# The Inside Guide to COTTON & SUSTAINABILITY

Second Edition

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*The Inside Guide to*
**COTTON & SUSTAINABILITY**

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# Unravelling the threads

Cotton is a complicated crop with an ancient history and a very uncertain future. We now have a decade to stop runaway climate change, and global soil degradation is worsening. Nor does cotton operate in isolation. It sits in an agricultural economy under multiple pressures: environmental, social, commercial and political. Humankind will need to be very fleet of foot to stave off serious problems in future.

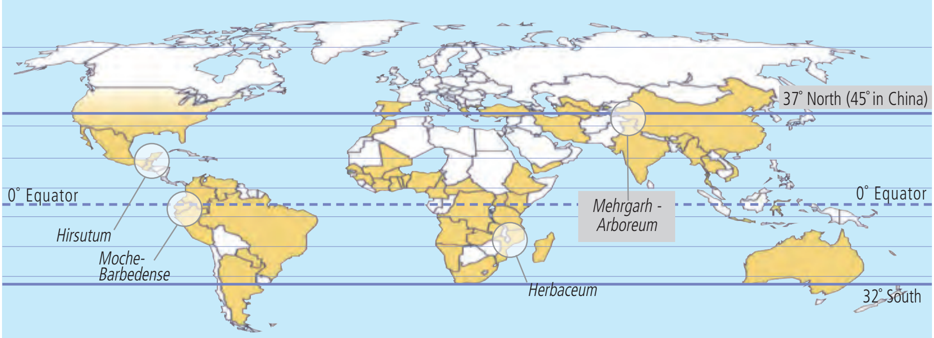
While cotton production is by itself not circular, it can feed into a circular economy that will still need raw materials but must be able to carry on over time while sustaining a wider ecosystem and the associated human economy.

Cotton production, cotton yields and area have been remarkably stable in the past decade even as some of the most damaging practices have been reduced. But there continues to be competition between sustainability initiatives and those making sustainability claims for different types of cotton, complicated by use of poor or misleading data and a lack of consistency in how impacts are assessed. What farmers need may be in conflict with what a cotton buyer wants. Where does corporate responsibility lie: with customers or beyond? With 33 million in Africa vulnerable to climate crisis and famine, this is an existential question. If we don't shift to total responsibility by all for all, then we are +2°C toast.

In 2010, the genesis for the first edition of this guide published back in 2012 was a presentation at a RITE Group Conference in London. But in this newly revised Guide, we ask much bigger questions including whether existing standards and schemes are still fit for purpose – they are, after all, a decades old response in a world that is now fully digital, which makes a more flexible due diligence approach possible.

Crucially, in another 10 years, the window for preventing catastrophic climate change will have closed. Can the cotton industry do enough – do its share – in preventing the inexorable advent of the anthropocene[1], where climate change and biosphere integrity are 'core boundaries' beyond which there is no

### Major cotton growing regions



return if they become too damaged? Cotton production can affect both of these, but it could also mitigate problems if the scale and scope of problem solving is rapid enough.

We identified several future challenges in our first edition of this guide, published back in 2012, and many remain or have grown in importance. Land is finite, and pressure on land is high. Can new developments in robotics and digital data along with new genetic technologies, like gene editing and more investment in overall research, help?

> **“What farmers need may be in conflict with what buyers’ want**

Water remains a point of attack on cotton, frequently without justification. If cotton uses little water compared to many crops, and is drought tolerant, its potential to pollute the water used for passing through the farm system remains high. But the tendency to point the finger at cotton for its overall water use means questions are not asked about specific instances of pollution, or the wide disparity between water use in different areas and regions.

There has been talk of precision agriculture, and climate smart agriculture. However, we have not locked carbon in soil in measurable ways. Soil carbon is not part of carbon credit schemes, and there is little research. Few if any cotton standards and schemes monitor soils or soil carbon, and recommendations on soil management tend to be based on prescription rather than measurement.

The cotton trading sector remains challenging for many producing countries and farmers. Much else still needs addressing: energy, resource constraints, cotton research funding, sustainability funding, government and international regulation, and of course many social and economic challenges.

In the previous edition of this guide we simply could not cover these topics, but since then, new laws have been introduced, including the Modern Slavery Act in the UK, corporate vigilance in France and child labour due diligence in Holland. It is a problem from distant fields in cotton growing countries to finishing factories in wealthy countries. But as the recent side-lining of a UK report on sustainable fashion shows, governments remain short term thinkers extraordinaire, perhaps more so than those businesses who are content to sit and wait to see what others do. And we continue to see global averages and out of date facts being used in campaigning. Global averaging is useless with cotton and means local reality is not addressed. Each distinct cotton region needs to address its own specific problems.

