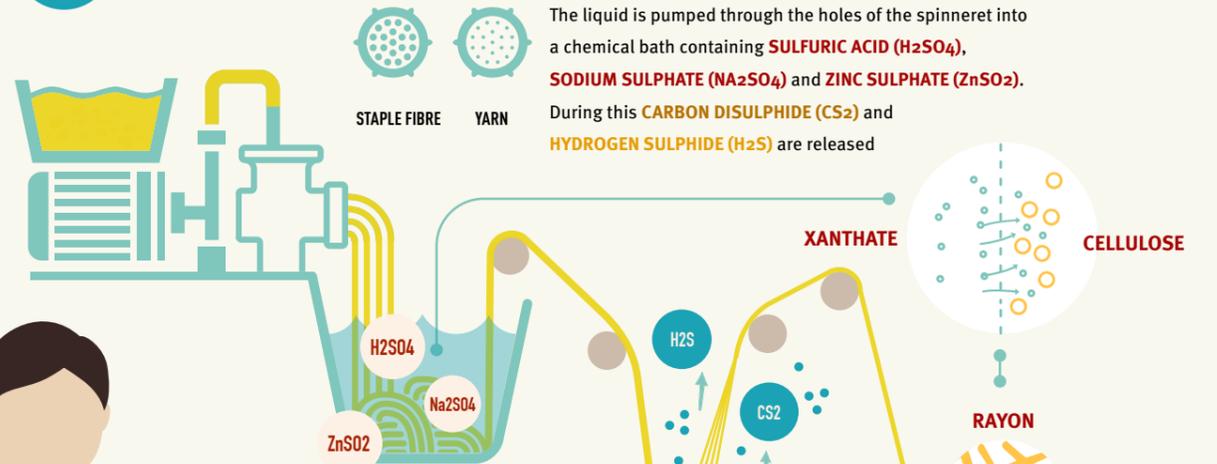
E. DISSOLVING:
Crumbs are again dissolved in a weak solution of **CAUSTIC SODA (NaOH)** to form a highly viscous liquid - viscose - which looks like honey



E. RIPENING PROCESS



4 WET SPINNING TO PRODUCE VISCOSE RAYON

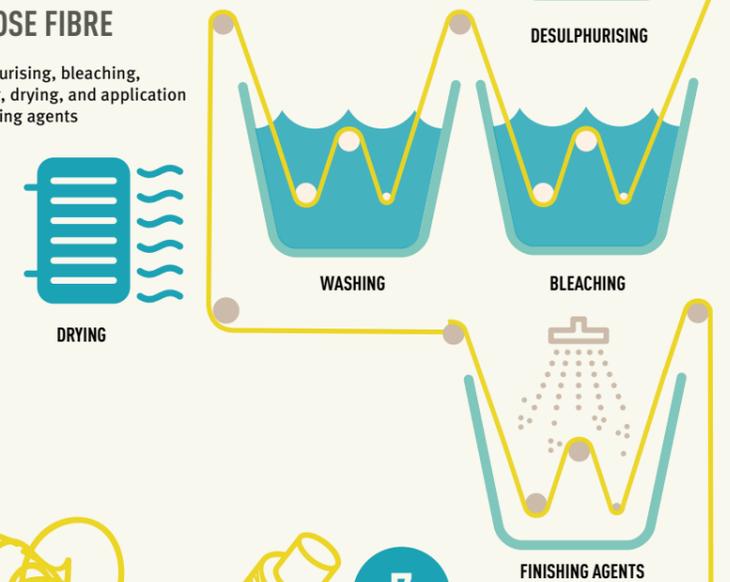


5 DRAWING TO MAKE FIBRES STRONGER

After extrusion from the spinneret, the viscose rayon fibres are still very fragile. To make them stronger, they are drawn and stretched

6 AFTER TREATMENT TO PRODUCE FINAL VISCOSE FIBRE

desulphurising, bleaching, washing, drying, and application of finishing agents



8



7

VISCOSE STAPLE FIBRE/FILAMENT YARN READY FOR USE

clean drinking water and earn a living from activities such as fishing or aquaculture.

To improve the effluent quality before it is discharged from viscose plants to the surrounding water, it needs to go through 'tertiary' treatment. This treatment includes the removal of zinc by the sedimentation method, removal of COD by the biochemical method, and ion exchange and electro-dialysis. Many viscose fibre factories in operation today, such as those in China, still only apply primary treatment, or in some cases secondary treatment,ⁱ with tertiary treatment still at an experimental stage.⁴⁰

D.2 Air pollution

The most commonly used viscose production method applies a spinnable solution with around 25 to 35 percent of carbon disulphide,⁵³ which means that a large amount of toxic and harmful carbon disulphide and hydrogen sulphide is released into the air during the transformation of wood pulp into viscose fibre. This pollution can be recognised by the distinctive smell of rotten eggs which it gives off. In light of carbon disulphide's extreme toxicity, the whole production process should be completely closed and the final product desulphurised, to prevent negative impacts. In reality, many plants fail to do this effectively and as a result, significant amounts of toxic chemicals end up in the immediate environment of viscose plants and nearby areas.⁵⁴

E. Viscose production through minimised chemical use

There are various types of man-made cellulose fibres on the market, namely, viscose, modal, lyocell, and cuprammonium (cupro), all of which use different technologies to 'regenerate' cellulose. The different methods of generating cellulose-based fibre vary in their use of chemicals and in their control of emissions, and therefore their potential adverse environmental and health impacts. Viscose is still the dominant production method and represents more than 70 percent of the global viscose market, with modal and lyocell respectively representing 19 percent and 9 percent.⁵⁵

A variant of the basic viscose process has been trademarked as 'Modal'. While the same chemicals are applied throughout the process, the modified chemical baths contribute to higher wet strength of modal fibres. Today, the viscose process can recycle

and reuse up to 70 percent of carbon disulphide, although that still means that 30 percent is lost to the ambient environment.

The only production method excluding carbon disulphide is called the 'lyocell' process, which uses wood (branded Tencel[®] by Lenzing) or bamboo (branded Monocel[®] by a Norwegian company of the same name). The lyocell process works in a 'closed loop', meaning that water and chemicals in the process are reused. It uses an organic solvent called N-methylmorpholine-N-oxide (NMMO) instead of sodium hydroxide (caustic soda) to dissolve pulp. Unfortunately, there is almost no human toxicity data available on NMMO.⁵⁶ In February 2017, Lenzing launched a new branded fibre - Refibra[™] - produced through the same lyocell process but made from cotton scraps and responsibly harvested wood.⁵⁷

Other types of man-made cellulose fibres include 'cuprammonium rayon (cupro)', which, while it avoids the use of carbon disulphide, still uses a chemically intensive process. It is still used to manufacture specialty rayon in Japan but has a tiny market share.

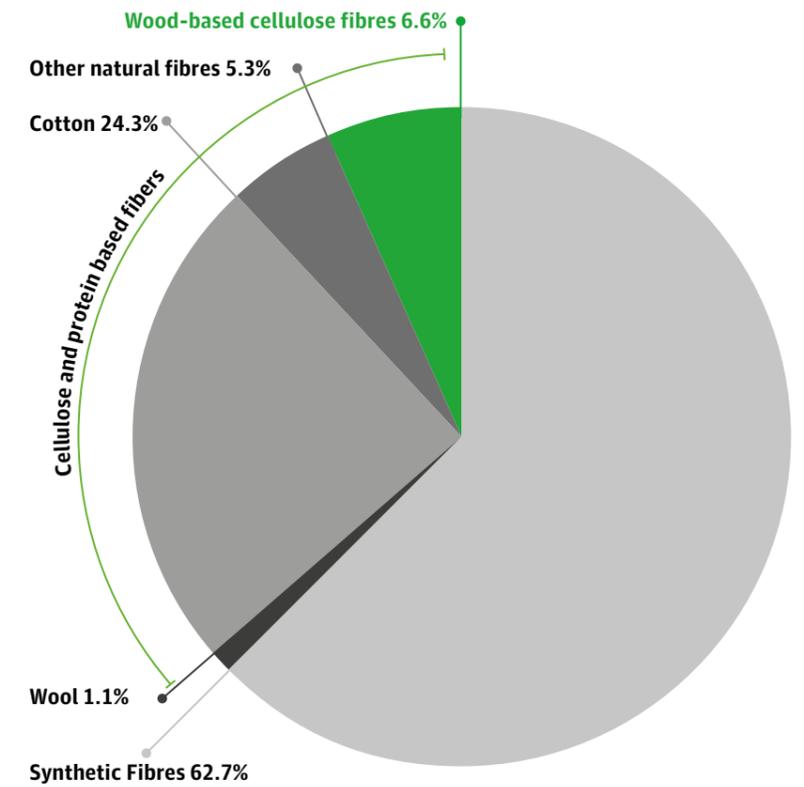
F. Current and future trends

In 2016, wood-based cellulose fibres represented 6.6 percent of the global fibre market. While that is a small percentage in comparison to the dominant synthetic fibres (62.7 percent) and cotton (24.3 percent), wood-based cellulose fibres continue to exhibit high growth rates.⁵⁸ By 2021, the global viscose staple fibre market is projected to grow from \$13.45 billion in 2016 to around \$16.78 billion per year,⁵⁹ representing a compound annual growth rate of 4.64 percent.⁶⁰

Figure 3 projects global fibre demand out to 2030. According to Textile World, cellulose fibre has made a surprising recovery after a decline in production in the 1990s. Much of this increased demand has come from China where cellulosic staple mill production in 2000 totalled 0.6 million tonnes, and in 2014 reached 3 million tonnes.⁶¹ Production in China has since increased to approximately 3.5 million tonnes across 21 viscose fibre manufacturers. This has contributed to overall production costs coming down. The Chinese government is supportive of the country's burgeoning viscose industry. Another driving force has been the push for diversification among the forest producing countries. For example, the Swedish forest industry faces new challenges originating from declining demand for printing paper and growing global competition among producers. The Research Institutes of Sweden

(RISE) highlight how new value-added products are needed for the Swedish forestry industry to stay competitive and claim that sustainable 'forest-based' textiles are a great example of such products. Support for this move has come in the form of research projects such as Swedish research group Swerea's initiative on sustainable cellulose-based textiles.⁶²

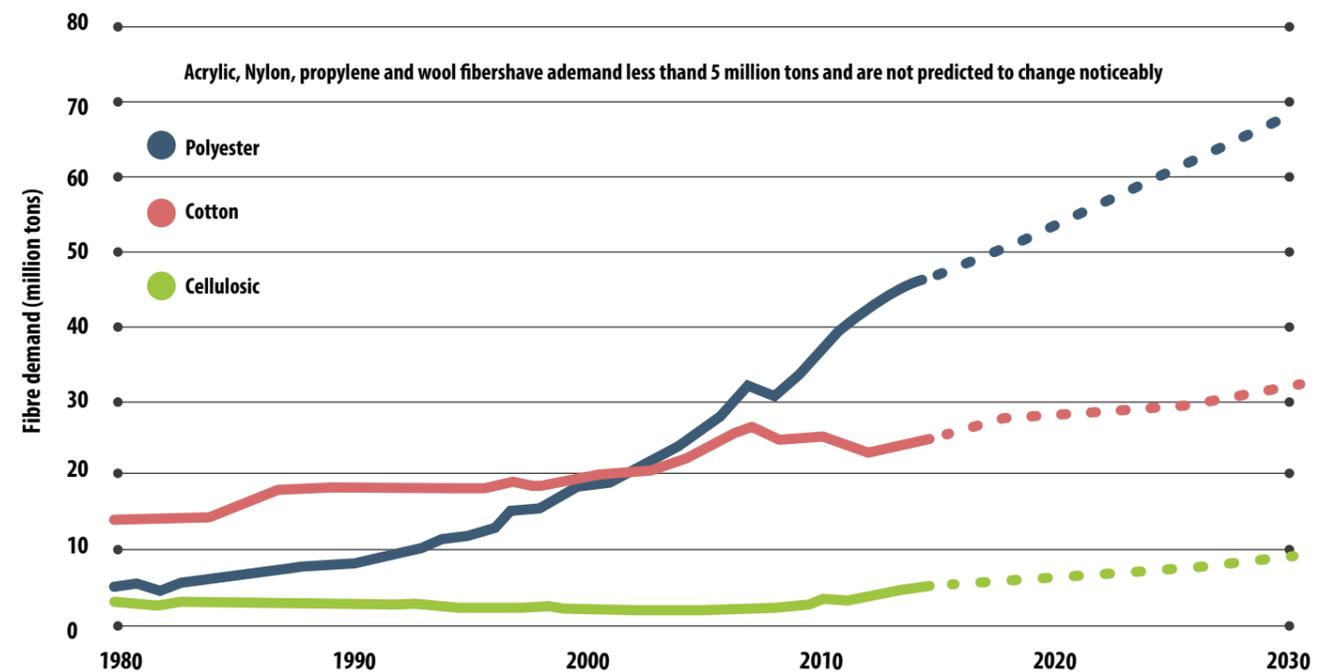
Figure 2: Global fibre consumption in 2016 by type of fibre. Source: Lenzing



Source: ICAC, CIRFS, TFY, FEB, Lenzing Estimates

Figure 3: Global Fibre Demand

Source: Textile World



i - Primary treatment is used to remove heavy solids that settle to the bottom and skim off grease and oils rising to the surface. Secondary treatment uses a biological process to remove dissolved and suspended organic compounds in the sewage. Tertiary treatment is the final cleaning process that improves wastewater quality before it is discharged, by removing remaining inorganic compounds and substances.

3. The investigation



China, India and Southeast Asia (notably Indonesia) together account for over 83 percent of global viscose fibre production. They are home to plants operated by the world's largest viscose manufacturers which supply fibre and yarn to global retailers and fashion brands including H&M and Zara. On-the-ground investigations in China, Indonesia and India in spring 2017 provided clear evidence of severe pollution near manufacturing sites operated by some of these producers, including the Aditya Birla Group, Tangshan Sanyou, Sateri, Shandong Helon and Lenzing. This pollution affects both air quality and water supplies, damages ecosystems, creates a hazardous working environment for factory employees and makes living conditions for communities living near the factories toxic. Despite constant appeals from local people, measures taken to address these issues have either been poorly implemented and audited or played down due to corruption. Until now, it has only been seen as a local pollution problem without any accountability being extended to the corporate clients of these polluting factories.

Aim and methods of the investigation

The investigation focused on large manufacturers,ⁱ whose poor environmental performance had already been reported in the national media or sanctioned by government authorities.

During the initial research phase, we gathered secondary evidence on pollution at these sites through an in-depth review of media reports, government announcements and penalties, and by examining national regulations in China, Indonesia and India on industrial pollution and pollution in the textile industry. We also spoke to local NGOs to understand the key problems and challenges facing people on the ground and to narrow down the focus of our research. Primary evidence was obtained through an on-the-ground investigation during March, April and May 2017. Our investigators visited 10 manufacturing sites in total:

China

1. **Jiujiang Jinyuan Chemical Fiber Co., Ltd.**, Jiujiang, Jiangxi province
2. **Sateri (Jiangxi) Chemical Fiber Co., Ltd.**, Gutang Town, Jiangxi province
3. **Sateri (Jiujiang) Fiber Co., Ltd.**, Hukou County, Jiangxi Province
4. **Tangshan Sanyou Group Xingda Chemical Fiber Co., Ltd.**, Tangshan City, Hebei Province
5. **Tangshan Sanyou Group Yuanda Chemical Fiber Co., Ltd.**, Tangshan City, Hebei Province
6. **Shandong CHTC Helon Co., Ltd.**, Weifang, Shandong province
7. **Shandong Silver Hawk Chemical Fiber Co., Ltd.**, Gaomi City, Shandong province

ⁱ - Manufacturers with more than 150,000 tonnes output of viscose fibre.

Left: Taking water samples from a ditch on the north side of the Shandong Helon Chemical Fiber plant

DIRTY FACTORIES

Our investigation showed clear evidence of severe pollution at manufacturing sites operated by some of the world's top global viscose producers. From contaminated waterways to air pollution exceeding national safety limits, irresponsible viscose production is impacting on thousands of people's health, livelihoods and lives.



Air pollution detected



Polluted water



Factory suspected of dumping untreated wastewater



Public health impacts



Accidents



Fish/food chains affected

01 PT INDO BHARAT RAYON (ADITYA BIRLA GROUP)
The largest viscose factory in Indonesia, and the second largest in the world. The plant is located near Purwakarta City, directly adjacent to the Citarum River. Our investigation found bags of semi-processed viscose scattered around the village and heard that residents regularly fall sick because of the pollution. Villagers were found separating, washing, hanging, and gathering viscose without protective gear.

02 PT SOUTH PACIFIC VISCOSE (LENZING)
Also located near Purwakarta City, next to the Citarum River. In 2016, more than 40 residents living near the PT South Pacific Viscose factory fell ill after a leak from the plant exposed them to sulphuric acid. Our investigation found no evidence that any precautionary measures have been taken by the factory since the poisoning incident. Open bags of viscose fibres labelled South Pacific Viscose were found throughout the village.

03 JIUJIANG JINYUAN CHEMICAL FIBER CO., LTD.
Located in Gutang Town, Jiangxi Province, close to China's largest freshwater lake, Poyang Lake. Has been fined for a series of environmental misdemeanors; our investigation identified buried discharge pipes near the factory and a big outfall pipe directly into Poyang lake. Water sampling found that the effluent from these pipes was acid, and that total zinc content was over 10 times higher than the permitted limit. Local residents told us that this has a severe impact on fishing.

04 SATERI (JIANGXI) CHEMICAL FIBER CO., LTD.
Also located in Gutang Town, Jiangxi Province. Our investigation found evidence that the plant has been discharging industrial effluent into Poyang Lake. Air tests revealed that the hydrogen sulphide level downwind of the factory was over 12 times the limit.