The picture over the past 10 years is not bleak across the board, however. Pesticide and fertiliser use continues to be below the extreme levels of the past, as evidenced by PAN UK research published in 2017.

There are some who would say that cotton growing is not essential in the way food production is, and cotton should give up its 30 million hectares of land. This both ignores the cultural value and history of cotton, but also endorses a notion that we just need to grow more food rather than reduce waste, for example – and just eat whatever someone decides is a suitable global diet. However, cotton remains woven into human history and culture – and will continue to do so for the foreseeable future.

[1] http://anthropocene.info/

## Cotton's vital statistics

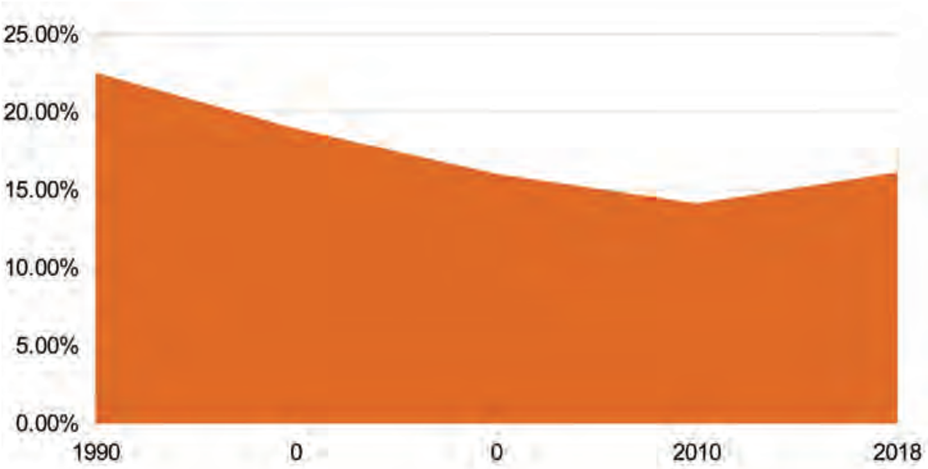
| | | |
|---|---|---|
| Cotton area | 33.08 million hectares (estimated) in 2017/18 | 2015/16: 30.6 million hectares<br>2008/09: 29.99 million hectares |
| Cotton area | 2.1% of global arable land.<br>Cotton area is relatively stable compared to other major arable crops, all of which are increasing in area except maize. | Wheat: 215 million hectares (up from 200m)<br>Rice 154 – 160 million hectares (up from 150m) and maize: 140 million hectares (down 10m)<br>Soy beans: 124 million hectares (up from 90m) |
| Producing countries | 80 | Including USA, China, India, Pakistan, Brazil, Australia, Benin, Burkina Faso, Argentina, Mexico, Colombia, Paraguay, Uganda, Tanzania, Senegal, Ivory Coast, Kenya, South Africa, Uzbekistan, Kyrgyzstan, Greece, Syria etc. |
| People | 26 million farming households [i] (some talk of around 100 million) | 200 to 250 million livelihoods depend on cotton and associated industries and services for lint production (excluding textiles, inputs and machinery manufacture) |
| Global value of cotton lint production and trade | US$52.19 billion (2017/18)<br>US$37 billion (2009/10) | For 22 million tonnes in 2009/10 |
| Percentage of global pesticides sales destined for cotton | 5.7% (2017) | 6.2% (2009) |
| Percentage of insecticides sales destined for cotton | 16.1% (2017) | 14.1% (2009) |
| Percentage of agricultural water used on cotton | 2 – 3% | - |
| Cotton share of global fibres market | 27% (2018) | 33.5% (2010) |
| Average yield (kg/ lint/hectare) | 2018/19: 792 (pro.) | 2007/08: 797<br>2008/09: 767<br>2009/10: 726<br>2010/11: 759<br>2015/16: 700 |
| Annual cotton exports/trade | 8.1 million tonnes (2016/17) | Previously 8 million tonnes |
| Biggest exporter | USA: 3.2 million tonnes | Up from 2.5 million |
| Imports | 8 million tonnes | Around 1/3 of global annual production |
| Biggest importer | Bangladesh 1.4 million tonnes | Previously China: 3.4 million tonnes |
| Additional costs of cotton per tonne if negative externalities included | US $7,266 | Greenhouse gases, supply chain water, nitrate pollution, irrigation water |
| Percentage of cotton that is long and extra long staple | 1.8% down from 3% previously | USA, Egypt, India, China |