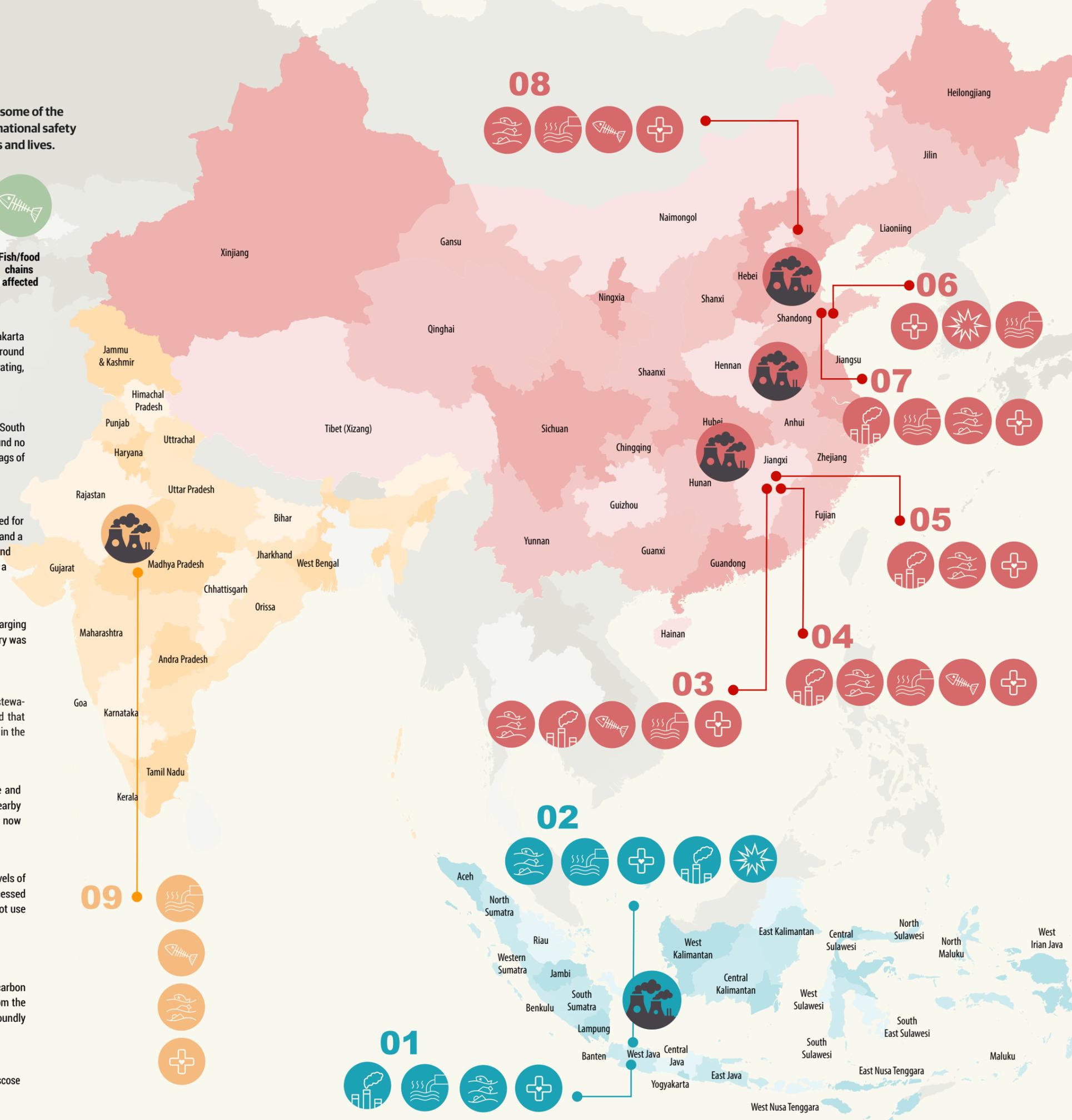
05 SATERI (JIUJIANG) CHEMICAL FIBER CO., LTD
Situated in Jinshawan Industrial Zone, Jiangxi Province. The factory has been fined for illicitly discharging wastewater, mostly at night. Effluent from the plant is discharged into the Yangtze River. The investigation revealed that villagers suffer from a non-stop and sickening smell of rotten eggs. Drinking water from a restaurant situated in the industrial zone exceeded the COD limit.

06 SHANDONG CHTC HELON CO., LTD. (HENGtian HAILONG)
Located in Weifang City Hanting Economic Development Zone near an irrigation channel feeding the Weihe and Bailang Rivers. Air pollution caused by the plant has been a problem for the past decade; we found that in a nearby residential area carbon disulphide levels were three times higher than the limit; water from the village well is now undrinkable due to pollution.

07 SHANDONG SILVER HAWK CHEMICAL FIBER CO., LTD
There are many villages surrounding the industrial zone where this plant is located. Our investigation found levels of hydrogen sulphide in breach of the permitted limit. Villagers testified that the plant secretly discharges unprocessed wastewater into the Beijiao Xinhe River at night. The groundwater has become poisonous, and villagers do not use the local well for drinking or for irrigation.

08 SANYOU CHEMICAL FIBER (TANGSHAN SANYOU GROUP XINGDA CHEMICAL FIBER CO., TANGSHAN SANYOU GROUP YUANDA CHEMICAL FIBRE CO., LTD.)
Located in Caofeidian Nanbao Development Zone, Tangshan City, in Hebei Province. We found that the level of carbon disulphide in the residential area was over the permitted limit. The COD level of residential drinking water from the Heiyanzi River also exceeded the limit. Locals complained that arrival of Sanyou group in the area profoundly disturbed the fisheries.

09 GRASIM INDUSTRIES (ADITYA BIRLA GROUP)
Located in Nagda, Madhya Pradesh. We found evidence of the factory discharging toxic wastewater and dumping viscose in the surrounding area. Groundwater and soil were contaminated by industrial pollution.



Indonesia:

8. **PT Indo Bharat Rayon (Aditya Birla Group)**, Purwakarta Regency, West Java
9. **PT South Pacific Viscose (Lenzing Group)**, Purwakarta Regency, West Java

India:

10. **Grasim Industries, Staple Fiber Division (Aditya Birla Group)**, Nagda in Madhya Pradesh

The aim of the investigation was to collect information on how these plants are affecting their surrounding environment and local residents. The investigation teams observed conditions around the factories, and in residential areas with a focus on air and water pollution, and looked for possible hidden pipes and wastewater outfalls. Investigators in China conducted quick testsⁱⁱ to gauge water and air quality. In all three countries, investigators engaged with local people to gain a better understanding of living conditions around the plants and their historical environmental performance.

A. China

1. China's viscose industry

The Chinese viscose industry, which accounted for just 8 percent of total global capacity in the 1990s, has witnessed remarkable growth over the past two decades, spurred on by declining production in the West, support from the Chinese government, cheap labour and lower environmental standards.⁶³

Today, China is the world's largest manufacturer and consumer of viscose fibre, representing more than 65 percent of global viscose fibre production. China's annual viscose output is expected to grow further, from 3.511 million tonnes in 2016 to 4.430 million tonnes in 2022.⁶⁴

Currently, there are 21 viscose fibre manufacturers in China, 19 of which produce staple fibre. Most of the companies are located in eastern coastal areas and Xinjiang Province, in the country's northwest.⁶⁵

2. Government pollution regulations & the role of communities

In recent years, Chinese viscose manufacturers have repeatedly hit the headlines for breaking pollution laws. In response, law enforcement efforts have been intensified and companies have been fined or in some cases shut down to make mandated improvements. However, manufacturers have become adept at polluting covertly, often under the cover of darkness, making it much more challenging for the environmental authorities to act. Strict security measures around some plants have impeded journalists and activists from documenting the effects of pollution. What's more, in many cases, corruption makes local government officials turn a blind eye to illegal industrial activities.

This situation is made worse by weak community power. Because factories bring jobs and money to the local economy, most residents tolerate or even welcome highly polluting industries at the expense of their health, and the quality of their air and water supplies. For example, most of the residents of the Nanbao Development Zone in Tangshan (Hebei Province) approve the presence of the Sanyou Group on the basis of its economic contribution and do not take the resultant pollution seriously. As a staff member stated: "It is the law of human development, we pollute, we develop, and then we clear up pollution."

That said, every industrial zone we visited has given rise to complaints from nearby residents. However, owing to past experience, most residents feel quite pessimistic about achieving much change.

3. Case studies

1. Jiujiang Jinyuan Chemical Fiber Co., Ltd.

Jiujiang Jinyuan Chemical Fiber Co., Ltd. is a large chemical fibre production site in China. Originally a state-owned plant, there are many dormitories for its workers in the surrounding neighbourhoods.

The plant is located in Gutang Town, Jiujiang City, Jiangxi Province, on the east side of Lushan Mountain and close to China's largest fresh lake - Poyang Lake - where it discharges its wastewater. It was just a small town until the arrival of numerous factories whose presence has permanently changed

the local environment.

1.1. Past scandals

In successive incidents between 2011 and 2016, a number of media outlets reported that Jinyuan Chemical was discharging green wastewater into Poyang Lake. The effluent affected local rice paddies and drinking water and emitted a deeply unpleasant odour.⁶⁶ After media exposure, the company was fined and ordered to suspend production to make mandated improvements.^{67 68 69 70 71}

In September 2015, the plant was ordered to make improvements to its environmental management system when it was found to be emitting hydrogen sulphide and improperly treating and disposing of wastewater.^{72 73} In 2016, the local Environmental Protection Bureau fined Jinyuan Chemical after the company was found in breach of the permitted limit for hydrogen sulphide.⁷⁴

In October 2016, a worker was poisoned and killed in a production accident at the factory. According to local sources, the worker was first poisoned in 2015 by hydrogen sulphide. In 2016, when he was poisoned for the second time, he died. This incident

resulted in the shutdown of the company's viscose staple fibre (VSF) production line. An employee revealed that according to a company announcement, production would remain suspended. However, when our investigators tested waste outfalls near the plant, they found excessive concentrations of the heavy metal zinc, which suggests the line has been operating secretly.

1.2. Current impacts

Polluted water: Some workers admitted that sewage from their plant was directly discharged into Poyang Lake without any processing. Our investigators subsequently identified a number of buried discharge pipes near the factory and a big outfall pipe into Poyang lake. The sampling results revealed that the water flowing from the buried discharge pipes was acid and that total zinc content was over ten times higher than the permitted limit.ⁱⁱⁱ

Increasingly poor air quality: Investigators experienced first-hand the chemical stench emitted by the plant, and villagers living near the plant testified that it is hard to live with the non-stop air pollution. Our investigation revealed that in the quarterly data published by Jiujiang City Environmental Protection Bureau, the only air pollutants tested are sulphur

iii - Chinese Integrated Wastewater Discharge Standards GB8978-1996



ii - Tools used in the investigation included: GASTEC hydrogen sulphide detector tube, GASTEC carbon disulphide detector tube, pH paper, Kyoritsu Zinc test tube, Kyoritsu Ammonia Nitrogen test tube, TDS Meter, Macherey-Nagel, and water hardness test strips

dioxide, nitrogen oxides and the density of smoke using the Ringelmann scale. However, the most dangerous air pollutants in viscose fibre production, hydrogen sulphide and carbon disulphide, are not included.⁷⁵

Affected Fisheries: Local people claimed that the pollution has done great harm to the quality of fishery products and that fishermen no longer come here. They complained that due to sewage discharged by chemical plants, fish and shrimps struggle to survive in the polluted Poyang Lake, with one resident stating: *“Even if you are lucky to catch any, they die pretty quickly afterwards.”* Our investigators heard that these dead shrimps and fish can't even be used as pig feed.

2. Sateri (Jiangxi) Chemical Fiber Co., Ltd.

Sateri Holdings Limited is one of the largest speciality cellulose producers in the world. Its Jiangxi plant is owned by Royal Golden Eagle (RGE) International, which is based in Singapore and owned by Indonesian billionaire Sukanto Tanoto. Another subsidiary of the RGE group, APRIL, which is Indonesia's second largest pulp and paper company, has also come under attack from the international community for clearcutting thousands of hectares of rainforest to feed its pulp mills.⁷⁶

Sateri (Jiangxi) Chemical Fiber is located close to the Lushan mountain in Gutang Town, Jiujiang City, near Poyang Lake and not far from Jinyuan Chemical Fiber. The plant produces both viscose staple fibre and sodium sulphate.

Sateri is part of CanopyStyle's top ten priority list, meaning that it has committed to eliminate sourcing from ancient, endangered forests and controversial sources by 2017.⁷⁷

Brands and retailers sourcing from Sateri include: H&M (Sweden), Marks & Spencer (UK)^{iv}, Zara/Inditex (Spain), Tesco (UK)^v

2.1. Past scandals

In 2011, an internet user claiming to be a former Sateri staff member accused Sateri of pollution and the local authorities of turning a blind eye. He also pointed out that Sateri's desulphurisation facilities were only turned on when the

Municipal Environmental Protection Bureau came to inspect the site.⁷⁸

In October 2015, an online newspaper Consumption Daily reported that Sateri (Jiangxi) had been discharging industrial effluent into Poyang Lake. According to villagers from Dengqiao Village, Gutang, the air was filled with an unbearable odour which was especially noticeable in the summer time.

Villagers reported that the water in the lake had turned almost black and fish and shrimps had died, making it hard to make a living from fishing. Yellow and white froth accumulated around wastewater outlets, emitting an unpleasant odour and killing plants. The pollution had also affected crops and grasses on the lake shore. According to Consumption Daily, the cancer rate was significantly higher than in other villages nearby. Most cancer patients treated in Jiujiang City Hospital were from areas near Sateri and Jinyuan Chemical Fiber.

When confronted by the media, Sateri denied all wrongdoing and insisted that its wastewater was treated in compliance with environmental regulations.⁷⁹

2.2. Current impacts

Air pollution: Like Jinyuan Chemical, Sateri has not been subject to testing for hydrogen sulphide and carbon disulphide by the Jiujiang City Environmental Protection Bureau (see previous section).

Given the proximity of the two plants, the impacts observed on the ground were very similar to the ones described above. The investigators reported an intense odour in the streets of Gutang Town, especially in the areas surrounding Sateri, which was hard to bear even when wearing masks. The test results revealed that the hydrogen sulphide level downwind of the factory was 12 times over the limit^{vi} (0.5ppm in comparison to the standard of 0.039ppm), which explains the intense smell they encountered.

Polluted wastewater: Both plants discharge effluent into Poyang Lake. Water samples from Sateri's outfall could not be obtained owing to the security measures in place around the plant. A retired Sateri worker testified that black effluent was often seen being discharged into Poyang Lake and Gushan Lake near the plant. The investigation found black and yellow sediments near buried outlets, which could be linked to the presence of toxic

pollutants and sludge containing heavy metals.

Affected fisheries: Fishermen in the area expressed a concern that while Gutang Town's drinking water has so far been unaffected owing to its location upstream of Poyang Lake, it is possible that downstream drinking water sources have already been contaminated. They confirmed that industrial pollution has done great harm to the quality of fishery products in the area.

3. Sateri (Jiujiang) Chemical Fiber Co., Ltd.

Sateri (Jiujiang) Fiber Co., Ltd. was built by Sateri China with an investment of 11 billion RMB (approximately €1.43 billion).

The plant is located in Jinshawan Industrial Zone, Hukou County, Jiangxi Province and covers an area of nearly 2,000 acres. It



Dead sheep near Sateri (Jiangxi) Fiber and Jiujiang Jinyuan Chemical Fiber viscose plants

The struggles of Gutang Town

Gutang Town and nearby Poyang Lake, China's largest freshwater lake, have been heavily impacted by pollution from local viscose factories. According to locals, villagers have filed complaints against polluting companies operating in the area, including both Jinyuan Chemical Fiber and Sateri. However, they allege that manufacturers receive tip-offs ahead of inspections by the environmental protection authorities, and thus can avoid getting caught polluting.

The local authorities have thrown their full backing behind the development of the viscose industry in Gutang. In recent years, the government has expropriated lands for industrial construction, providing villagers with very little compensation (up to a maximum of 10,000 RMB – roughly €1,300 – per acre of land.) Our investigators were told that a delegation of villagers travelled to Beijing to petition the government about this. However, the issue has never been properly dealt with.

is surrounded by other factories and sits next to the Yangtze River. There are no residential neighbourhoods nearby. Effluent is discharged into the Yangtze River following processing at its own sewage treatment plant.

Sateri Jiujiang Chemical Fiber has also signed up to the CanopyStyle commitment.

Brands and retailers sourcing from Sateri include: H&M (Sweden), Zara/Inditex (Spain), Marks & Spencer (UK)^{vii} and Tesco (UK)^{viii}

3.1. Past scandals

During 2015 and 2016 at least seven fines were issued to Sateri Jiujiang by Jiujiang City Hukou. These largely relate to the illicit discharging of wastewater.^{80 81 82}

In June 2016, Jiangxi Provincial Environmental Protection Department found Sateri (Jiujiang) Fibre Co illegally discharging industrial waste near Zhoutouxiang water treatment plant by the Yangtze River. The company was ordered to shut down and make the required improvements to its environmental management system, and was fined 5.697 million RMB (approximately €742,000) by the authorities for burying waste pipes. Members of Sateri's senior management were detained in custody for ten days.

An online newspaper Outlook Weekly reported that the company had been secretly discharging sewage at night for a long time. At midnight, investigators noted black water flowing directly into the river and making a very obvious trail on the water surface near Sateri's wastewater outlet. This was accompanied by a foul smell like rotten eggs. Test results showed that chemical oxygen demand (COD) levels were 30 times the limit, while zinc levels were 1,000 times the limit.⁸³

The report also pointed out that Sateri (Jiujiang) was taking advantage of the fact that it is located on the border of two provinces, Jiangxi and Anhui, to avoid punishment by the environmental protection authorities. When this type of cross-boundary pollution occurs, the downstream environmental protection departments cannot do much about it owing to administrative restrictions.

vii - Marks and Spencer communicated to us that they source 83 percent of their viscose from fibre producers engaged with Canopy - of which Sateri is one.

viii - Similarly, Tesco communicated to us that they source 87 percent of their viscose from the top 10 viscose producers engaged with Canopy - of which Sateri is one.

iv - Marks and Spencer communicated to us that they source 83 percent of their viscose from fibre producers engaged with Canopy - of which Sateri is one.

v - Similarly, Tesco communicated to us that they source 87 percent of their viscose from the top 10 viscose producers engaged with Canopy - of which Sateri is one.

vi - According to Chinese Emission Standard for Odour Pollutants GB14554-93



3.2. Current impacts

Air pollution: Our investigators observed that Sateri Jiujiang Chemical Fiber is subject to less criticism from the community than other plants. This is probably in part a result of the distance between the plant and residential neighbourhoods.

A resident who lived near a wastewater outlet commented that he was often woken up by an intense odour at night. He testified:

“Even well water from my home smells. In summer, when there is a south wind blowing, the smell of pesticides and rotten eggs makes people want to vomit. If you hang a washed clean white shirt to dry out in the air, by the time you come home in the early evening, the shirt will be yellow.”

Resident living close to Sateri factories

Water pollution: Our investigators observed that wastewater from the plant smelt acidic. Drinking water from a restaurant situated in the industrial zone exceeded the COD limit.^{ix}

4. Sanyou Chemical Fiber (Tangshan Sanyou Group Xingda Chemical Fiber Co., Ltd., Tangshan Sanyou Group Yuanda Chemical Fiber Co., Ltd.)

Tangshan Sanyou Group Xingda Chemical Fibre Co., is a subsidiary company of Tangshan Sanyou Group Co.

Tangshan Sanyou’s viscose plants are located in Caofeidian Nanbao Development Zone, Tangshan City, Hebei Province, adjacent to the Beijing-Tianjin-Tangshan metropolitan region. Most of the companies inside the industrial zone are subsidiaries of Sanyou Group, including Xingda Chemical Fiber, Yuanda Chemical Fiber, a silicon plant, a chlor-alkali plant and a thermal power plant. The industrial zone to the northwest is clearly separated from residential areas in the south and south east.

Tangshan Sanyou is part of the CanopyStyle commitment. Brands and retailers sourcing from Tangshan Sanyou include: H&M (Sweden), Marks & Spencer (UK)^x and Tesco (UK)^{xi}

ix - Chinese Standards for Drinking Water Quality GB5749-2006

x - Marks and Spencer communicated to us that they source 83 percent of their viscose from fibre producers engaged with Canopy - of which Tangshan Sanyou is one.

xi - Similarly, Tesco communicated to us that they source 87 percent of their viscose from the top 10 viscose producers engaged with Canopy - of which Tangshan Sanyou is one.

4.1. Past scandals

In May 2013, China’s Daily Economic News reported that Sanyou Chemical had discharged highly alkaline wastewater^{xii} into Bohai Bay, which has traditionally been one of China’s richest fishing zones.⁸⁴ In recent years, it was alleged, the actions of Sanyou chemical have turned the nearby area into “a dead sea without fish”, “[endangering the] ecology of the Bohai Sea”. Sanyou group denied these allegations.⁸⁵

In both 2013 and 2016, several internet users posted online (via Weibo etc) complaining about Sanyou discharging foul-smelling waste at night, turning the water black.^{86 87}

In 2015, first quarter data released in a Tangshan City monitoring report based on data from the company, disclosed that Tangshan Sanyou was discharging sulphides into the water above the standards.⁸⁸

In 2016, the authorities responsible for regulating Nanbao Development Zone received complaints from residents about the Sanyou Group, including allegations of serious air pollution and repeated discharging of effluent. The response from the Nanbao Environmental Protection Bureau stated that Sanyou had not been found guilty of any wrongdoing but that the company had been urged to strengthen management procedures to ensure that pollution control systems operate properly.^{89 90}

Local residents claim that Sanyou Group connections in the government resulted in pollution scandals being swept under the rug. Every year the authorities come to inspect the site but never seem to report any pollution problem. Locals testify that every year Sanyou Group pays a pollution compensation fee to the Nanbao Development Zone Government, but the villagers do not receive any of it.

4.2. Current impacts

Air contamination: Our investigators smelled a strong odour in the Nanbao Development Zone, particularly around the Sanyou plants. Villagers claimed that it was much worse two years ago, and believed the air quality had improved as a result of stricter law enforcement. They were reluctant to complain because they credited Sanyou Group with fostering economic development and creating jobs in the local area.

xii - An alkaline pH can have a deadly impact on fish and can also increase the toxicity of other substances.

xiii - Chinese Hygienic Standards for the Design of Industrial Enterprises TJ36-79

xiv - Chinese Standards for Drinking Water Quality GB5749-2006

Due to strict security measures, air quality around the factory’s exhaust chimney could not be examined. However, the level of CS₂ in the residential area exceeded the permitted limit,^{xiii} and the investigators therefore thought it was possible that CS₂ levels in the plant might also be in breach of the limit.

Water pollution: Nanbao Development Zone has a centralised water treatment plant, which made it impossible for our investigators to identify a direct wastewater outfall from the Tangshan Sanyou viscose plant. However, given the dominant role of Sanyou in the Nanbao Zone, they believed that most of it originated from there. The COD level of residential drinking water by the Heiyanzi River was also above the limit.^{xiv}

While the investigation was conducted in the rainy season, the fishermen complained that more severe impacts of water pollution are seen in the dry season, when the river water gets turbid and factory wastewater discharge is more clearly visible. According to fishermen, the village committee notifies them when plants discharge effluent into the river, and are instructed “*not to take any water from the river in the coming few days*”, because it would be very dirty. The villagers commented that this situation has been going on since the Sanyou Group arrived in the area and it has slightly improved since the sewage treatment plant was built.

Fishery: According to locals, industrial pollution - which has intensified since the arrival of the Sanyou group - has severely impacted the area’s fish stocks. While in the past, fishermen mostly fished around the mouth of the Heiyanzi River, an area rich in marine life, about three years ago a large number of fish and shrimp were found dead in many of the area’s fish ponds. Fish farmers complained to the local village committee, which negotiated with the plant, and the fishermen were paid compensation. During our investigation, fishermen said dead fish continue to be found near wastewater outfalls.

5. Shandong CHTC Helon Co., Ltd. (Hengtian Hailong)

Shandong Helon Co., Ltd. produces viscose staple fibre and viscose filament yarn which is sold to more than 20 countries and regions in Southeast Asia, the EU, the Middle East and South America.



Roadside ditch containing foul looking water near Tangshan Sanyou Factory in China

The Shandong Helon factory is located in Weifang City Hanting Economic Development zone near a pulp factory. It is in the vicinity of an irrigation channel which feeds the Weihe and Bailang Rivers.

Shandong Helon is one the world's top ten viscose producers and has made a public committed under CanopyStyle to improve its viscose sourcing policies. Brands and retailers sourcing from Shandong CHTC Helon Co include: H&M (Sweden), Zara/ Inditex (Spain), Marks & Spencer (UK)^{xv} and Tesco (UK)^{xvi}

5.1. Past scandals

Air pollution caused by Shandong Helon has been a controversial issue for the past decade. Back in May 2010, a document issued by the Weifang Environmental Science Research & Design Institute (Weifang City Pollution Treatment Plan for Six Polluted Rivers and Polluted Air Zones⁹¹) pointed out that air pollution in the northern part of Weifang City was mainly caused by CS₂, H₂S and waste gas from pulp production discharged by Shandong Helon and six other polluting companies. The government subsequently ordered Shandong Helon to address the issue.

In both 2014⁹² and 2015⁹³, the company was fined and ordered to take measures to prevent the excessive emission of air pollutants.^{94 95 96} Shandong Helon even featured as the worst listed company on the blacklist of the Green Stock report, published by a Chinese NGO's Institute of Public and Environmental Affairs, owing to illegal and excessive pollution discharge.⁹⁷

In spring 2015, the Weifang Municipal Environmental Protection Bureau announced six administrative penalties against Shandong CHTC Helon Co., Ltd. for discharging air pollutants that were exceeding national and local standards.^{98 99}

According to Outlook Weekly, in October 2015, four workers heading to dump Helon's chemical liquid waste to a coal mine were poisoned and killed.¹⁰⁰

In May 2016, residents near the plant filed complaints against Helon citing the black smoke and strange odour generated by the plant and its solid waste disposal problems. There was no smoke coming out of the chimneys during the day, *"but at night, two chimneys in the chemical fibre plant give out black smoke."* Piles of coal within the plant's perimeter were also said to be polluting the irrigation canal.¹⁰¹

Again, in December 2016, Weifang Municipal Environmental Protection Bureau ordered the company to strictly implement mandated limits on production and to take effective measures against air pollution.¹⁰²

5.2. Current Impacts

Air pollution: The investigators reported an unpleasant smell in the Economic Development Zone, particularly around the Helon plant and local neighbourhoods. In the residential area carbon disulphide levels exceeded the permitted limit by three times.^{xvii}

Locals complained that the smell has been a problem for decades, but said they were forced to get used to it. A petition to the local government had barely improved the situation. Usually when government authorities come to conduct an inspection, the plant stops discharging waste. According to locals, the plant pays compensation to all of the village committees in the local area but none of this is given to villagers.

Undrinkable groundwater: Until three or four years ago, villagers used to drink water from the well. However, this practice has stopped as a result of all the pollution. They are particularly strict about not letting their children drink the well water, which *"has got a terrible taste, bad smell and turbid texture."* Our investigators found levels of COD exceeding the limit in drinking water at a small restaurant in a local neighbourhood.^{xviii}

Rising incidence of cancer: According to some locals, in the past few years an increasing number of people living near the Shandong Helon factory have died of cancer. They report that cases of lung cancer, gastric cancer or oesophageal cancer are common. The connection between those cancer cases and industrial pollution has however not been proven.

Fatal accidents: Locals told of a number of fatal accidents associated with Shandong Helon, where causes of death remain unknown. For example, a Helon worker fell into a pool inside the plant and died during his shift but full details regarding the circumstances of his death had not been disclosed by the company.



Water samples taken from outside the Sateri viscose plants in China severely exceeded safe limits for zinc

Wastewater: Villagers believed that wastewater from the Shandong Helon plant was discharged into an irrigation channel which feeds the Weihe River or the Bailang River further away. The investigation team observed that the channel had a yellowish colour and piles of what looked like coal covered by a net to stop coal dust escaping.

6. Shandong Silver Hawk Chemical Fiber Co., Ltd

Shandong Silver Hawk Chemical Fiber Co., Ltd., is a large company, mainly engaged in the production of viscose. Silver Hawk Chemical Fiber Industrial Zone is made up of Silver Hawk Chemical Fiber Plant and a thermal power station.

There are many villages surrounding the industrial zone, including Ximenjia Lingzhi Village in the north and Qiujiawa village in the west. There are other small factories located in the same area, but Silver Hawk is the biggest one.

6.1. Past scandals

In 2010, villagers who lived near Silver Hawk petitioned the local government about environmental pollution caused by the company. According to them, *"as soon as the wind blows, we will smell the odour from far away and every street we go to. Day time is not too bad. When the night comes, they will start operating at their fullest capacity. The smell will be bad enough to keep people up all night. Sometimes they don't process their [wastewater] and just discharge it directly."*¹⁰³

It was reported the same year that air pollution problems in the north-east area of Gaomi City were caused *inter alia* by carbon disulphide and hydrogen sulphide from Silver Hawk. The government authorities ordered the company to finish mandated improvements with regard to the release of the two chemicals by June 2011.¹⁰⁴

In 2011, a report pointed out that Weifang Municipal Government invested 105 million RMB (approximately €13.7 million) in the implementation of the company's carbon disulphide and hydrogen sulphide waste gas treatment project, proving that the sewage discharge system has been deficient beforehand.¹⁰⁵ However, based on the information gathered by our investigators, this major investment has not improved the situation for local people.

In 2016, local anger about pollution from Silver Hawk was

xv - Marks and Spencer communicated to us that they source 83 percent of their viscose from fibre producers engaged with Canopy of which Shandong Helon is one.

xvi - Similarly, Tesco communicated to us that they source 87 percent of their viscose from the top 10 viscose producers engaged with Canopy of which Shandong Helon is one.

xvii - Chinese Hygienic Standard for the Design of Industrial Enterprises TJ36-79

xviii - According to Chinese Standards for Drinking Water Quality GB5749-2006

captured in an article entitled “Give Back My Clear Blue Sky”,¹⁰⁶ which spoke of people breathing “air stained with chemicals”.¹⁰⁷

6.2. Current impacts

Air pollution: The odour in the area was found to severely affect people’s daily lives. Although the factory’s chimney was not producing much smoke during the investigation, the team could smell an intense odour adjacent to the site and in the surrounding residential areas. Locals commented that it is generally worse at night time when the plant secretly discharges waste gas. In the summer time, the villagers won’t even open their windows. According to them, it has been like this for seven to eight years and the situation has not improved at all.

The investigators tested the air 50 metres from the factory’s vent, and found levels of hydrogen sulphide in breach of the legal limit.^{xix} CS₂ levels in the local residential area also exceeded the permitted limit.^{xx} The plant also burns a lot of coal during the winter, which causes pollution in the nearby villages.

Secret discharging of untreated wastewater at night:

Villagers confirmed that the Silver Hawk Chemical Fiber plant also operates at night. According to a notice outside the plant, processed wastewater is supposed to run through the urban sewer pipelines on to the next treatment plant. However, villagers testified that unprocessed wastewater is secretly discharged into the Beijiao Xinhe River under cover of darkness. A villager disclosed that he once witnessed a worker pumping



Beijiao Xinhe River in vicinity of Silver Hawk plant

xix - Chinese Emission Standard for Odor Pollutants GB14554-93

xx - Chinese Hygienic Standard for the Design of Industrial Enterprises TJ36-79

xxi - According to Chinese Wastewater Quality Standards for Discharge to Municipal Sewers CJ343-2010

xxii - According to Chinese Standards for Drinking Water Quality GB5749-2006

wastewater from the plant and discharging it directly into the river.

Locals report that water from the Beijiao Xinhe River has always been smelly and dirty because of discharges from the nearby factories, mainly Silver Hawk. Villagers keep petitioning local authorities about these problems and last year filed complaints with higher government authorities. However, no improvements have been made.

Our investigators obtained water samples from an underground channel of Silver Hawk Chemical Fibre Sewage Plant. Total zinc levels^{xxi} exceeded the permitted limit by two to three times. Even after processing, wastewater from Silver Hawk does not reach the standards.

Polluted groundwater: Villagers living near Silver Hawk claimed that the groundwater has become poisonous. They avoid using well water for drinking or irrigation because it can kill their plants.

Our investigators obtained some water samples. The water temperature was almost 20°C and it was a bit turbid. Groundwater samples in Ximenjia Lingzhi Village revealed that hardness of water exceeded the permitted limit.^{xxii}

B. Indonesia

1. Indonesia’s viscose industry

Indonesia is one of the world’s top three manufacturers of viscose fibre and has been competing with other markets since the 1990s.¹⁰⁸ In 2016, it produced 439 billion tonnes of viscose fibre, a figure projected to rise to 464 billion tonnes in 2017.¹⁰⁹ The Indonesian textiles industry has experienced rapid growth in recent years, supported by Government incentives to achieve the country’s long-term goal of overtaking China as the world’s largest textile exporter.¹¹⁰

The bulk of Indonesia’s textile industry is located in West Java. This is chiefly due to quick access to Indonesia’s largest container port, Tanjung Priok, located within the Jakarta

Capital Region, and better infrastructure than the rest of the country.¹¹¹ West Java is home to 46 million people, and is a part of the island of Java, with a population of 140 million. This high population density puts incredible pressure on the natural environment.¹¹²

Our investigation in Indonesia focused on the country’s two largest viscose factories – PT South Pacific Viscose, owned by the Lenzing Group, and PT Indo Bharat Rayon, a subsidiary of India’s Aditya Birla Group. It also looked at four other factories that are subsidiaries of Aditya Birla. Three of the factories were located in Purwakarta Regency, one in Karawang Regency, and one in Bekasi.¹¹³ Several other viscose manufacturing plants in the area, and in nearby Central and East Java provinces, were not covered in this investigation.

2. Government pollution regulations and the role of communities

Regulation of Indonesia’s textile industry is weak and poorly enforced. Unfortunately, the growth of the country’s textile and viscose sectors has not been accompanied by the type of legal reforms that would help limit the environmental impacts of industrialisation. Weak regulation, a lack of transparency and a lack of enforcement all contribute to widespread industrial pollution throughout Indonesia.

Some observers believe that the decentralisation of power at the turn of the millennium has led to a rise in corruption as it empowered local leaders to take bribes and illegal payments.¹¹⁴

In 2015, Indonesia merged the two agencies responsible for managing the environment and waste – the Ministry of Environment and the Ministry of Forestry. The prominent environmental journalist and activist Harry Surjardi told us that the focus of enforcement by the new merged ministry has been on illegal poaching and forests issues, leaving few resources for monitoring and enforcing environmental regulations on manufacturing.

Weak regulation

Indonesia’s main environmental law^{xxiii} appears to have several weaknesses when it comes to the specifics.¹¹⁵ The number of chemicals regulated by environmental regulations in the textile industry is low – only 264, according to Greenpeace.^{xxiv} Other

xxiii - Law #32/2009 – Environmental Protection and Management

xxiv - As set in law #74/2001

chemicals can therefore be legally discharged into waterways with no repercussions, and there is no effective system in place to update this law and add new chemicals.

Even the chemicals listed, though, are not properly regulated or monitored. The main law regulating hazardous waste states that if someone who produces hazardous waste cannot utilise or treat it, they should pass it on to a third party with the capacity to do so, or export it to another country (with reference to the Basel Convention guidelines).¹¹⁶ In practice, though, these regulations are not followed, with environmental watchdog organisation WALHI West Java estimating that 80 percent of factories situated in West Java have illegally dumped either chemical waste, or coal ash generated during electricity production, into the Citarum Basin and nearby waterways¹¹⁷ which represent a vitally important water supply for both the city of Bandung and the greater Jakarta region.¹¹⁸

Lack of transparency

Public access to data about pollution, water quality, or factory discharges in Indonesia is extremely limited. Most NGOs refer to local communities, not Government agencies, as their chief source of information. Surjardi noted that the national Freedom of Information Act (FOIA) does exist in theory, but in reality information is tough to access for journalists and the process can be long and cumbersome. Government records about violations, or complaints against viscose factories seem to be nonexistent. WALHI West Java noted that BPLHD West Java (the West Java Regional Environmental Management Board) does patrol the Citarum River Basin, but the monitoring results are not published.

Lack of enforcement

There are numerous structural and bureaucratic issues that make enforcing even these weak laws nearly impossible. The key problem is the severe shortage of inspectors and environmental monitors in West Java, meaning that factories have little to no oversight.

According to Greenpeace, the Indonesian authorities do not conduct random or unannounced inspections at factories in West Java. They have documented several instances where factories stopped discharging illegally and suspended other environmentally harmful practices just on the days when an inspection was announced.

Greenpeace also noted that in West Java Province, where the factories we investigated are located, there are just two inspectors who have the authority to inspect factories, indicating that at present the Government does not even have the capacity to enforce the existing regulations.

In 2015, Greenpeace, along with WALHI and LBH Bandung, filed a lawsuit against the Government's decision to continue issuing wastewater discharge permits to three textile companies. In May 2016, an Indonesian court decided to suspend Government decrees that legalise pollution.

However, according to Greenpeace, despite the victories, the case must still be heard by the Supreme Court, and is currently awaiting this hearing. It's expected that the defendants will call for an appeal if the decision is upheld. Until this is finalised, the companies mentioned are free to practice as they have been.¹¹⁹ However, if the decision is upheld, it could force the Government to reopen the permitting process for nearly all textile factories, including those investigated in this report.

Environmental and health impacts

The textile industry is located around the Citarum River basin. According to the Asian Development Bank, there are over 2,000 industrial and manufacturing factories situated along the banks of the Citarum and its tributaries.¹²⁰ The river is the third largest in Indonesia, and its basin covers 13,000 square kilometres. The basin plays a vital role in the regional economy - for example, it irrigates 5 percent of Indonesia's rice, and provides nearly 80 percent of Jakarta's drinking water.

Today, the Citarum is an environmental disaster, considered one of the most polluted rivers in the world by many NGOs.¹²¹ The chief sources of this are the factories which line its banks and which, for decades, have discharged pollution at will into the river.

Several viscose factories, including the largest in Indonesia, are located in the Citarum River Basin and are likely connected to the pollution of the river, with several documented cases of harmful discharges, adverse health impacts and illegal waste dumping connected to this industry. While the sheer scale of the industrialisation of the Citarum region makes it difficult to pinpoint the problem on any single factory, the entire textile industry should be held accountable.

xxv - Based on information from Aditya Birla website, Our Brand Customers, <http://www.grasimbhawanitextiles.com/our-partners.aspx>

This investigation either directly, or through interviews with those impacted, uncovered several instances of environmentally harmful activities taking place in and around viscose factories, including the discovery of villagers living close to a viscose factory washing, gathering and hanging viscose staple fibre by hand without protective gear - exposing themselves to hazardous chemicals and health risks.

3. Case studies

1. PT Indo Bharat Rayon (Aditya Birla Group)

PT Indo Bharat Rayon (IBR) is the largest viscose factory in Indonesia, and the second biggest in the world. It is owned by the Aditya Birla Group, an Indian multinational conglomerate and the world's leading producer of viscose staple fibre. IBR produces viscose staple fibre, anhydrous sodium sulphate and sulphuric acid.

Indonesia's Minister of Industry Saleh Husin attended the inauguration of the expanded IBR plant in 2015.¹²² The expansion cost USD \$60 million (approximately €53.6 million) and increased the plant's capacity for both viscose staple fibre and sulphuric acid. Products manufactured by IBR are marketed as Birla Cellulosic and are 100 percent Rayon.¹²³

IBR is located about 7km outside the center of Purwakarta city, very close to Lenzing's South Pacific Viscose factory. There are several small villages located next to the factory, as well as farmland. The factory is situated right by the Citarum River.