*Sources: ICAC 2009, 2010, 2011, McKinsey, UNCTAD, FAO, IRRI, Bremen Cotton Exchange* lint (the fibre that leaves the gin for the spinning mill). The costs of seed cotton include fertilisation and soil fertility management, inputs costs (pesticides, fertilisers), labour, seed, energy and irrigation (where used). In 2010, the ICAC reported an average cost of production for seed cotton of US$0.40, which they estimated gave a cost for lint including CIF (cost, insurance, freight) of US$50-60 per pound.[v]

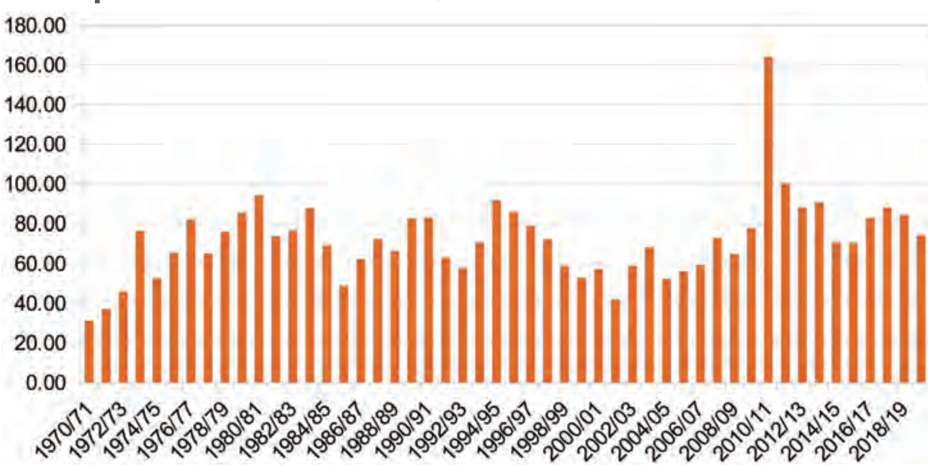
The costs of production are rising for two main reasons, the rising costs of some inputs and the fact that productivity increases in cotton seem to have reached a 'plateau', with yields peaking at 797 kg/ha of lint in 2007/08. Average yield in 2009/10 was 726

## Trends in insecticide use since the 1990s

Source: PAN UK

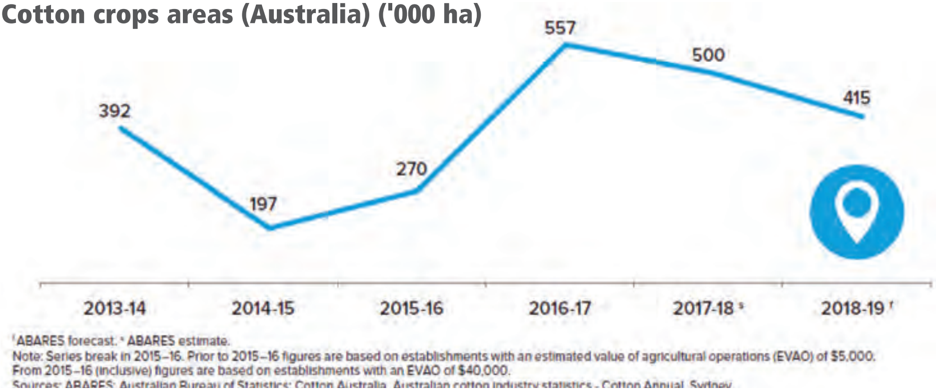



## Cotton prices since the 1970s in US$/Pound




Source: Cotlook A Index prices

## Cotton crops areas (Australia) ('000 ha)




| Core areas of MyBMP – Australia | | |
|---|---|---|
| Area | Detail | # Checklist items |
| Biosecurity | Pest and disease management | 10 |
| Energy and input efficiency | Electricity, fuel and fertilisers | 18 |
| Fibre quality | Ensuring high quality cotton | 14 |
| Human Resources and Work Health and Safety | Management and providing a workplace both safe and in compliance with obligations | 50 |
| Integrated Pest agement (IPM) | Management of pests, weeds and diseases | 30 |
| Sustainable Natural Landscape (Natural Assets) | Managing vegetative and riparian areas on farm | 80 |
| Pesticide Management | Pesticide management, storage and use | 75 |
| Petrochemical Storage and Handling | Fuel, etc. | 32 |
| Soil Health | Soil management | 28 |
| Water Management | Managing water, water storage, and distribution | 67 |
| Source: Cotton Australia, 2014 and MyBMP Factsheet and 2019: Background Paper on Australian Cotton | | |

MyBMP is benchmarked with BCI.[22]

MyBMP is centred on online systems linking growers to information and tools with a view to reducing pesticide use, using water more efficiently and improving soil health. Audits highlight improvements farmers can make, and whether they meet legal obligations and match industry best practice. The auditing process is in three stages, from checking self-assessment to checking progress (after 14 months) and finally verifying continuous improvement (after another 18 months).

There are arranged and random audits.

[22] http://cottonaustralia.com.au/uploads/resources/Cotton_Australia_advocacy_wins_040314.pdf

[23] The Australian Cotton Water Story 2011 http://www.cottoncrc.org.au/industry/Publications/Water

| Quantity of irrigation water per hectare per season | |
|---|---|
| Total water use in irrigated cotton (mm) | Countries — Source ICAC 2017 Crop Production Practices, report by the technical information section |
| 30-60 | China, Israel and Turkey (Adana) |
| 80-140 | Argentina (Chaco), Brazil (Cerrado), Bulgaria and Kazakhstan |
| 240-300 | Pakistan (Punjab), South Africa (Loskpop), Spain (Andalucia) and Turkey (Aegean) |
| 300-500 | Argentina (De Reigo), Colombia (Interior), Egypt and India (Orissa) |
| 650-800 | Australia, India (Central and South), Kyrgyzstan (organic) and Myanmar |
| 800-1,223 | Sudan and Turkey (Sanliurfa) |

reports suggest that the extinction rate has increased 1,000 fold since the industrial revolution, with agriculture accounting for 70 per cent of projected losses in terrestrial biodiversity, according to the latest *SSI Biodiversity policy* brief published in 2017.

## Soils

Biodiversity in soils, and soil degradation are accelerating at alarming levels. Good soils provide the nutrients for good plant growth, and a strong plant will be more resistant to pests as well as to climatic stress. Good soils retain more moisture and require less water under irrigation. However, to date 24 per cent of the 11.5 billion hectares of vegetated land worldwide has 'undergone human induced soil degradation', mostly from erosion, with 12 per cent of crop land lost to farming. [lxxxix xc]

Good soils are also carbon sinks and can lock up tonnes of $CO_2$ and other Greenhouse gases. The trading of soil carbon and greenhouse gas credits could in future be a good source of income for farmers, and would help to make sustainable cotton more competitive, especially if on the reverse poor practices had to pay carbon taxes.[xci]

But good soil and water management is costly. There exist many ways of reducing degradation and improving soil fertility. For example, the use of bunds, contours, barrier plants and crops, agro-forestry, mulch and cover crops can do much to reduce erosion and soil degradation by reducing the damage caused by excess water and run-off, improving moisture retention and reducing wind erosion.[xcii xciii]

The 2015 Soil Atlas (Facts and figures about earth, land and fields 2015, published by Heinrich Boll Foundation and the Institute for Advanced Sustainability Studies) records 300 million hectares of high clay soils in the tropics which are under cotton and grazing where 'cropping is only possible under strict water

24 per cent of vegetated land worldwide has undergone human induced soil degradation.

control.' But often the degradation is in the footprint of consuming nations: Six of the top 10 'land-importing' countries are in Europe: Germany, UK (these two countries need some 80 million hectares a year each), Italy, France, Netherlands and Spain; this means these countries need land to sustain themselves outside their own borders (far more in the case of the UK than its own land area).

However, cotton is salt and drought tolerant, which has benefits and allows it to grow where other crops fail, but it has long been thought of as a soil miner, i.e., as depleting critical resources.

Soil is a living, dynamic ecosystem ... converting dead and decaying matter as well as minerals to plant nutrients...; controlling plant disease, insect and weed pests; improving soil structure with positive effects for soil water and nutrient holding capacity, and ultimately improving crop production. A healthy soil also contributes to mitigating climate change by maintaining or increasing its carbon content. Thus, any business concerned with textiles and a long term business strategy needs to be actively seeking fibres from well managed soils, because making soil takes hundreds to thousands of years to form one centimetre of soil from parent rock, but that centimetre of soil can be lost in a single year through erosion.

Business as usual means '*50,000 square kilometres of soil, an area the size of Costa Rica, is lost each year*', according to the Global Soil Partnership.[15] We have perhaps already reached peak soil, with 25 per cent of agricultural land already seriously degraded.