Aditya Birla is part of the Canopy Commitment and is ranked second best in terms of forest issues. Brands buying viscose from Aditya Birla are: H&M (Sweden), ASOS (UK), Marks & Spencer (UK), Tesco (UK), Zara/Inditex (Spain), Levi's (US), United Colors of Benetton (Italy), Burton (UK), Next (UK), ASDA (UK), Dockers (US), Debenhams (UK), Matalan (UK), Van Heusen (US) and Haggard (US)^{xxv}

1.1 Past scandals

IBR has a long, and chequered history in Indonesia. It first began operations in the country in 1974, with the Purkawarta plant opening in 1982. IBR also used to operate a factory in

North Sumatra, but after the fall of Indonesia's dictator, General Suharto, in 1998, protests about environmental impacts forced the plant to shut down in 1999.¹²⁴ Protests took place at IBR's Purwakarta factory, and nearby PT South Pacific Viscose in 1999 due to complaints about air pollution.¹²⁵

In 2013, labour protests resulted in disruption at the Purwakarta factory.¹²⁶ In March 2011, Wahana Pemerhati Lingkungan Indonesia (WAPLI), a NGO based in Purwakarta, Indonesia, filed a complaint after IBR illegally dumped coal waste, including fly ash, into what was a lake behind the factory, right alongside the Citarum River. The total area was five hectares. Five years later, in June 2016, IBR was found guilty, with its CEO facing potential prison time and the company fined 10 billion IDR (approximately €673,000). However, the company is appealing and the CEO has, according to WAPLI, left Indonesia. According to WAPLI, there have been few noticeable changes at the factory site despite the court case. They are concerned that sludge from the manufacturing process is now being burnt in the coal power plant, which releases more toxins into the environment, ignoring regulations that require such waste to be incinerated in a less polluting manner.

1.2 Current impacts

Our investigators visited the location where illegal dumping of coal waste was documented in 2011, and found that it is now a rice paddy. WAPLI commented that the Government has failed to play its role of informing people of the dangers of farming there.

The investigation team visited Kampung Sawah, Desa Cilanap, and Kecamatan Babak Cikao, situated right alongside the factory

and the Citarum River. They experienced a shocking situation in the village; the air was thick with a strong stench emanating from both the factory and the river. Locals complained that it is usually much worse and that they regularly fall sick because of the air pollution.

The investigators came across open bags of viscose fibres throughout the village, with labels identifying them as being from both IBR and nearby PT South Pacific Viscose. Though some bags were labeled 'raw viscose', WAPLI disclosed that this was actually slightly more-processed viscose and that the bags were mislabelled, mostly because the bags were likely being re-used.

According to WAPLI, the factories employ the villagers as an intermediary. They do the dirty work - cleaning the viscose in the river, thus polluting it but at a much lower cost than if IBR did it themselves, or used proper waste management practices. Villagers then sell the viscose to other factories who use it in various other stages of production.

The investigators found a dozen villagers, mostly women, separating, washing, hanging, and gathering viscose without any protective gear. There seemed to be no proper clean-up, as viscose waste can be found littering the ground throughout the village.

One villager interviewed said he makes about 80,000 IDR (approximately €5.40) per day from doing this work. He also mentioned that many people there would rather work for the factory, as they can get a higher wage. Because the river is so polluted, other economic opportunities, such as fishing or farming, provide even less income than processing viscose. Our investigators observed no fishing activity in this village, and were told that no one swims in the river anymore, as was once common.

Alongside the river banks yellow particles were observed, which according to WAPLI, were sulphur waste from IBR. Villagers were found walking barefoot paying no attention to potential contamination. Villagers also reported that they rarely, if ever, see Government officials in this village, and have no recollection of an inspection taking place at IBR. They believe, as does WAPLI, that IBR dumps waste at night.



Sulphur pollution in village adjacent to PT Indo Bharat Rayon and South Pacific Viscose factories in West Java, Indonesia, as identified by WAPLI. Credit: Muhammad Fajar Fauzan



Villager hanging viscose to dry (credit - Muhammad Fajar Fauzan)

Viscose bags in local village bearing PT South Pacific Viscose label (credit - Muhammad Fajar Fauzan)



2. PT South Pacific Viscose (Lenzing)

PT South Pacific Viscose (SPV) is a member of the Lenzing group, headquartered in Austria. The company has produced viscose staple fibre and anhydrous sodium sulphate since 1982. SPV also has plans to expand in Indonesia.¹²⁷

As with IBR, SPV is located about 7km outside the center of Purwakarta city. There are several small villages located right along the factory, and farmland as well. The factory is situated right by the Citarum River.

Lenzing is part of the Canopy Commitment and received the highest ranking on forest issues. Brands buying viscose from South Pacific Viscose are: ASOS (UK), H&M (Sweden), Marks & Spencer (UK)^{xxvi}, Tesco (UK)^{xxvii} and Eileen Fisher (US).^{xxviii}

2.1 Past scandals

There have been numerous environmental incidents at SPV's factory in Purwakarta. In 2006, villagers asked to be relocated because of the smell emitted by the site's coal-fired power plant, and news reports said that the village was covered with waste

ash.¹²⁸ In November 2016, more than 40 residents of Kampung Ciroyom, Desa Cicadas and Kecamatan Babakan Cikaa, located right alongside SPV, were poisoned and sickened after a leak exposed them to sulphuric acid. According to the news website Republica.co, Hermawan Prio Utomo from PT South Pacific Viscose Corporate Affairs admitted to, and apologised for, the poisoning incident.¹²⁹ No legal action has yet been taken against the plant.

2.2 Current impacts

The investigation team visited Kampung Sawah, Desa Cilanap, and Kecamatan Babak Cikao. They found no evidence that any precautionary measures had been taken by SPV after the poisoning incident in November 2016. Any leak whatsoever would immediately impact the village and would give no time for an evacuation.

There was a strong chemical smell in the areas they visited, though it was not possible to tell if it was coming from SPV, the Citarum River, or the nearby Indo Bharat Rayon plant. The investigation team encountered challenges talking to villagers, who according to WAPLI are often paid off to not speak to journalists, or to inform the company about those who do.

WAPLI believes that SPV bypasses water treatment and

discharges waste water into the Citarum river. They also assume SPV is mixing solid waste with coal in their power plant because they lack an incinerator, pumping air pollution into the area. WAPLI expressed concern that an accident in the factory could kill many villagers, saying that if SPV and IBR were to blow up, "Purwakarta would be destroyed."

C. India

1. India's viscose industry

India is the world's second largest producer and exporter of viscose fibre after China, accounting for about 11 percent of the global viscose fibre production market, expected to grow to 14 percent in 2022. One powerful player, India's Aditya Birla Group, dominates the viscose fibre industry across South and Southeast Asia. Aditya Birla Group is a multinational conglomerate, with business interests in apparel, cement, fertilisers and synthetic chemicals. Today the Birla Group and its subsidiaries and joint ventures command 16 percent of global Viscose Staple Fibre (VSF) market share. Grasim Industries, a subsidiary of the Aditya Birla Group, is the sole producer of viscose staple fibre in India (excluding Bamboo fibre).

2. Government pollution regulations & the role of communities

Air and water pollution in India is governed by a broad set of rules and regulations, namely the Air (Prevention and Control) Act¹³⁰ from 1981 and Environment (Protection) Act¹³¹ from 1986

(EPA), and the Water Act,¹³² amended in 1988.

Powers and functions under these Acts are entrusted to the Central Pollution Control Board (CPCB), and the State Pollution Control Board (SPCB), which are the statutory organisations under the Ministry of Environment, Forest and Climate Change (MoEF&CC). The CPCB is the nodal agency for setting national standards and provide technical assistance to MoEF&CC and SPCBs, whereas, the SPCBs have the authority to issue and revoke permits to operate, require self-monitoring and reporting, conduct sampling, inspect facilities,

require corrective action, impose fines and even direct facility closure (some of these functions are also carried out by CPCB on occasions).

However, the environmental standards set by the CPBC, such as the National Ambient Quality Standards, fall short of regulating the most dangerous pollutants in viscose fibre production. In addition, the environmental standards for emission or discharge of environmental pollutants specific to the man-made fibre industry only set limits on bio-chemical oxygen demand (BOD), pH and suspended solids.¹³⁵

The 2016 Hazardous Waste Management Rules¹³⁶ outline the management process for industries that generate hazardous wastes and their safe handling. The rules command the State Pollution Control Boards (SPCBs) to prepare an annual inventory of the waste generated and an inventory of hazardous waste generators, actual users and disposal facilities, to be submitted to the CPCB. Moreover, the Factories Act of 1949 mandates compulsory disclosure of information by a company involved in a hazardous process regarding the dangers and health risks from exposure, as well as measures for the handling of hazardous substances.¹³⁷

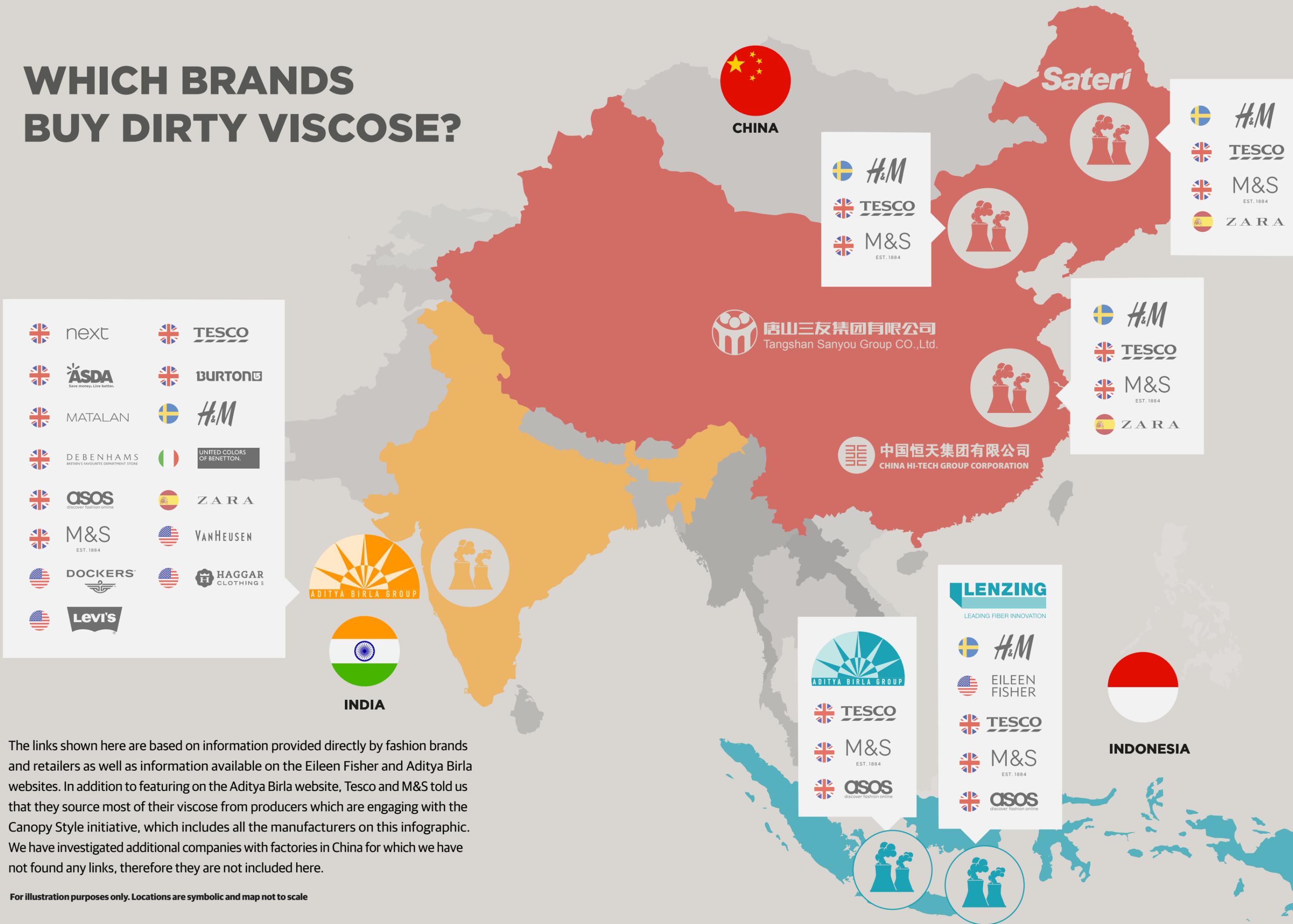
In addition to this, in October 2003, the Supreme Court ordered SPCBs to prepare a 'toxic inventory' for the generation of hazardous wastes. The Central Pollution Control Board was required to compile this data into a National Toxic Inventory. However, the process of creating such an inventory in India has been slow.¹³⁸ As was noted by the Supreme Court in the past, the "problem is not as much of absence of the Rules as it is of implementation."¹³⁹

xxvi - Marks and Spencer communicated to us that they source 83 percent of their viscose from fibre producers engaged with Canopy of which Lenzing is one.

xxvii - Similarly, Tesco communicated to us that they source 87 percent of their viscose from the top 10 viscose producers engaged with Canopy of which Lenzing is one.

xxviii - Based on information from Eileen Fisher website, <https://www.eileenfisher.com/sustainable-fibers/choosing-tencel-over-viscose/>

WHICH BRANDS BUY DIRTY VISCOSE?



The links shown here are based on information provided directly by fashion brands and retailers as well as information available on the Eileen Fisher and Aditya Birla websites. In addition to featuring on the Aditya Birla website, Tesco and M&S told us that they source most of their viscose from producers which are engaging with the Canopy Style initiative, which includes all the manufacturers on this infographic. We have investigated additional companies with factories in China for which we have not found any links, therefore they are not included here.

For illustration purposes only. Locations are symbolic and map not to scale

Another problem with the enforcement of pollution rules is the grip that industries have over the Pollution Control Boards, regional politicians and local communities. Grasim Industries is a case in point. They provide jobs, accommodation and other amenities to the residents of Nagda, the majority of whom depend on the company for their livelihood. This economic power is reflected in the huge influence the company wields over local officials, which in turn has allowed the company to pollute in impunity over a period of several decades. Our investigators spoke to many local people who were acutely aware of the pollution caused by the Grasim plant and the dangers it presents, although they were in the dark regarding the type of substances released, as the company communicates no information on this. Residents of villages upstream from the plant have also led protests against dams built by Grasim which have caused a local water crisis, flooding and erosion of land on either side of the banks of the Chambal River, but to no avail.

According to the local Right to Information (RTI) activist, Abhay Chopra, Grasim's influence is not only well seeded with national authorities, but the company's management also controls Grasim labour unions and a local hospital. When the government wanted to install intake wells to provide safe drinking water to the residents of 14 villages impacted by Grasim's activities, the move was met with protest from labour union leaders, fearing an adverse impact on water access could affect production at the factory.

According to locals, the management also approached the local MLA^{xxix}, who is also a minister in the state government, and took them to Delhi on a chartered plane to get an approval for the diversion of water from the Narmada-Shipra river linking project to Nagda. After this approval, the project for intake wells was deemed as an unnecessary expenditure and cancelled. The residents of Parmarkhedhi, one of 14 villages situated downstream of the Grasim plant, are now demanding that a dam be built near their village to provide clean drinking water to them and other villages downstream.

3. Case Study

Grasim Industries

Grasim Industries was established in 1947 as the textile manufacturing arm of the Aditya Birla Group. After setting

up its first (imported rayon) fabric manufacturing facility at Gwalior, Uttar Pradesh, the company ventured into cement, chemicals and viscose staple fibre. Grasim commenced VSF production at Nagda in Madhya Pradesh in 1954 and today, VSF and cement constitute 90 percent of Grasim's revenue and operating profits.¹⁴⁰ Grasim is also the leading manufacturer of caustic soda in India, an input in the manufacturing of VSF. The company's VSF plants are located at Nagda in Madhya Pradesh, Kharach and Vilayat in Gujarat and Harihar in Karnataka, with an aggregate capacity of 498,000 tonnes per annum.¹⁴¹ Nagda is its largest unit producing a wide range of VSF and also other fibres, such as Modal.

The company is a subsidiary of Aditya Birla Group, which operates over 40 companies in 12 countries on four continents, and is associated with the post-independence industrialisation drive of the Indian state. This has allowed its successive heirs to gain political proximity to authorities and enforcement agencies. As a result, the group and its business ventures have enjoyed the lenience of the state. Its businesses across India have been embroiled in multiple controversies over land acquisition, pollution, displacement and labour rights violations. However, these stories hardly get reported due to the company's efficient media management strategies and the increasingly rapid media cycle.

Aditya Birla is part of the Canopy Commitment and is ranked second best in terms of forest issues. Brands buying viscose from Aditya Birla are: H&M (Sweden), ASOS (UK), Marks & Spencer (UK), Tesco (UK), Zara/Inditex (Spain), Levi's (US), United Colors of Benetton (Italy), Burton (UK), Next (UK), ASDA (UK), Dockers (US), Debenhams (UK), Matalan (UK), Van Heusen (US) and Haggard (US)^{xxx}

Nagda : a town living in the shadow of Aditya Birla

Nagda is an industrial town in the Ujjain district of Madhya Pradesh. It is situated on the banks of the Chambal River, the largest tributary of the River Yamuna. Nagda is part of the Malwa Plateau, which is a semi-arid region with low rainfall due to which the city faces recurring water shortages. The Chambal itself is a non-perennial river as it originates in the Vindhya mountain

xxix - In India, a Member of Legislative Assembly (MLA) is a representative elected by the voters of an electoral district (constituency) to the Legislature of a State. Each state has between seven and nine MLAs for every Member of Parliament (MP) that it has in the country's parliament, the Lok Sabha.

xxx -Based on information from Aditya Birla website, Our Brand Customers, <http://www.grasimbhiwanitextiles.com/our-partners.aspx>



Aditya Birla Grasim

Past scandals

Gwalior Rayons: Aditya Birla's dark past

Aditya Birla established its first fabric manufacturing facility Gwalior Rayons at Mavoor in Kerala. The company, which later changed the name to Grasim Industries, closed down the plants at Mavoor in 2001, explaining that the closure was "primarily due to non-availability of raw materials and the resultant poor quality of fibre and overall unviable operations."¹⁴⁶ In reality, the company had ruthlessly exploited local forests leading to the destruction of bamboo and eucalyptus supplies.

The company experienced labour unrest and bitter protests from environmentalists and villagers downstream of the river over the illegal discharge of untreated effluents.¹⁴⁷ A large quantity of pollutants produced by Grasim ended up in the Chaliyar River which flowed beside the factory, killing fish and other aquatic organisms. Air pollution led to increased incidence of asthma and other respiratory diseases. As many as 29 deaths out of 136 (21 percent) reported in the death register of the panchayatⁱ of Vazhakkad in 1999 were due to cancer.^{148 149 150} Part of the land is still owned by the Aditya Birla Group.

The Indian NGO Common Cause accused Aditya Birla of paying off politicians, including Gujarat's then Chief Minister and current Prime Minister of India Narendra Modi and Environment Minister Jayanthi Natarajan. Birla had allegedly made an estimated 1,000 payments to politicians over a 10-year period. The NGO argued that during Jayanthi Natarajan's tenure as Environment Minister, nearly 13 Aditya Birla Group projects were cleared. The court dismissed the case, based on a lack of sufficiently incriminating evidence.^{151 152}

Different sources during our investigation at Nagda confirmed the continued existence of a close nexus between the local authorities and Grasim management which made it almost impossible for violations to be reported. A few local media channels did report stories but they scarcely made an impact on the state of affairs.

An audit in early 2017 by the National Mission for Clean Ganga named three rivers in Madhya Pradesh, including the Chambal, as contributing to pollution in the Ganges, India's sacred river. The Mission identified "industrial pollution" from Nagda as the main source of pollution of the Chambal.¹⁵³

i - A panchayat is a village council

ranges (only the Himalayan rivers are perennial). The Chambal is the main source of water for the Grasim Industrial Complex and residential township referred to as 'Birlagram'. Prior to the take-over by the Birla/Grasim group, Nagda was a small agricultural village. Land was acquired for the establishment of Birlagram and the Grasim factory in 1952. The township and the plant stand on about 236 acres of land.^{xxx1} The land allocated for industrial activity is around nine hectares.¹⁴² The population of Nagda municipality is 100,039 as per the 2011 Census of India, out of which around 31,000 individuals are engaged in work or a business activity.¹⁴³ The majority of the town's population is engaged in jobs at one of the nine industrial units in the area. The biggest employer is Grasim followed by Lanxess, a German-owned multinational company, which manufactures specialty chemicals.¹⁴⁴

The Chambal River is famous for its unique eco-system that supports two critically endangered reptiles - the Gharial crocodile and the red-crowned roof turtle - as well as the endangered Ganges river dolphin. In September 1978, the government of

"The main source of pollution in the Chambal river is industrial waste from Nagda"

Source: India's National Mission for Clean Ganga

xxx1 - Google maps calculations
xxxii -IKL = 1,000 liters

India established the National Chambal Sanctuary on an area of 5,400 square kilometres for the protection of these three species.¹⁴⁵ The sanctuary is currently co-managed by the states of Rajasthan, Madhya Pradesh and Uttar Pradesh.

Current impacts

Water crisis

At the heart of the Grasim case at Nagda lies a conflict over access to one of the most stressed resources in the Malwa region: water. The factory is problematic both for villages located downstream, due to its releases of toxic pollution, and upstream, due to its growing consumption of water.

Water is the quintessential ingredient in VSF production and its ability to access sufficient water resources has a direct impact on the profits of the company. Grasim has been forced to shut its operations several times in the past decade¹⁵⁴ owing to water scarcity. According to media reports, Nagda factory shutdowns were recorded in 2011,¹⁵⁵ 2012,¹⁵⁶ 2015¹⁵⁷ and 2016.¹⁵⁸ Abhay Chopra said that, as a result, *"the company has blocked 950 million cubic feet of water in two dams, of which 150 million cubic feet is for public consumption and the rest is for the factory."* Grasim's existing water consumption is 32,200 kilo litres per day (KLD).^{xxxii}



Water scarcity is a major problem in Nagda and the Grasim plant has ceased operating numerous times over the years

Grasim's dam is a source of woes for the residents at the Piplonda village, situated upstream from the Nagda plant. Piplonda is the site of one of Grasim's two dams which has been linked to the annual flooding in the region, which has caused loss of crops and land. Most recently the residents of Piplonda protested against Grasim's proposal to raise the dam height by one metre, which would lead to the submergence of agricultural lands and homes along the bank.¹⁵⁹ The presence of the dam has been linked to erosion of land on either side of the river banks. However, there is no official record of land lost with the local administration which chooses to classify this as natural flooding.

Water pollution

For downstream villages the main problem is water pollution, which is significantly affecting people's livelihoods. Parmarkhedi is one of 14 downstream villages, including Takkarwada, Old Nagda, Parmarkhedi, Bhagatpuri, Batisuda, Atlawada, Gidgarh, Nepania and Kilodiya, to be impacted by the groundwater contamination caused by Grasim. A study by the Indian Institute of Soil Sciences, Bhopal, looking into soil quality in Nagda, concluded that effluent from the industrial area might have contaminated not only the Chambal River but also the groundwater in nearby villages.¹⁶⁰ This in turn has impacted soil quality over time and decreased productivity. The impact is worse in the winter crop months when the fresh water flow is low.

During the field investigation, a drain carrying toxic effluents running out of the factory across the road eventually joining the Chambal River several kilometres away at *Juna Nagda* (Old Nagda) was documented. The water at Juna Nagda is dark black in colour with streaks of red and an intense smell of rotting radishes. The factory also dumps huge quantities of its viscose rejects on the bank of the river which are washed away into the river during monsoons.

Health impacts

According to Chopra, worker safety at the plant is very poor. Most hazardous jobs are carried out by contract workers brought in from neighbouring states of Rajasthan and Uttar Pradesh. According to him, *"several deaths have been reported due to chemical exposure but since the victims are taken to the factory run hospital these are recorded as natural deaths (due to heart failure etc)."*

Cases of cancer and birth deformities were reported by the

residents of villages downstream. However, in the absence of any official data it was hard to put numbers to the claims. Our investigation team met with the village elders at the home of Kallu Singh, a soya bean farmer. His wife and he are the sole caregivers to their three disabled children Sharda (aged 24), Manish (aged 22) and Kanahiya (aged 20). Kallu Singh says that all his children were born healthy and went to school until the age of 10 but began showing signs of mental and physical deterioration between the ages of 10 and 12. *"The water in the area is to blame,"* says Kallu Singh's 90-year-old aunt who lives with him.



Highly toxic pool of effluent in the Chambal River close to the Grasim viscose plant

"The water from the wells was never this sour, the government came and marked the hand pumps red and asked us not to drink from them. But what do we do for water? Now just one well supplies water to the whole village."

Air pollution

According to the records available from the Madhya Pradesh Pollution Control Board (MPPCB), Grasim VSF and its ancillary units at Nagda produce and/or handle chemicals such as sodium sulphate, carbon disulphide (CS₂), sulphuric acid, caustic soda and liquid chlorine and coal for the captive power plant. The residents of Nagda town complained of a lingering smell of rotten radishes, typically associated with less refined grades of CS₂¹⁶¹, which constantly prevailed in the air around the township. The presence of other chemicals could not be determined as



there are no air monitoring stations in the immediate vicinity of the plant. The two stations - one at the Grasim Welfare Centre and the other one at the BCI Labour Club - are at least 5km away from the factory site.¹⁶² Moreover, the stations only monitor basic parameters such as PM10, SO₂ and NO₂ which are inadequate and not specific to the type of pollution generated at the Nagda plant.

Despite everything they have suffered so far, and although they have been powerless to effect change, villagers interviewed by our investigation team said that given Grasim's major role in the local economy, they would like the company to clean up rather than clear out.

As the information and insights collected during our on-the-ground investigations in India, Indonesia and China make clear,

pollution from viscose manufacturing is a serious problem in all three countries, blighting the lives and livelihoods of thousands of people. However, it doesn't have to be this way: as explained in Chapter 2, there are alternative production processes available which would radically reduce the environmental impacts of viscose manufacturing by closing the loop and cutting the use of chemicals. These now need to be taken to scale and rolled out across the industry. Retailers and fashion brands have a key role to play in making this happen. As the following chapter will show, they are currently taking no specific measures to address the environmental impacts of viscose production and acknowledgement of the issue remains minimal. They should quickly seize the opportunity to address this by becoming better informed about impacts from viscose production in their own supply chain and by putting pressure on viscose producers to clean up their act.



Sharda Singh from a village in Madhya Pradesh has developed learning disorders and debilitating physical disorders. Her parents believe poisoned ground water from factory pollution is to blame.

Grasim sets its sights on expansion

In 2015, Grasim Industries commissioned a new production line for VSF at its plant in Vilayat, in India's western state of Gujarat. The expansion significantly increased Grasim's production capacity but is not yet operational.

Grasim Industries' staple fibre division in Nagda, Madhya Pradesh, is now proposing to significantly expand its viscose staple fibre capacity (from 1,44,175 TPA to 2,33,600 TPA), as well as that of its sulphuric acid production line. It also plans to increase generation at its Captive Power Plant and expand production of Solvent Spun Cellulosic Fibre.¹⁶³ The proposed expansion aims to almost double the capacity of Grasim industries in Nagda.

This would place a significant burden on the area's already depleted water resources; in its submissions, the company mentions the source of water for the expansion as dams and reservoirs created on the Chambal River by Grasim Industries Limited.¹⁶⁴ The local residents are unaware about the proposed expansion plans.



4. Stamping out dirty viscose: transparency is a crucial first step towards action

Since the 2013 Rana Plaza disaster, in which 1,138 low-paid garment workers lost their lives following a factory collapse in Bangladesh, the fashion industry has begun to respond to the need for enhanced transparency and more sustainable supply chains.¹⁶⁵ Industry leaders - such as H&M and Marks & Spencer - have embraced the notion of transparency, signing up to high-profile sustainability schemes and publishing some details about their factories and suppliers.

This is undoubtedly a positive step. However, as we explore in this chapter, there are two problems. Firstly, transparency is not happening across the whole industry and nor does it cover entire supply chains. Transparency is a vital tool to create change in the fashion industry, encouraging brands to move towards better business models that minimise environmental impacts of material sourcing and production, respect workers' rights, and ensure that the fashion industry stays within planetary limits. Without real transparency, this progress simply cannot happen. Secondly, even companies that have sustainability criteria in place, often do not ensure that these are implemented throughout their supply chains, as demonstrated in the previous chapter.

The industry today

With its globalised supply chains, establishing comprehensive traceability across the fashion industry is a major challenge. The construction of a 'fast fashion' garment is immensely complex; one recent BBC article described the making of a dress for high street chain Zara (Inditex), tracking the item across no fewer than six countries, and at least three continents, from production of the fabric to the eventual sale.¹⁶⁶ It is because of this complexity that transparency has been presented as a challenge. But with the fashion industry's expanding social and environmental impacts, it is also an indispensable requirement if the industry is to move in a more sustainable direction.

There is some evidence of progress. For example, many brands are starting to disclose what are known as 'tier one' suppliers - these are the factories which create the finished garment, with whom brands have a direct business relationship. Marks and Spencer and H&M have recently taken the step of publishing these via an interactive map on their website; Uniqlo (owned by Japan-based Fast Retailing) has recently published its 'core factory partners' online, and ASOS has published its list of approved factory partners.^{167 168 169 170}

This is all laudable, but there is a risk that in the rush to congratulate brands, vital parts of the supply chain remain forgotten. In its 2017 Fashion Transparency Index, based on a thorough review of information available in the public domain, the NGO Fashion Revolution points out that "brands publish supplier lists with varying degrees of detail. Some brands simply publish the name and country where their factories are located. Over 80 percent of the brands publishing supplier lists (tier 1) include a location and less than half of those disclose what types of products are made in each facility." When it comes to the

sourcing of raw materials, Fashion Revolution states that “no one is publishing a list of raw material suppliers, so there is no way of knowing where their cotton, wool, leather or other fibres come from or who produce them.”¹⁷¹

In addition, Canadian NGO Canopy Planet has had success in recent years enlisting the support of the world’s top fashion brands to end the sourcing of wood pulp (used to make viscose and other cellulose-based fabrics) from endangered forests, and now covers 100 global fashion companies (see box below for more details about this initiative). However, when it comes to understanding where the different brands are sourcing their staple fibre and filament yarn from, things are decidedly more opaque. There is a ‘missing link’ in supply chain transparency.

As outlined in previous chapters, the creation of viscose staple fibre and viscose yarn from wood pulp is an environmental hot spot – a stage at which, if not managed correctly, high levels of toxic chemicals are released into the surrounding environment. Fashion brands need to know who they are purchasing their viscose staple fibre and yarn from to ensure that they are not buying from polluting factories. They then have a responsibility to communicate this to customers to enable them to make informed decisions based on the environmental impact of their purchases.

Brands and their supply chains

As part of the research for this report, Changing Markets, Ethical Consumer and SumOfUs reached out to 45 top global fashion brands, seeking clarity on three key issues:

1. What percentage of the brand’s textile products are made of viscose (whether as part of a blend, or the sole component);
2. Whether the brand has an environmental policy in place that specifically addresses the environmental impact of its viscose production;
3. Which factories the brands source their viscose from.

Ironically, transparency is far from being a clear-cut issue. One third of the companies responded to our letter, but of the replies received, only one – H&M – provided a full list of the factories from which they source their viscose; Inditex supplied a list of companies, and where they are located, but did not specify which of the companies’ factories they specifically source from. ASOS pointed us in the direction of two large companies they use, as well as the countries, but did not specify how the countries and companies are linked (interestingly, they noted that they themselves are currently trying to ascertain where their viscose

is sourced.)

Tesco and Marks & Spencer replied that most of their viscose (87 and 83 percent respectively) comes from the top 10 companies, as they are part of Canopy Commitment, but since these companies represent 70 percent of the market and their performance differs significantly, it is difficult to judge the sustainability of their viscose operations.¹⁷² Others, such as Primark, replied citing their participation in schemes as a demonstration of their dedication to sustainability, but without acknowledging how these schemes related to viscose production, or responding more concretely to the questions asked. Worse still, some brands either did not reply to the letter at all, or else responded with no detail, citing confidentiality of this information as their reason for not disclosing information (Monsoon, Chanel). A full overview of responses and the information we found on the websites of the companies which did not respond to our letter, as well as findings from the viscose producers’ websites, is available in the table on the following pages.

We took a closer look at the schemes cited by brands in their responses, outlining their areas of focus, and their limitations with regard to the questions we had put to them. Many of these schemes focus on the general environmental performance of

textiles and not directly on viscose production.

Despite the fact that none of the schemes cited by manufacturers addresses the specific environmental impacts of viscose manufacturing, there is a growing awareness among some brands that viscose production in its current form is inherently unsustainable. Several players have started to move away from traditional viscose and are developing innovative production techniques. Swiss brand Freitag uses hemp and flax fibres as well as Lyocell and Modal. Clothing in its F-ABRIC range is 100% naturally biodegradable and the brand also states that its entire supply chain is located within 2,500 kilometres of its Zurich factory, thus cutting down on transportation emissions.¹⁷⁶ European brand Skunkfunk claims that 60 percent of its latest collection is made of ‘environmentally preferred’ raw materials including Lyocell and it also has a ‘zero waste’ collection.¹⁷⁷ Ethical fashion brand People Tree has a dedicated Tencel collection, and does not appear to use any viscose in its apparel.¹⁷⁸ As sustainability issues become more and more apparent in the fashion industry, it is clear that all brands need to explore alternative methods of production as a matter of utmost priority.

Canopy Commitment – sustainable pulp sourcing initiative

Driven by Canadian NGO Canopy, the CanopyStyle initiative currently comprises 96 fashion brands, designers and retailers, representing over \$112 billion in annual revenue, who are committed to eliminate sourcing from endangered forests.¹⁷³ These brands are called CanopyStyle leaders and they include the world’s two largest clothing brands, Zara/Inditex and H&M, as well as high street stalwarts Levi Strauss & Co., Marks & Spencer, Arcadia Group, Eileen Fisher and Patagonia. Canopy partnerships with leading clothing brands involve engaging with viscose producers to achieve full traceability of pulp and eliminate sourcing from forest hotspots, such as the Indonesian rainforest and the Canadian boreal forest.

A big part of the Canopy campaign is engaging with rayon and viscose producers to shift sourcing to more sustainable options and demonstrate their progress by putting robust policies in place, eliminating any controversial sources of forest fibre, completing independent third party audits and advancing the development of sustainable alternatives.¹⁷⁴

Their latest report from 2016, The Hot Button Issue, covered eleven of the biggest viscose producers, which together represent 75 percent of total global production. Eight out of these 10 companies have shared sourcing data with Canopy and two of them (Lenzing and Aditya Birla, which together represent 35 percent of the market) have undergone the CanopyStyle Audit. This audit stipulates that “all forest management operations, plantations, dissolving pulp and viscose mills of a given company must be verified to be deemed low risk of sourcing from ancient and endangered forests and other controversial sources.”¹⁷⁵

Based on this pledge, Canopy ranked eleven viscose producers’ performance using six criteria, which range from transparency of supply chains to contribution to forest conservation legacies and development of new alternative fibres. As our report investigates several factories that are owned by these companies, we provide an overview of their CanopyStyle 2016 ranking below. CanopyStyle does not include any criteria on manufacturing nor any obligations for brands to be transparent with regard to the factories from which they source their viscose fibre. For this reason, we have added a column showing whether the factories have been investigated in this report (more details on our investigation and supply chain links are available in Chapter 3 of this report.)

Company	Canopy performance result in 2016 (Max 25 points)	Completed CanopyStyle Desktop Audit	Factories investigated by Changing Markets
Lenzing	17	yes	PT South Pacific Viscose
Aditya Birla	16	yes	Grasim Industries, Ltd., India, and PT. Indo Bharat Rayon, Indonesia (West Java)
Tangshan Sanyou	10	Expected to complete in 2017	Tangshan Sanyou Group Xingda Chemical Fiber Co., Ltd. and Tangshan Sanyou Group Yuanda Chemical Fiber Co., Ltd.
Fulida	7	No, associated with risk of sourcing from ancient forest	No
Shandong Yamei	7	No, associated with risk of sourcing from ancient forest	No
CTHC/Shandong Helon	6	No, associated with risk of sourcing from ancient forest	Shandong CHTC Helon Co., Ltd.
Xianxiang Bailu	6	No, associated with risk of sourcing from ancient forest	No
Nanjing NCFC	5	No, associated with risk of sourcing from ancient forest	No
Sateri	4	No, associated with risk of sourcing from ancient forest	Sateri (Jiangxi) Chemical Fiber Co., Ltd. and Sateri (Jiujiang) Fiber Co., Ltd.
Jiangsu Xiangsheng	-1	No, associated with high risk of sourcing from ancient forest	No
Aoyang Technology	-5	No, associated with high risk of sourcing from ancient forest	No

WHERE DO BRANDS STAND ON VISCOSE?