European Union supported work ('Soil: how much do we value this critical resource? Highlights from recent JRC research') on soil loss estimates that between 2001 and 2012, 35 billion tonnes of soil have been eroded. The report says: "some 7.5 million km$^2$ erosion exceeds the generic tolerable soil erosion threshold." The worst erosion is found in China, Brazil and equatorial Africa, with the most rapid increases in soil loss in sub-Saharan Africa, South America and South-east Asia. In South America, conversion of land for cropping is the main driver of soil loss. Conservation agriculture practices only cover 15 per cent of cropland globally at present. The UN FAO reports that: "an annual loss of 75 billion tons of soil from arable land is estimated to cost about USD 400 billion each year in lost agricultural production."[xciv]

Related to soils, desertification remains a massive problem. The latest World Atlas of Desertification, produced by the European Commission (Office of the European Union, Luxembourg, 2018) says "if lost to degradation, previously productive soils cannot be reclaimed in human timescales."[xcv]

The report also points out that apparent increases in available surface water are temporary, reflecting the loss of glaciers and ice to climate change: "*groundwater depletion threatens sustained agriculture production systems in both developed (e.g. California) and emerging (e.g. India) economies*."

## Seed research

''Public investments in agronomic and seed breeding research and extension services have been important sources of farm productivity growth all over the world' (Tschirley and Kabwe 2007).

Recent years have seen a big shift from public to private investment in agricultural research despite the good track record and

[15] http://www.fao.org/globalsoilpartnership/en/

# Mapping the future

Water and pesticide use are often cited as the most significant environmental impacts of cotton production and while the pesticides issue may be less of a widespread concern nowadays compared with twenty years ago, responsible water use remains high on the agenda.

While environmental challenges are always variable dependent on local agricultural context, and the misuse of pesticides in cotton production still remains a problem in some regions, perhaps the key missing ingredient in moving forwards is traceability – not just for 'sustainable' cotton, but for all cotton.

The industry needs to know exactly where its cotton comes from, where it goes and what impacts it has, especially if we are to monitor and 'price in' negative impacts and reward good behaviour. Ideally, we need this in real time, including impact data. Data to help decide if cotton is good to go in the supply chain and data to decide what kind of price or tax (cut or extra) might go on it.

And in addition to environmental issues, a 2016 benchmarking exercise by 'Know the Chain' did give apparel and footwear a very poor score for transparency when it came to brands addressing forced labour risks within their global supply chains.[i]

Competition and the use of multiple and often incompatible systems makes life difficult, especially where brands use multiple cotton and sustainable cotton sources. Of course, locking people into a unique system also might lock them into a single source of sustainable cotton.

But brands need to be able to correlate and compare to improve their footprints.

# Fields of conflict

A detailed look at new and old biological techniques such as GM and gene editing, but also mechanical interventions such as robotics and information technologies like the use of so-called 'big data' – which holds promise but also poses threats. This relates to the tensions these 'solutions' often lead to between large and small cotton farmers.

Biotechnology is a broad term encompassing traditional plant research and breeding (including hybridisation) as well as approaches based on modification through recombinant DNA (DNA in new sequences) and now gene editing. There are of course differences not only in the techniques but how they are perceived as well as how they work in the field.

*Genetic engineering (n), gene-splicing, recombinant DNA technology: the technology of preparing recombinant DNA in vitro by cutting up DNA molecules and splicing together fragments from more than one organism.*[i]

Genetic engineering refers specifically to the processes involved in gene splicing or recombinant DNA, which allow the introduction of new DNA to organisms. These can then produce new proteins, and so new traits can be incorporated, or existing traits strengthened. It is this area that causes controversy and led to the highly emotive and misleading term 'Frankenfoods' in the 1990s.[ii][iii]

Biotechnology has its origins in 1953 with the discovery by Watson and Crick of the structure of DNA, the double helix. The discovery that genes are arranged in sequences of four chemical bases in different permutations or genetic codes, an alphabet of four letters is at the root of biotech and indeed many advances in medicine, such as the production of insulin.[iv]

Base pairs can be spliced to another piece of DNA – this is the process which supporters of biotech claim to be similar but more precise than what conventional cotton breeders do, while opponents do not accept this, pointing out that DNA from unrelated species can be used in this way. These combinations or re-combinations give us the term recombinant DNA.

Herbicide tolerance and insect resistance are the main cotton traits, often combined today.