NO ANSWER

ANSWERED

NOT FOUND ON THE WEBSITE

NAME OF RETAILER	RESPONDED TO OUR LETTER?	% OF TEXTILE PRODUCTS MADE OF VISCOSE	ENVIRONMENTAL POLICIES		LIST OF SUPPLIERS
			MATERIAL/WOOD PULP SOURCING	CLEAN FIBRE PRODUCTION	
		14%	Member of Canopy Style They are exploring customer supply chain waste as an alternative raw material input	Committed to lower the environmental (water and carbon) impact of their raw materials throughout the supply chain	Currently able to trace 57% of viscose – to date all can be traced to Aditya Birla or Lenzing, located in Austria, China, India and Indonesia
		Small portion, depending on the fabric used	Does not proactively communicate about CSR issues.	No information provided	Refused to reveal factory list
		Small share mostly use cotton	Gap has committed to sourcing 100% of its cotton from sustainable sources by 2021. Athleta has committed to using sustainable fibres for 80% of its apparel by 2020 Gap Inc has used Lenzing Tencel in its collections (harvested from sustainably managed trees)	Mostly focused on cotton production; in their response we could not find any policies on fibre manufacturing ZDHC Programme signatory	Provided a list of factories (available on their website), but this does not cover raw material producers.
		8%	Member of Canopy Style Promote use of Forest Stewardship Council (FSC) certified wood pulp sources They are encouraging the development of alternative fibre sources for man-made cellulosic (MMC) fabrics	H&M has conducted an internal benchmark of man-made cellulosic fibres with MADEBY Within the benchmark, the production process is based partly on the HIGG Index (developed by the Sustainable Apparel Coalition), evaluating waste/waste water use among other factors Greenpeace Detox 2020 signatory ('avant-garde' rating) ZDHC Programme signatory	H&M sent us a full list of their factories, including locations and some addresses. This makes H&M the most transparent of all the retailers. Their suppliers are: - Lenzing's factories based in Austria, China and Indonesia; - Aditya Birla, India - Fulida, China - Tangshan Sanyou, China - Sateri, China - Aoyang Technology, China - Shandong Helong, China - Xinxiang Bailu, China - Jiangsu Xiangsheng, China, Shandong Yamei, China - Nanjing Chemical Fiber, China - Jilin Chemical, China - ENKA GmbH & Co.KG, Germany - Kelheim Fibres, GmbH, Germany - Formosa Chemicals & Fibres Corporation, Taiwan For more information on supply chain links, see chapter 3
		3% (regenerated fibre)	Did not communicate policy relating to sourcing wood pulp	Also have an Environmental Commitment, which covers third party supplier requirements and the brand's Manufacturing Restricted Substances List (MRSL)	Did not disclose list of suppliers
		10%	Member of Canopy Style	ZDHC Programme signatory. M&S has its own MRSL based on Zero Discharge of Hazardous Chemicals (ZDHC) Foundation programme, with some additional requirements	Did not disclose suppliers – although they did state that 83% of M&S viscose products are sourced from factories engaged with Canopy Style Did not communicate its viscose suppliers, but the Aditya Birla website lists M&S as one of its customers.
		Small proportion	Their environmental policy for suppliers is confidential	No information provided	Refused to disclose due to confidentiality
		12%	Member of Canopy Style	No information provided	Responded they will be disclosing supply chain information on their website, but didn't say when
		Member of WRAP's SCAP, but didn't disclose share of viscose	Did not communicate policy relating to sourcing wood pulp	Greenpeace Detox 2020 signatory ('evolution' mode) – have MRSL based on ZDHC Foundation programme ZDHC Programme signatory	Did not disclose list of suppliers
		7%	Member of Canopy Style Committed to sourcing all own-brand wood-fibre materials from FSC or PEFC ¹ certified forest by 2020	Their viscose environmental focuses on sourcing, and does not cover environmental impacts of production ZDHC Programme signatory	Did not disclose suppliers – although they did state that 87% of Tesco viscose products are sourced from factories engaged with Canopy Style (See Box on Canopy Commitment) Did not communicate its viscose suppliers, but the Aditya Birla website lists Tesco as one of its customers.
		Did not communicate exact share	Did not communicate policy relating to sourcing wood pulp	Have a MRSL available on their website Greenpeace Detox 2020 signatory ('evolution' mode)	Did not disclose suppliers
		9.7%	Member of Canopy Style	Greenpeace Detox 2020 signatory ('avant-garde' rating) ZDHC Programme signatory They have an in-house programme called The List which looks at chemicals in production of fabrics Inditex stated in their letter that the Canopy commitment gives them a platform to engage with cellulosic fibre suppliers to develop cleaner methods of production They are increasing the share of cellulosic fibres with lower chemical impact, such as lyocell and Refibra in partnership with Lenzing	Inditex provided a list of companies from which they source viscose fibres, which include: • 8 companies in China (Nanjing NCF, Fulida, Sateri, Shandong Helong, Shandong Yamei, Xinxiang Bailu, Jiangsu Xiangsheng, Aoyan Technology), • Aditya Birla in India and • Lenzing in Austria They have not provided specific locations, so their response was second best in terms of transparency
		Less than 1%	Member of Canopy Style	Greenpeace Detox 2020 signatory ('evolution' mode) ZDHC Programme signatory	Publish list of tier 1 factories on website Did not communicate its viscose suppliers, but the Aditya Birla website lists Levi's as one of its customers
		Member of WRAP's SCAP scheme but didn't disclose share of viscose	Member of Canopy Style	Have policies on cellulose fabrics, leather, cotton, cashmere, recycled fabrics, and wood and paper	Website states the factories used in viscose process (Domsjö Fabrikerin Mill in Sweden; ENKA viscose filament mill in Germany) – but it is unclear whether they also use others Did not reveal the names of factories in its response.
		Did not provide this information – but stated that they only use Lyocell, not viscose rayon	Member of Canopy Style	They only use Lyocell, and stated: "the wood pulp is dissolved in a non-toxic solvent, NMMO and recaptured and re-used in processing in a closed loop system"	Did not disclose names in letter but stated that they exclusively use Lenzing Tencel
			None found on website	Has a LVMH RSL (Restricted Substances List) – but details of this are not available on website	

			None found on website	Has a LVMH RSL (Restricted Substances List) – but details of this are not available on website
			Sustainable sourcing is part of the brand's Environmental Policy – but this is not specific to viscose, and full policy is not available online	The Gucci website states its Environmental Policy covers use and management of chemicals and development of environmentally-friendly materials – but the full policy is not available online Website states that production is 100% in Italy (although this is tier 1 only). Full list not available on website
Arcadia		Member of WRAP's SCAP scheme but don't disclose percentage of viscose on their website	Member of Canopy Style	Nothing specific to viscose on website. Reference to development of a Sustainable Clothing Framework on website, to be trialled with one brand in 2017 – "it will introduce new sustainability approaches and alternatives to traditional sourcing practices and fibres" Discloses some information about tier 1 suppliers on website, but doesn't go into detail (list number of countries and factories they source from, but not which countries these are)
			Working with suppliers to ensure they do not knowingly source wood pulp from endangered forest by 2017, and instead source from FSC-certified forest, or other certified forestry operations sources that are independently verified	Greenpeace Detox 2020 signatory ('faux pas' rating) ZDHC Programme signatory - adopted ZDHC Manufacturing Restricted Substances list as its own L Brand list (not available on their website)
			Tommy Hilfiger is increasing its use of Tencel	Have an RSL, available on their website – this has been developed using the HIGG Index. ZDHC Programme signatory
			No viscose sourcing policy on website	Have an RSL, but this is not available on the website
			Viscose is not mentioned in sustainability report (cotton, leather and polyester are referenced)	Nike uses the China Pollution Map Database developed by the Institute of Public & Environmental Affairs (IPE) to screen facilities in China for wastewater violations. Publishes tier one factories on an interactive map – but does not disclose raw material suppliers Greenpeace Detox 2020 signatory ('faux pas' rating) ZDHC Programme signatory
			Names Tencel as one of their most commonly used sustainable materials – but do not have viscose-specific policy	Adopted ZDHC MRSL in 2016 (ZDHC Programme signatory) Greenpeace Detox 2020 signatory ('evolution' mode) Publishes list of tier 1 factories on website.
			No mention of viscose in sustainability reports	No specific clean production policy on website
		Website states 80% of fabric used is cotton – but doesn't specify the remaining 20%	Have a wood pulp policy (since 2015) – created in partnership with Rainforest Action Network (RAN)	Not found on website States that 75% of their raw material is supplied from Asia-Pacific region – but doesn't disclose factory list on website
			No viscose sourcing policy on website	Has a Restricted Substances Standard (monitor REACH legislation) – but not available online, and not related specifically to viscose Report states that they plan to map their supply chain of principal raw materials (including viscose) by 2020 Did not communicate its viscose suppliers, but the Aditya Birla website lists Next as one of its customers

MICHAEL KORS			No viscose sourcing policy on website	Not found on website
FOREVER 21			No viscose sourcing policy on website	Brand states its commitment to reduce its environmental footprint on its website, but doesn't outline an specific policies relating to this
BURBERRY			No viscose sourcing policy on website	Greenpeace Detox 2020 signatory ('evolution' mode) ZDHC Programme signatory
Abercrombie & Fitch			No viscose sourcing policy on website	Working toward zero discharge of hazardous chemicals – but not Greenpeace Detox 2020 signatory Outlines development of 'stewardship' programme on website – but this has not been updated since 2013
URBAN OUTFITTERS			No viscose sourcing policy on website	No detailed environmental policy on corporate website – state they are "committed to making supplier decisions with social and environmental factors in mind"
MANGO		44% natural fibres; 56% synthetic (but does not specify further)	(received acknowledgment that letter was received – but no official response)	No specific policy on viscose stated in sustainability report Greenpeace Detox 2020 signatory ('evolution' mode) Have MRSL available in sustainability report, and Code of Conduct for suppliers stating that they will observe this Provides number of suppliers/factories (513/885) – but does not provide further details
			No viscose-specific sourcing policy (Uzbek cotton ban, sandblasting ban)	They have developed the American Eagle Outfitters Wastewater Management Standard for their production partners List countries from which they source on their website – but no further details
			Have an Environmental Code of Practice that covers fabric from third party manufacturing contractors (but doesn't specify viscose) – also have cotton sourcing policy	Have a Restricted Substances List available on their website Vertically-integrated company – lists factory locations/functions on website but doesn't give any further details It looks like their textile/yarn mills are all based in the Americas
EILEEN FISHER			Member of Canopy Style	Don't have specific production policies – however, the website states they are moving away from viscose – aiming to eliminate viscose altogether by 2020, in favour of Tencel (Lyocell by Lenzing) Currently working on mapping their supply chain – should be publishing an update later this year List of factories not shared on website – but we have drawn a link between Eileen Fisher and Lenzing factories in Indonesia and China
		Member of WRAP's SCAP scheme but don't disclose percentage of viscose on their website	No specific viscose policy on website	Publishes names and addresses of tier one suppliers on website. Did not communicate its viscose suppliers, but the Aditya Birla website lists Asda as one of its customers
Sainsbury's			States that all key raw materials are sourced sustainably to an independent standard (not specific to viscose)	
MORRISONS			Mentions Forest Stewardship Council (FSC) sourcing of products, but doesn't mention viscose on website	
John Lewis		Member of WRAP's SCAP scheme but don't disclose percentage of viscose on their website	No viscose sourcing policy on website – have policies for cotton, leather, feather and down, timber and paper	Responsible Sourcing Code of Practice doesn't cover environmental factors

HQ: MADRID, SPAIN



INDITEX

ANNUAL
TURNOVER:
€23.3bn

Stradivarius ZARA PULL&BEAR

ZARA HOME Bershka OYSHO Massimo Dutti

Inditex' Environmental Sustainability Policy is available on its website although this does not provide much detail. The brand is a member of the joint roadmap of the ZDHC initiative, and a signatory to the Greenpeace Detox Commitment. Inditex has published a list of its wet processing units.

SUSTAINABILITY COMMITMENTS

Like H&M, Inditex is increasing its use of more sustainable cellulosic fibres, such as lyocell; the brand has grown its use of lyocell by 100% over the past year (five times faster than growth in its use of viscose) and is currently the largest user of lyocell worldwide, according to the Textile Exchange Preferred Fibre Market Report 2016.

SUSTAINABILITY SCHEME MEMBERSHIP



Ø ZDHC



wrap

canopy

Higg Index



PERFORMANCE IN DIFFERENT RANKINGS



36% OVERALL
one of the highest scores
12% ON TRACEABILITY



AVANT GARDE
highest rating

rankabrand

GRADE 'C' (14/36)
reasonable, could be better (this is just Zara - Pull & Bear, Massimo Dutti and Berskha all score much lower (E grade)

CITI

Zara is ranked
10TH OUT OF 199 BRANDS

REALITY CHECK:
Inditex responded to our letter by providing an overview of its policies and the names of the factories it sources viscose from. This includes a number of polluting viscose factories in India and China, including Aditya Birla, Sateri and Shanding Helong

HQ: STOCKHOLM, SWEDEN



H&M GROUPS

ANNUAL
TURNOVER:
£19.5bn

CHEAP MONDAY & Other Stories

MONKI COS WEEKDAY

H&M's website gives an overview of its environmental policy and commitments; this section is fairly easy to navigate to from the brand's main website.

H&M was the first fashion retailer to make its supplier list public, in 2013. The brand now provides an interactive supplier map on its website - although as this only covers tiers one and two, meaning that its viscose (and other fibre) suppliers are not included on the map

In April 2017, the Group published its latest sustainability report, outlining an ambitious strategy to use 100 per cent sustainable cotton by 2020, and 100 per cent sustainable fabric by 2030. On its website H&M names lyocell as its preferred choice of viscose-style fabrics; the brand is the second largest user of Lenzing's Tencel, also known as Lyocell, in the world.

That said, H&M's sustainability report for 2016 outlines a pilot traceability system for organic cotton and viscose, created in partnership with Control Union. The brand states that it plans to scale up the systems to cover the entire viscose supply chain over the next few years.



Ø ZDHC



wrap

canopy

Higg Index



48% OVERALL
one of the highest scores
29% ON TRACEABILITY



AVANT GARDE
highest rating

rankabrand

GRADE 'C' (17/36)
reasonable, could be better

CITI

H&M is ranked
16TH OUT OF 199 BRANDS

REALITY CHECK:
H&M provided the most information about its viscose sourcing policies and factories of all the brands contacted. However, it sources viscose fibre from several polluting factories in Indonesia, China and India (for more details see chapter 3).

HQ: LONDON, UK



M&S

EST. 1884

ANNUAL
TURNOVER:
£1.4bn



The brand's corporate responsibility webpage is focused around Plan A, its sustainability plan which was launched in 2007, and updated in 2014 with a vision for 2020.

Transparency is identified as a key priority within the 2020 plan, with sourcing of wood pulp for viscose cited as an area in which transparency is essential.

M&S publishes an interactive list of tier one factories on its website - the brand is engaged with its wet processing factories through IPE and the Greenpeace Detox campaign. However, this does not go further down the supply chain, i.e. fibre sourcing.

M&S has a policy related to sourcing of wood pulp for viscose and other cellulose fabrics - this is called the M&S Commitment on Protecting Forests Through Fabric Choices. In it, it also outlines the use of Modal and Tencel, also known as Lyocell.

canopy

wrap



Higg Index



48% OVERALL
one of the highest scores
22% ON TRACEABILITY



EVOLUTION MODE
middle rating

rankabrand

NOT RANKED

CITI

ranked
5TH OUT OF 199 BRANDS

REALITY CHECK:
Marks & Spencer responded to our letter but didn't provide a list of its viscose factories. It sources from companies that are members of the Canopy Commitment representing 75% of the viscose market. Several of these companies operate polluting factories that were investigated in this report.

HQ: LONDON, UK



ASOS
discover fashion online

ANNUAL
TURNOVER:
£1.4bn

ASOS has an extensive Corporate Responsibility section on its website, which is fairly easy to find from the main website

The brand's sustainable sourcing programme has four 'pillars', two of which are improving traceability of raw materials, and lowering environmental impact. As part of the former, ASOS states that it wants to work towards 100% verified cellulosic fibres.

The brand lists tier one factories on its website, along with a sourcing map.

canopy

wrap



Higg Index



33% OVERALL
one of the highest scores
26% ON TRACEABILITY



NOT A MEMBER

rankabrand

GRADE 'D' (7/36)
Should be better

CITI

NOT RANKED

REALITY CHECK:
ASOS responded that they are able to trace 57% of their viscose. Our research indicates that some of the factories listed by ASOS are polluting



Explanation of different fashion rankings and sustainability initiatives



Fashion Revolution Transparency Index - ranking of top 100 global fashion brands on supply chain transparency in five key areas - policy and commitment, tracking and traceability, audits and remediation, engagement and collaboration, and governance.



Greenpeace Detox Campaign/Detox Catwalk - The Detox campaign was launched in 2011 to expose the direct links between global clothing brands, their suppliers and toxic water pollution around the world. Many brands signed up to a 'Detox Pledge' to eliminate the emission of hazardous chemicals in their supply chain - the Detox Catwalk is an annual assessment of the steps taken by fashion brands to fulfil these commitments.



RankABrand - Online rating system covering a number of consumer industries, including food, electronics and fashion. Ranks brands on sustainability and social responsibility purely based on information available on their websites.



Corporate Information Transparency Index (CITI) - Quantitative evaluation system designed to assess brands' environmental management of their supply chains in China, jointly developed by IPE (Institute of Public and Environmental Affairs) and the Natural Resources Defense Council (NRDC).



SCAP - The Sustainable Clothing Action Plan is run by WRAP (the Waste and Resources Admin Programme), and offers advice to brands/retailers about how they can extend the life of their products through their choice of fibres used, reducing their carbon, water and waste footprints. Signatories to the SCAP 2020 plan have committed to reduce their carbon, water and waste footprint on clothing they supply or receive in the UK by 15% by 2020 (starting from a 2012 baseline.) Signatories to this scheme must record the percentage of different fibres used in their products but they are not required to make this public.



Canopy Style - Canadian NGO Canopy Planet's campaign focused on ending the sourcing of wood pulp (used for viscose and other cellulose fibres) from endangered forests. Canopy works with and publicly rates viscose factories according to their sourcing policies, and engages with brands to put pressure on these factories to end sourcing from endangered forests by 2017. Around 100 brands have signed up to the campaign.



Sustainable Apparel Coalition (SAC)/HIGG Index - The SAC is an industry alliance for sustainable production. The coalition was formed in 2009 by Walmart and Patagonia, and includes brands and retailers, manufacturers, academics, government bodies and NGOs. The HIGG Index is an online programme for members to self-assess the environmental, social and labour impacts of their business.



Forest Stewardship Council (FSC) - The FSC runs a global forest certification system that ensures wood, paper and other forest products are sourced from well-managed forests and/or recycled materials. The certification covers forest management and tracing the wood through all stages of production and distribution.



MADE-BY - Founded in 2004, MADE-BY is a not-for-profit that works with brands to implement sustainable practices in the fashion industry through "targeted consultancy, partnerships and stakeholder engagement."



Zero Discharge of Hazardous Chemicals (ZDHC) Programme - An industry-wide voluntary scheme aiming to eliminate use of priority chemicals in the fashion supply chain. The Programme focuses on companies' Manufacturing Restricted Substances List (MRSL) and conformity guidance, wastewater quality, audit protocol, research, data and disclosure, and training. The Programme has created a roadmap to eliminating hazardous chemicals in partnership with a number of its member brands, as a response to the Greenpeace Detox Campaign; however, Greenpeace believe that this roadmap is not ambitious enough.



5. Conclusion

This report has exposed widespread pollution at viscose factories supplying the North American and European markets. At many of the factories our investigation teams visited, conditions were reminiscent of the dark days of viscose production in the late 19th and early 20th centuries.

Despite the existence of technological solutions which would make it possible to produce viscose in a sustainable way, these are not being rolled out across the industry, so their impact remains limited. Viscose can play a role in the transition to a truly sustainable textiles industry but a lot needs to change to make sustainable viscose a reality. As a priority, carbon disulphide should be eradicated altogether from the viscose production process. It is a highly toxic endocrine disruptor and has no place in modern viscose production. In addition to this, all viscose production should take place in a closed loop, with zero chemical discharge and the recycling of chemicals used in the process.

There are many reasons for fashion brands to change course. As discussed in Chapter 2, water crises are the biggest threat facing the planet over the coming decade. As a major consumer and polluter of water, the fashion industry should therefore take great care to preserve this precious resource, not just for our collective benefit but also for purely selfish reasons, as declining water quality and availability represent a major business risk. However, as shown in this report, many companies involved in the textiles supply chain are doing the very opposite and behaving with great recklessness.

Our research has shown that there is a huge vacuum when it comes to tracking and regulating environmental impacts throughout the global textiles supply chain. The starting point is the introduction of full transparency and traceability throughout the supply chain,

which in today's globally integrated fashion industry are non-negotiable components of responsible corporate behaviour.

However, retailers' and fashion brands' responsibility does not stop at transparency. All companies should actively monitor their suppliers and act swiftly to put a stop to environmental and social violations wherever they occur in the supply chain. Regulators can contribute to this by demanding due diligence in supply chains, as is already the case for issues such as slavery and child labour.

European due diligence initiatives

A number of European countries are making moves in this direction in the wake of the Rana Plaza collapse. In France, the recently adopted law on mandatory due diligence (or 'Rana Plaza Law') introduces a legally enforceable requirement for companies to "establish and implement an effective vigilance plan" to allow for risk identification and for the prevention of severe violations of human rights and fundamental freedoms, serious bodily injury or environmental damage or health risks resulting directly or indirectly from the operations of the company and of the companies it controls.¹⁷⁹ This requirement, effective from 1 January 2018, covers companies' own activities as well as those of their subsidiaries, sub-contractors and suppliers both in France and abroad.¹⁸⁰

The Dutch Sustainable Garment and Textile Agreement, which aims to cover 80 percent of the Dutch garment and textile sector by 2020 likewise aims to improve the sustainability of international textiles production and supply chains by, *inter alia*, promoting healthy and safe working conditions, reducing the negative environmental impact of raw material production, cutting the use of water, energy and chemicals, and producing less chemical

waste and waste water with the objective of gradually giving Dutch consumers access to fairer, more sustainable garments and textiles.¹⁸¹

The German Partnership for Sustainable Textiles, a multi-stakeholder initiative spearheaded by the German Federal Ministry for Economic Cooperation and Development (BMZ) also aims to “bring about social, ecological and economic improvements all along the textile supply chain.”¹⁸²

Although it does not cover environmental breaches, the UK’s Modern Slavery Act does aim to open up supply chains to external scrutiny and explicitly acknowledges that adverse impacts “can occur at any level of a supply chain - from direct suppliers, all the way through multiple layers of sub-suppliers and sub-contractors, to raw material providers and franchisees or distributors.”¹⁸³

While these initiatives are to be welcomed, tackling environmental and social violations in the global fashion supply chain requires an approach that goes beyond national borders. A coalition of 80 NGOs recently called for enforcement mechanisms at the EU level to make these disparate initiatives effective. In their words: “*The time has come for the European Commission to develop a smart mix of rules that will include binding regulation on human rights due diligence, in accordance with the UN Guiding Principles on Business and Human Rights (UNGPs) and the OECD Due Diligence Guidance for Responsible Supply Chains in the Garment and Footwear Sector.*”¹⁸⁴

OECD Due Diligence Guidance

The OECD guidance has been designed to create a level playing field for responsible business conduct worldwide. It applies to all companies operating in or sourcing from the 46 adhering countries, but is relevant for any company with global supply chains. Under the guidance, companies are expected to scope risks across the full length of their supply chain, including risks related to subcontracting and homeworkers. The assessment goes beyond auditing in that it requires companies to not only identify labour, human rights and environmental impacts, but also to understand why they are occurring.¹⁸⁵

With the right to a healthy environment increasingly being recognised as a fundamental human right¹⁸⁶, there is a clear need to put environmental violations on an equal footing with more traditional breaches of human rights. Water and air pollution, and the damage they are wreaking on the health of factory workers and local communities are issues that big brands can no longer afford to ignore.

Recommendations for brands, viscose producers, policy makers and consumers

Cleaning up the viscose supply chain and putting a stop to the environmental violations which have been recorded in this report will require the involvement of a range of different actors including viscose producers, fashion brands and retailers, policy makers and consumers.

- **BRANDS AND RETAILERS** must provide full transparency about the factories from which they source textiles and communicate these clearly on their website. This should include all stages in the supply chain, making it possible to identify raw materials suppliers and not just ‘tier one’ and ‘tier two’ factories. They should have a strict zero pollution policy in place and conduct regular audits to ensure that this is implemented. Given that viscose production is a highly concentrated industry, brands have huge market power and should work with viscose suppliers to encourage them to move towards a closed loop system of production and the elimination of harmful chemicals. If these factories fail to clean up their act, brands should take their business elsewhere.
- **VISCOSE PRODUCERS** must invest in the technology to move towards a closed loop system of viscose production and stop dumping toxic chemicals in the environment. The best way to do this is to minimise or eliminate the use of chemicals in the production process. In addition, they should take every measure to ensure that workers and residents are not exposed to toxic chemicals. They should also invest in cleaning up historical pollution and pay compensation to affected communities.
- As a first step, **GOVERNMENTS AND POLICY MAKERS** should mandate transparency across the entire supply chain. In addition, they should introduce environmental criteria in supply chain due diligence regulations, mirroring the French and Dutch initiatives. Reflecting the global nature of the textiles industry, these national moves should be captured by regional and international rules and enforcement mechanisms, without which measures at national level will remain too fragmented to address the full scale of the problem. The EU flagship initiative on the garment sector, which was adopted by an overwhelming majority of members of the European Parliament in April 2017 calls on the European Commission to table a binding legislative proposal for a due diligence system¹⁸⁷ based on the recent OECD guidelines on Responsible Supply Chains in the Garment and Footwear Sector.¹⁸⁸ The European Commission must now act rapidly to bring legislation forward. Given the size and spending power of the European market, coordinated action at EU level would have a significant impact on the global fashion industry and could also serve as a model for other regions.
- **CONSUMERS** should make sure that they buy viscose from brands that have made a clear commitment to sustainable sourcing of wood pulp and clean viscose production. They can also write to their favourite brands asking them to disclose their viscose suppliers and demand that they stop purchasing viscose from dirty factories.

Viscose is a potentially sustainable fibre, but significant steps need to be taken by everyone in the supply chain to ensure that it is sourced and manufactured in a genuinely green and sustainable way. This should be a priority for any industry that is interested in its continued existence in a resource-constrained world.

1. Eco Watch, Shocking Photos Show China's Largest Freshwater Lake Is Drying Up Fast, 10.11.2016, <http://www.ecowatch.com/china-poyang-lake-drought-2084891682.html> Encyclopaedia Britannica entry on cellulose. Available at: <https://www.britannica.com/science/cellulose>
2. Rainforest Action Network, Out Of Fashion campaign, http://www.ran.org/out_of_fashion
3. New York Times, New Rayon Clothing Ruffles Some Wearers, 08.06.1991, <http://www.nytimes.com/1991/06/08/news/new-rayon-clothing-ruffles-some-wearers.html>
4. Paul Blanc, 2016, Fake Silk – The Lethal History of Viscose Rayon, Yale University Press, p.viii
5. 6 See Vancouver-based Canopy Planet's ongoing Canopy Style campaign, <http://canopyplanet.org>, and Rainforest Action Network's Out Of Fashion campaign, http://www.ran.org/out_of_fashion
6. The Economist, Looking good can be extremely bad for the planet, 08.04.2017, <http://www.economist.com/news/business-and-finance/21720200-global-clothing-production-doubled-between-2000-and-2014-looking-good-can-be>
7. Fung Global Retail and Tech, May 2017, Fast Fashion Speeding Toward Ultrafast Fashion, <http://tinyurl.com/ycb4km7j>
8. The Guardian, Zara founder to receive £1.1bn payout after record sales, 15.03.2017, <https://www.theguardian.com/business/2017/mar/15/zara-founder-payout-sales-amancio-ortega-inditex>
9. Oxfam report, 2004 quoted in: <https://www.ethicalfashionforum.com/the-issues/fast-fashion-cheap-fashion>
10. Lucy Siegle, 2011, To Die For: Is Fashion Wearing Out The World?, Fourth Estate HarperCollins, p.xciii
11. Paul Blanc, 2016, Op. Cit.
12. Sixta et al., 2015, Ioncell-F: A High-strength regenerated cellulose fibre, Nordic Pulp & Paper Research Journal, Vol 30 no (1), https://www.npprj.se/html/storage/pmw_lpdqlorcspkv.pdf
13. Hergert et al., 1977, Rayon – A fibre with a future, ITT Rayonier, Inc., Eastern Research Div., Whippany, N.J. 0798, <http://cdn-pubs.acs.org/doi/pdfplus/10.1021/bk-1977-0058.ch001>
14. Global Viscose Fiber Market Research Report 2017, May 2017, QYR Chemical & Materials Research Center
15. Ibid.
16. Ibid.
17. Madehow, Rayon, <http://www.madehow.com/Volume-1/Rayon.html>
18. Swicofil, Viscose rayon, 2015, <http://www.swicofil.com/products/200viscose.html>
19. Chemical & Engineering News, Cutting out Textile Pollution. Cleaning up one of the world's dirtiest industries will require new technology and more, 19.10.2015, <http://cen.acs.org/articles/93/i41/Cutting-Textile-Pollution.html>
20. Forbes, From Frivolity To Sustainability: Why Technology And Innovation Matter For The Future Of Fashion, 07.12.2016, <https://www.forbes.com/sites/rachelarthur/2016/12/07/from-frivolity-to-sustainability-why-technology-and-innovation-matter-for-the-future-of-fashion/>
21. Greenpeace Detox campaign, <http://www.greenpeace.org/international/en/campaigns/detox/>
22. Green Choice Apparel Supply Chain, April 2012, Cleaning up the Fashion Industry, <http://ipe.org.cn/Upload/file/Notices/Reports/Fashion-Industry-Report-Press-Release-En.pdf>
23. Paul Blanc, 2016, Op. Cit.
24. WHO Regional Office for Europe, 2000, Air Quality Guidelines - Second Edition, Chapter 5.4 Carbon Disulphide, http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbdisulfide.PDF
25. United States Environmental Protection Agency, 2016, Carbon disulphide, <https://www.epa.gov/sites/production/files/2016.../carbon-disulfide.pdf>
26. Klemmer et al., 2000, Carbon disulfide nephropathy, Am J Kidney Dis. 2000 Sep;36(3):626-9
27. Patel et al., 2004, Male exposure mediated adverse reproductive outcomes in carbon disulphide exposed rayon workers, J Environ Biol. 2004 Oct;25(4):413-8.
28. Lodde ey al., 2006, Neurobehavioral and clinical effects in workers exposed to CS2, Int. J. Hyg. Environ.-Health 209 (2006) 139-150
29. Gelbke et al., 2009, A review of health effects of carbon disulfide in viscose industry and a proposal for an occupational exposure limit, CRC Crit Rev Toxicol, 39(Suppl 2): - 26; Tan et al., 2001, Carbon disulfide exposure assessment in a Chinese viscose filament plant, Int J Hyg Environ Health. 2001 Jul; 203(5-6):465-71
30. Health Council of the Netherlands, July 2006, Hydrogen sulphide, Health-based recommended occupational exposure limit in the Netherlands, <http://werkgroepierlinden.be/H2SC.pdf>
31. Handbook of Hazardous Materials, 1993, edited by Morton Corn
32. Shen et al, 2010, Life Cycle Assessment of Man-Made Cellulose Fibres, Lenzinger Berichte 88 (2010) 1-59.
33. PubChem, National Center for Biotechnology Information, U.S. National Library of Medicine, SODIUM HYDROXIDE, <https://pubchem.ncbi.nlm.nih.gov/compound/14798#section=Information-Sources>
34. PubChem, National Center for Biotechnology Information, U.S. National Library of Medicine, SULFURIC ACID, <https://pubchem.ncbi.nlm.nih.gov/compound/1118#section=NIOSH-Toxicity-Data>
35. WHO Regional Office for Europe, 2000, Air Quality Guidelines – Second Edition, Chapter 5.4 Carbon Disulphide, http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbdisulfide.PDF
36. Youlong Qiu. Environmental Protection Objectives of China and the Impact on the Chinese Viscose Fiber Industry [A] China Textile Leader, 2013 No.10
37. Ambient aquatic life water quality criteria for dissolved oxygen (salt-water): Cape Cod to Cape Hatteras, 30.11.2000, <https://tinyurl.com/y8lf6vgu>
38. Pharos project, Hazardous to the aquatic environment (acute) - Category 2. <https://www.pharosproject.net/hazard/hazard/show/620>, <https://www.pharosproject.net/material/show/2007102>
39. Youlong Qiu. Environmental Protection Objectives of China and the Impact on the Chinese Viscose Fiber Industry [A] China Textile Leader, 2013 No.10
40. World Economic Forum, 2015, Water crises are a top global risk, <https://www.weforum.org/agenda/2015/01/why-world-water-crises-are-a-top-global-risk/>
41. UNEP, Half the world to face severe water stress by 2030 unless water use is “decoupled” from economic growth, says international resource panel, 21.03.2016, <http://www.rona.unep.org/news/2016/half-world-face-severe-water-stress-2030-unless-water-use-decoupled-economic-growth-says>
42. Changing Markets, 2016, Running on Empty: What Business, Government and Citizens must do to confront South Africa's water crisis, http://changingmarket.wpengine.com/wp-content/uploads/2016/12/Running-on-empty_final-report_spread.pdf
43. Global Fashion Agenda & Boston Consulting Group, 2017, Pulse of the Fashion Industry, https://www.copenhagenfashionsummit.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf
44. The Guardian, How can we stop water from becoming a fashion victim?, 07.03.2012 <https://www.theguardian.com/sustainable-business/water-scarcity-fashion-industry>
45. Nordic Fashion Association, Rayon, <http://nordicfashionassociation.com/content/rayon>
46. Muthu, S, 2014, Assessing the Environmental Impact of Textiles and the Clothing Supply Chain, Woodhead publishing, Cambridge
47. WWF, The Impact of a Cotton T-Shirt, 16.01.2013, <https://www.worldwildlife.org/stories/the-impact-of-a-cotton-t-shirt>
48. The Guardian, How can we stop water from becoming a fashion victim?, 07.03.2012, <https://www.theguardian.com/sustainable-business/water-scarcity-fashion-industry>
49. Carbon Disclosure Project, 2014, From water risk to value creation, <http://tinyurl.com/y88ftzf2>
50. The Guardian, 10 things you need to know about water impacts of the fashion industry, 04.09.2014 <https://www.theguardian.com/sustainable-business/sustainable-fashion-blog/2014/sep/04/10-things-to-know-water-impact-fashion-industry>
51. Ibid.
52. Shen et al, 2010, Op. Cit.
53. Lina Tong, Viscose Fiber High Pollution Expected to Be Solved [N], China Textile News, 2015-05-18 (007)
54. Global Viscose Fiber Market Research Report 2017, May 2017, QYR Chemical & Materials Research Center
55. Shen et al, 2010, Op. Cit.
56. Lenzing, Closing the loop in textiles, 2017, <http://www.lenzing-fibers.com/en/tencel/refibra/>
57. Lenzing, Innovating for Balance, Sustainability Report 2016, http://www.lenzing.com/fileadmin/template/pdf/konzern/nachhaltigkeit/LENZING_Sustainability_Report_2016_EN.pdf
58. Mordor intelligence, January 2017, Global Viscose Staple Fiber Market - Segmented by Production Process, Application, and Geography – Growth, Trends and Forecasts (2016 - 2021)
59. Beige Market Intelligence, Global Viscose Staple Fiber Market – Strategic Assessment and Forecast Till 2021, <http://tinyurl.com/y7x7br29>
60. Textile World, Man-Made Fibers Continue to Grow, 03.02.2015, <http://www.textileworld.com/textile-world/fiber-world/2015/02/man-made-fibers-continue-to-grow/>
61. Swerea, CelluTex – Motives, <http://www.swerea.se/en/cellutex/motives>
62. Bywater, 2011, The Global Viscose Fibre Industry in the 21st Century – The First 10 Years, Lenzinger Berichte 89 (2011) 22-29
63. Global Viscose Fibre Market Research Report 2017, May 2017, QYR Chemical & Materials Research Center.
64. O16 Analysis Report of Current Chinese Viscose Fibre Market Research and Development Trend Prediction, http://www.cir.cn/R_FangZhiFuZhuang/65/ZhanJiaoXianWeiDeXianZhuangHeFaZhanQuShi.html
65. Villagers of Gutang Village, Lushan District, Jiujiang City Complain about Underlying Sewage Discharge by Jiujiang Jinyuan Chemical Fibre and Jiangxi Datang Chemical to Poyang River, <http://www.ndidu.com/zixunguanzhu/minshengguanzhu/nongyenongcunnongmin/2015-01-13/13969.html>
66. Notice of Administrative Punishment Decision December 2016 (web cache, original has been deleted on its official website), http://webcache.googleusercontent.com/search?q=cache:XAMgCREB-WWJ:www.lsq.gov.cn/xxgk/zfgbml/qjhbjh/zwdt_19667/201612/t20161229_201241.htm+&cd=8&hl=zh-TW&ct=clnk&gl=us
67. Enterprises Directly Discharge Sewage into Poyang Lake in Jiangxi Province, Treatment Plant Completion Date Remains Unknown, <http://china.huanqiu.com/roll/2011-04/1618205.html>
68. Chemical Fibre Plant Shut Down Completely for Polluting Poyang Lake, Penalty of 670,000 RMB Imposed by Environmental Protection Bureau, <http://news.163.com/11/0418/20/71U5456F00014JB6.html>
69. Chemical Fibre Company in Jiangxi Province Ordered to shut down for Constant Law Violations and Causing Pollution in Poyang Lake Within 3 Years, <http://www.hinews.cn/news/system/2011/04/09/012298448.shtml>
70. Video: Chemical Fibre Company in Jiujiang City, Jiangxi Province Secretly Discharges Sewage through Underlying Pipelines, <http://video.sina.com.cn/p/news/c/v/2011-04-08/195661306525.html>
71. Notification of Jiujiang City Environment Polluting Companies Rectification, <http://www.jjwx.cn/2016/1112/274995.shtml>
72. Jiujiang City Environment Polluting Company Black List (II), http://www.jjpb.cn/zwgk/xwdt/gzdt/201509/t20150916_1500517.htm
73. Jiangxi Province Environmental Quality Information Release Platform, <http://111.75.227.203:9180/eipp/flexoutput/index.html>. This monitoring action was conducted by Environmental Protection Department East China Supervision Centre), <http://www.jjwx.cn/2016/1112/274995.shtml>
74. Jiujiang Municipal Environment Protection Bureau Pollution Monitoring Data, <http://www.jjpb.cn/zwgk/zfxgkzl/wryhjjxxgkpt/zlzk/>
75. The Ecologist, Pulp and paper giant - end deforestation!, 20.01.2014, http://www.theecologist.org/News/news_round_up/2244890/pulp_and_paper_giant_end_deforestation.html
76. Canopy, 2016, The Hot Button Issue: Canopy Viscose Report, <http://www.canopystyle.org/assets/The-Hot-Button-Issue-Canopy-Viscose-Report.pdf>
77. Inside Story of Sateri (Jiujiang)'s Vicious Underlying Sewage Discharge, <http://bbs.0513.org/thread-1408386-1-1.html>
78. Jiangxi Lushan District: Sewage Directly Discharged into Poyang Lake, Whose Price to Pay?, <http://www.yidianzixun.com/n/OAxHh-knQ?s=8&appid=&from=timeline&isappinstalled=0>
79. List of Administrative Penalties imposed by Hukou County Environment Protection Bureau in First Half of 2016 (with attachment), http://www.hukou.gov.cn/zxfb/201606/t20160629_72375.htm
80. List of Environmental Administrative Penalties Imposed by Hukou County Environment Protection Bureau in 2015 (with attachment), http://www.hukou.gov.cn/zfxgk/bmxxgk/hjbhj/bmwj_13188/201601/t20160125_70142.htm
81. Jiangxi Liuguo Chemical Industry and 12 Other Companies Fined for Environmental Law Violation, <http://jx.news.163.com/15/1119/10/B8PD9HGL04001509.html>
82. After 3 Months Investigation, Jiangxi Province Polluting Company Punished for Excessive Emission, <http://www.v4.cc/News-1319362.html>

83. Sanyou Chemical Industries Create a "Dead Sea". Solid Wastes Fill Area of 6,000 Basketball Fields, <http://www.nbd.com.cn/articles/2012-05-07/652191.html>
84. Sanyou Chemical Industries Pollution: Sanyou Denies any Water Pollution Activities and Bohai Sea Environment Protection Has Stepped in, <http://finance.sina.com.cn/stock/s/20120518/013012091577.shtml>
85. Netizen's Complaint: Waste Gas Discharge at Night Time, <http://weibo.com/1667553272/AdqHhhvn2?type=reply>
86. Netizen's Complaint: Darkened River Water Near Yuanda Chemical Fibre, http://weibo.com/5752393360/E4Uyebgtk?type=comment#_rnd1488092662453
87. 2015 First Quarter Tangshan City Nation Pollution Sources Enterprises Auto-monitoring Validity Verification (Attachment), <http://tinyurl.com/yabjc2nz>
88. 2016 Second Quarter Nanbao Development Zone Safety Production and Environmental Protection Bureau Environmental Petition Public Information, <http://www.nanpu.gov.cn/system/2016/07/11/010030401.shtml>
89. 2016 Third Quarter Nanbao Development Zone Safety Production and Environmental Protection Bureau Environmental Petition Public Information, <http://www.nanpu.gov.cn/system/2016/10/19/010031825.shtml>
90. Pollution Treatment Plan for Six Polluted Rivers and Polluted Air Zones in Weifang City, <http://www.sdwfeia.com/news/552.html>
91. Information Disclosure Chart of Atmospheric Environment Violations, http://www.sdein.gov.cn/zwgk/gsgg/201409/t20140929_265952.html
92. 2015 Shandong Province Annual Inspection Environment Violation Punishments Chart, http://xxgk.hanting.gov.cn/QHBFJ/201606/t20160624_344401.htm
93. May 2014 Weifang City Nation Pollution Sources Enterprises Auto-monitoring Validity Verification Data, http://www.wfepb.gov.cn/hbyw/hjjce/zdwry/201406/t20140625_703046.htm
94. August 2014 Weifang City Nation Pollution Sources Enterprises Auto-monitoring Validity Verification Data, http://www.wfepb.gov.cn/hbyw/hjjce/zdwry/201410/t20141031_721735.htm
95. November 2014 Weifang City Nation Pollution Sources Enterprises Auto-monitoring Validity Verification Data, http://www.wfepb.gov.cn/hbyw/hjjce/zdwry/201412/t20141222_770128.htm
96. A Few Shandong Stocks Involved in Illegal Discharge and Bring Serious Air Pollution. Next Year Performance at Stake, http://paper.dzwww.com/jjdb/data/20141217/html/1/content_5.html
97. Weifang Municipal Environment Protection Bureau Fined Pollution Company with Multiple Excessive Gas Discharge 600,000 RMB, http://weifang.dzwww.com/wfxwn/201503/t20150311_12016492.htm
98. Hanting Residents Filed Complaints against Polluting Manufacturer, <http://weifang.iqilu.com/wfminsheng/2015/1201/2619881.shtml>
99. http://www.dzshbw.com/news/2016/minsheng_0519/14466.html
100. ST* Helon Still Have Serious Pollution Issue after Special Treatment Rescinded, http://www.dzshbw.com/news/2016/minsheng_0519/14466.html
101. Weifang Municipal Environment Protection Bureau Arranged Talks with CHTC Helon (Weifang) New Materials Co., Ltd., http://xxgk.weifang.gov.cn/shbj/201612/t20161216_1786529.html
102. Unlicensed Production and Serious Pollution, Who Are the Protectors of Silver Hawk?, <http://www.cr-citynews.com/jzzl-liangpeijun.htm>
103. Pollution Treatment Plan Released for Six Polluted Rivers and Polluted Air Zones in Weifang City, <http://www.sdwfeia.com/news/552.html>
104. Gaomi City Focuses on River Basin Pollution Control, <http://news.cntv.cn/20111104/112205.shtml>
105. "Give Back My Clear Blue Sky" <http://weibo.com/ttarticle/p/show?id=2309404003260326348171&mod=zwenzhang?comment=1>
106. Internet users' complaints on Baidu Tieba: <http://tieba.baidu.com/p/2239159561>; <http://tieba.baidu.com/p/1165692831>; <http://tieba.baidu.com/p/4869544983?pid=100472552422&cid=100473071144#100473071144>; <http://tieba.baidu.com/p/4058243165?pid=76192725192&cid=0#76192725192>; <http://tieba.baidu.com/p/1046711622?pid=11857390495&cid=0#11857390495>
107. Barker, C, Important Trends Affecting the Asian Viscose Market, Lenzing
108. QYR Chemical & Material Research Center, 2017, Global Viscose Fibre Market Report 2017, p.55
109. Oxford Business Group, November 2014, Call for incentives as Indonesia aims high in textiles, <http://www.oxfordbusinessgroup.com/news/call-incentives-indonesia-aims-high-textiles>
110. Van Oord, n.d, Expansion of Indonesia's largest container port, <http://www.vanoord.com/activities/tanjung-priok-port-expansion-project>
111. City Population, n.d, Indonesia: Urban Population of Cities, <http://citypopulation.de/Indonesia-MU.html>
112. 113 Maps of all factories locations; <https://www.google.com/maps/d/u/0/edit?hl=en&authuser=0&mid=1TgOmjl28hQHW7hE-br15Lca2mwn8>
113. The Diplomat, Indonesia: The Downside of Decentralization, 05.09.2012, <http://thediplomat.com/2012/09/indonesia-the-downside-of-decentralization/>
114. Law of the Republic of Indonesia Number 32 Year 2009 Concerning Protection and Management of Environment; <http://referensi.elsam.or.id/2015/04/uu-nomor-32-tahun-2009-tentang-perlindungan-dan-pengelolaan-lingkungan-hidup-2/>
115. Ministry of Environment and Forestry - Republic of Indonesia, September 2016, Indonesia's Regulations on the Transboundary Movements of Wastes and The Prevention of Illegal Trafficking of Wastes, http://www.env.go.jp/en/recycle/asian_net/Annual_Workshops/2016_PDF/day1_S1_05_Indonesia.pdf
116. Interview with WALHI West Java
117. Asian Development Bank, October 2014, Cleaning up Indonesia's Citarum Basin, <https://www.adb.org/features/cleaning-indonesias-citarum-basin>
118. Ahmad Ashov Birry, June 2016, This court victory in Indonesia could send shock waves across the fashion world, <http://www.greenpeace.org/international/en/news/Blogs/makingwaves/detox-textile-Indonesia-pollution-court-victory/blog/56615/>
119. Asian Development Bank, October 2014, Cleaning up Indonesia's Citarum Basin, <https://www.adb.org/features/cleaning-indonesias-citarum-basin>
120. The Guardian, Pollution in the Citarum river, Indonesia, 05.12.2008; <https://www.theguardian.com/environment/gallery/2008/dec/05/water-pollution-citarum-river>
121. The President Post, Industry Minister Inaugurates World's Second Largest Textile Factory Expansion, 12.10.2015, <http://www.thepresidentpost.com/2015/10/12/industry-minister-inaugurates-worlds-second-largest-textile-factory-expansion/>
122. ELGI, n.d, Powerful Solutions for Indo-Bharat Rayon, <http://www.elgi.com/wp-content/uploads/Textiles-2.pdf>
123. World Socialist Web Site, Workers Struggles: Asia, 09.01.1999, <https://www9.wsws.org/en/articles/1999/01/lab-j09.html>
124. Ibid.
125. YouTube, Bloody Strike at PT. Indo Bharat Rayon (Aditya Birla Group), 26.02.2013, <https://www.youtube.com/watch?v=LegeTWW2Aw4>
126. Indotextiles, PT South Pacific Viscose Add Investment in Indonesia, 14.03.2017, https://www.indotextiles.com/index.php?option=com_content&task=view&id=4782&Itemid=1
127. Tempo, Tercemar Limbah Pabrik Warga Minta Direlokasi, 31.07.2006, <https://m.tempo.co/read/news/2006/07/31/05880901/tercemar-limbah-pabrik-warga-minta-direlokasi>
128. Republica.co, 03.11.2016, BPLHD Purwakarta Investigasi Penyebab Keracunan Limbah Pabrik, <http://www.republika.co.id/berita/nasional/daerah/16/11/03/og2gku383-bplhd-purwakarta-investigasi-penyebab-keracunan-limbah-pabrik>
129. THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981, <http://googleweblight.com/i?u=http://www.envfor.nic.in/legis/air/air1.html&grqid=IBsJKv&hl=en-IN>
130. THE ENVIRONMENT (PROTECTION) ACT, 1986, <http://envfor.nic.in/legis/env/env1.html>
131. THE WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974, https://googleweblight.com/i?u=https://indiankanoo.org/doc/867156/&grqid=avaR_7lr&hl=en-IN
132. Agrawal, S, 2016, Industrial air pollution control Regulatory Importance in India, Ministry of Environment & Forests Parivesh Bhavan, East Arjun Nagar, Delhi - 110032
133. National Ambient Air Quality standards, 2009, http://www.cpcb.nic.in/National_Ambient_Air_Quality_Standards.php
134. STANDARDS FOR EMISSION OR DISCHARGE OF ENVIRONMENTAL POLLUTANTS, 1986, <http://www.cpcb.nic.in/Industry-Specific-Standards/Effluent/402.pdf>
135. Hazardous Waste Management Rules, 2016, http://www.cpcb.nic.in/HWM_Rules_2016.pdf
136. The Factories Act, 1948, <https://www.ilo.org/dyn/natlex/docs/WB-TEXT/32063/64873/E87IND01.htm>
137. Gokhale-Welch, C, 2009, Toxic Release Inventory for India: A Discussion Paper, Institute for Financial Management and Research, Centre for Development Finance, http://www.ifmrlead.org/wp-content/uploads/2015/OWC/TRI_Report_Finale.pdf
138. Ibid.
139. Grasim Industries Limited website: http://www.grasim.net/about_us/index.htm
140. Grasim Industries Limited website: http://www.grasim.net/products/birla_viscose.htm
141. Govt. of India, Ministry of MSME: <http://dcmsme.gov.in/dips/ujaain.pdf>
142. Nagda Population Census 2011: <http://www.census2011.co.in/data/town/802225-nagda-madhy-pradesh.html>
143. Lanxess India Pvt. Ltd. Nagda: <http://lanxess.in/en/manufactur-ing-sites-india/nagda-site-india/products-nagda-india/>
144. World Heritage Encyclopedia: [http://www.worldlibrary.in/articles/eng/National_Chambal_\(Gharial\)_Wildlife_Sanctuary](http://www.worldlibrary.in/articles/eng/National_Chambal_(Gharial)_Wildlife_Sanctuary)
145. Business Standard Reported, Aditya Birla Group to set up training centre in Mavoor, Kerala, 17.08.2012, http://www.business-standard.com/article/companies/aditya-birla-group-to-set-up-training-centre-in-mavoor-kerala-112081700135_1.html, Grasim Annual report, 2002, http://www.grasim.com/investors/downloads/Grasim_Annual_Report_FY02.pdf
146. 147 The Hindu, Mavoor awaits Grasim resurrection, 18.08.2015, <http://www.thehindu.com/news/national/kerala/mavoor-awaits-grasim-resurrection/article7552509.ece>
147. Suren-dranath C., Justice denied, <http://www.india-seminar.com/2000/492/492%20surendranath%20c.htm>
148. India Today, Pollution: Withering village, December 15, 1981, <http://indiatoday.intoday.in/story/vazhakkad-village-in-kerala-dies-a-slow-death-due-to-effluence-from-grasim-factory/1402489.html>
149. Census of India 2001, Data from the 2001 Census, including cities, villages and towns (Provisional), <https://www.revolvy.com/main/index.php?s=Mavoor>
150. The Indian Express, Apex court tells CBI to probe Birla 'diary' details as per law, 13.10.2015, <http://indianexpress.com/article/india/india-news-india/apex-court-tells-cbi-to-probe-birla-diary-details-as-per-law/>
151. The Indian Express, Appraisal report after raids: Birla text message shows payoff to 'Gujarat CM' in 2012, says Arvind Kejriwal, 16.11.2016, <http://indianexpress.com/article/india/india-news-india/narendra-modi-bribe-arvind-kejriwal-aditya-birla-group-demonetisation-black-money-4377928/>
152. The Times of India, May 2017, <http://m.timesofindia.com/city/bhopal/3-mp-rivers-polluting-ganga-says-central-audit/article-show/58504644.cms>
153. The Free Press Journal, June 2016 <http://www.freepressjournal.in/bhopal/rains-might-help-grasim-to-start-industrial-works-by-june-20/604716>
154. NDTV Profit, Grasim Industries Ltd - Water Shortage at Company's Plants at Nagda (M.P.), 26.11.2011, <http://profit.ndtv.com/news/market/article-grasim-industries-ltd-water-shortage-at-company-39-s-plants-at-nagda-m-p-158768>
155. The Hindu Business Line, Water shortage forces Grasim to shut M.P. plant, 03.07.2012, <http://www.thehindubusinessline.com/companies/water-shortage-forces-grasim-to-shut-mp-plant/article3599021.ece>
156. Business Standard, Water shortage forces Grasim to stop staple fibre production at Nagda plant, 27.04.2015, http://www.business-standard.com/content/b2b-chemicals/water-shortage-forces-grasim-to-stop-staple-fibre-production-at-nagda-plant-115042700488_1.html
157. Business Standard, Water shortage forces Grasim to suspend operations at VSF plant in MP, 06.06.2016, http://www.business-standard.com/content/b2b-chemicals/water-shortage-forces-grasim-to-suspend-operations-at-ssf-plant-in-mp-116060600244_1.html
158. Patrika, 23.04.2017, <http://www.patrika.com/news/ujjain/grasim-and-rural-face-in-nagda-controversy-over-increasing-the-height-of-the-dam-1560292/>
159. Saha J.K. and Sharma, A.K. (2006) Impact of the use of polluted irrigation water on soil quality and crop productivity near Ratlam and

- Nagda industrial area. Agricultural Bulletin:ISS-1, Indian Institute of Soil Science, Bhopal, pp. 26
160. Factsheet on Carbon Disulfide – Agency for Toxic Substance and Disease Registry <https://www.atsdr.cdc.gov/toxfaqs/tfacts82.pdf>
 161. CPCB Air Quality Index, Madhya Pradesh - http://cpcb.nic.in/AQL_Madhyapradeshbh.pdf
 162. Grasim Industries Ltd., September 2016, Pre-Feasibility Report for Expansion of Viscose Staple Fibre, Sulphuric Acid, Captive Power Plant along with Solvent Spun Cellulosic Fibre http://environmentclearance.nic.in/writereaddata/Online/TOR/O7_Sep_2016_170551460EQHERH38PrefeasibilityReport.pdf
 163. Ibid.
 164. Clean Clothes Campaign, Rana Plaza overview, <https://cleanclothes.org/ua/2013/rana-plaza>; <https://cleanclothes.org/safety/ranaplaza/who-needs-to-pay-up>
 165. BBC Online, Has this dress been to more countries than you?, 22.03.2017, <http://www.bbc.co.uk/news/business-39337204>
 166. Interactive map of Marks & Spencer's suppliers available here: <https://interactivemap.marksandspencer.com>
 167. H&M supplier factory list available here: <http://sustainability.hm.com/en/sustainability/downloads-resources/resources/supplier-list.html>
 168. List of Uniqlo core partner factories available here: https://www.fastretailing.com/jp/sustainability/business/pdf/UniqloCorePartnerFactoryList_20170228.pdf
 169. ASOS factory list available here: <https://www.asosplc.com/-/media/Files/A/Asos-V2/documents/factory-list.pdf>
 170. Fashion Revolution, April 2017, Fashion Transparency Index, https://issuu.com/fashionrevolution/docs/fr_fashiontransparencyindex-2017?e=25766662/47726047
 171. Canopy Planet, October 2016, The Hot Button Issue: CanopyStyle update on viscose producers and forests, <http://www.canopystyle.org/assets/The-Hot-Button-Issue-Canopy-Viscose-Report.pdf>
 172. Canopy Planet, One of America's largest apparel conglomerates joins CanopyStyle, 26.02.2017, <http://canopyplanet.org/canopy-media/americas-largest-apparel-conglomerate-joins-canopystyle/>
 173. Canopy Planet, October 2016, Op. Cit.
 174. Ibid.
 175. Freitag, From Fibers to Fabric: <https://www.freitag.ch/en/fabric>
 176. Skunkfunk, Preferred fibers within our clothing collection SS17: <http://www.skunkfunk.com/en/sustainability/conscious-sourcing.php>
 177. Tencel for People Tree: <http://www.peopletree.co.uk/about-us/behind-the-clothes--creative-handicrafts>
 178. Business & Human Rights Resource Centre, France: Natl. Assembly adopts law imposing due diligence on multinationals to prevent serious human rights abuses in supply chains, 22.02.2017; <https://business-humanrights.org/en/france-natl-assembly-adopts-law-imposing-due-diligence-on-multinationals-to-prevent-serious-human-rights-abuses-in-their-supply-chains?page=1>
 179. Novethic, 2017, Devoir de Vigilance, <http://www.novethic.fr/lexique/detail/devoir-de-vigilance.html>
 180. SER (Social and Economic Council Act - Wet op de Sociaal-Economische Raad), 75 signatures endorse Sustainable Garment and Textile Sector agreement, 04.07.2016; <https://www.ser.nl/en/publications/news/20160704-sustainable-garment-textile-sector.aspx>
 181. Partnership for Sustainable Textiles (Bündnis für nachhaltige Textilien), https://www.textilbuendnis.com/images/pdf/20160203/2016_01_Factsheet_Partnership_for_Sustainable_Textiles.pdf
 182. Fox Williams, Modern Slavery Act 2017 – What does it mean for Fashion?, 01.06.2017, <http://www.foxwilliams.com/news/1167>
 183. Joint Letter to the European Commission: High Time to Impose Transparency in the Garment Supply Chain, 27.04.2017, <https://www.hrw.org/news/2017/04/27/joint-letter-european-commission-high-time-impose-transparency-garment-supply-chain>
 184. OECD, A Responsibility Revolution in the Fashion Industry: How OECD's new Due Diligence Instrument can transform the global garment industry, 31.01.2017, <http://oecdinsights.org/2017/01/31/fashion-industry-oecd-due-diligence-instrument/>
 185. Novethic, Le droit à un environnement sain, un droit en devenir, 05.09.2016, <http://www.novethic.fr/empreinte-terre/pollution/isr-rse/le-droit-a-un-environnement-sain-un-droit-encore-largement-ignorer-par-les-entreprises-144031.html>
 186. European Parliament, Textile imports: MEPs push for EU rules to curb worker exploitation, 27.04.2017, <http://www.europarl.europa.eu/news/en/press-room/20170424IPR72039/textile-imports-meps-push-for-eu-rules-to-curb-worker-exploitation>
 187. OECD, Responsible Supply Chains in the Garment and Footwear Sector, <http://mneguidelines.oecd.org/responsible-supply-chains-textile-garment-sector.htm>



Published in June 2017.
For more information visit www.changingmarkets.org