**Topic Two: Measuring Sustainability**

In topic 2 we took a closer look at sustainability assessment, metrics and tools. With the help of our topic experts we discovered how sustainability assessment can help facilitate supply chain investment decisions. We decided to focus on the “tier 4” farm-level impacts of materials production, because, although all life cycle assessments differ, it is fairly well accepted that this is the stage of a products life cycle with the greatest environmental impact— in particular water use, greenhouse gas emissions, and land use. It’s also the part of the supply chain brands and retailers have the least connection with and control over (outside of the consumer).

**Overview**

A number of sustainability assessment tools have been developed in recent years which allow farmers, supply chain operators, and other stakeholders to assess the footprint or life-cycle impact of their operations, and identify areas for improvement. The array of tools available can be confusing however as a result of differences in scope, the data sources used, and the time investment required. For example, some tools provide a quick overview of an entire farm and consider only impacts and emissions within the farm gate, whereas others provide a product focused assessment that accounts for emissions throughout an entire product life-cycle.

The limited scope of many of the tools currently available can also limit their usefulness, in particular issues such as water use, soil health, biodiversity, and animal welfare can be left by the wayside due to a primary focus on carbon. There is also a question of applicability; a tool that only considers the effect of activities without taking account of site specific variables, such as soil type, water availability, and cost of resources, can lead to misleading results (e.g. For nitrous oxide emissions and soil carbon sequestration rates). Furthermore, assessments could be improved through encouraging a conversation between farmers, the assessor, and members of the supply chain, throughout the process. Such an approach could foster a more effective approach to sustainability that moves beyond a simple “numbers game” and identifies effective, tailor-made solutions.


“It’s important to consider a range of factors when choosing an impact assessment tool, this can include...


- Laurence Smith, ORC, on choosing the right tool
Farm Footprinting

As awareness of the impact the textile industry has on the environment has increased, it has become more important to measure and monitor that impact accurately and environmental footprint calculators have been developed to address this need. While some include a wide range of environmental resources such as soil, water, and biodiversity, the vast majority however still focus on carbon footprints.

Diagram on the right: demonstrating the typical scope of the system boundaries of a carbon footprint (credit Soil & More) and below showing how carbon is one small piece of the footprint (credit PE International).
PUMA Tier 4 Impacts

PUMA’s pioneering work in Environmental Profit & Loss accounting revealed the significant impact of textile production occurring at “Tier 4” - raw material production.

Over half (57% or €83 million) of all PUMA’s environmental impacts are associated with the production of raw materials (including leather, cotton and rubber) in Tier 4 of PUMA’s supply chain.

Left: PUMA – EP&L results

“The unprecedented PUMA Environmental Profit and Loss Account has been indispensable for us to realize the immense value of nature’s services that are currently being taken for granted but without which companies could not sustain themselves.”

- Jochen Zeitz, Executive Chairman of PUMA and Chief Sustainability Officer of PPR
**Lifecycle Assessment**

There is now a growing interest in footprinting individual product life-cycles. This process attempts to account for all the environmental impacts associated with a product from raw material acquisition through manufacturing, to consumer use and disposal.

“By considering the whole life cycle of a product, incurred environmental impacts can, not only be partially avoided, but be exposed for analysis.”

- Sabine Deimling, PE
Laurence Smith, Senior Sustainability Researcher, Organic Research Centre

Laurence Smith is Senior Sustainability Researcher at the Organic Research Centre, Elm Farm, UK. His work is focused on the development and application of sustainability assessment tools and farm-system modelling. Laurence is also leading a work package within the Defra and Devolved Administration funded Greenhouse Gas Platform and is pursuing a part-time PhD at Cranfield University exploring the impacts of a large-scale conversion to organic farming in England and Wales. The Progressive Farming Trust Ltd trading as the Organic Research Centre is the UK’s leading independent research, development institution for organic agriculture and agro-ecology. It aims to develop and support sustainable land-use, agriculture and food systems, primarily within local economies, which build on organic principles to ensure the health and well-being of soil, plant, animal, man and his environment. Click here for more information on the Organic Research Centre.

Sabine Deimling, LCA Specialist (Agriculture & Forestry Systems), PE International

Dr Sabine Deimling has a master degree in Agriculture Biology and a PhD in Agriculture Science from the University of Hohenheim, Stuttgart. She has over twelve years experience in LCA, specializing in agricultural and forestry systems. At PE International, Sabine is responsible for the renewable resources sector, including agriculture and food production, renewable energy, forestry production, food packaging and material use of renewables. She has experience in setting up databases on renewable materials and has led on the development of specific models within GaBi Software for complex agrarian processes. Sabine is a member of the Technical Working Group “land use change” of the WRI and WBCSD Initiative developing the “Product Life Cycle Accounting and Reporting Standard”.

PE International offers extensive services in the field of sustainability including Life Cycle Assessment (LCA), Design for Environment, Carbon and Water Footprint, Environmental Product Declarations (EPDs), and CSR consultancy. Click here for more information on PE International.
Measuring Sustainability

Two Approaches to Assessing a Farm's Performance

Whole Farm Approach - GHG

LCA

Top Tips

Whole Farm Approach: Use CALM tool (Carbon Accounting for Land Managements)

Why the Whole Lifecycle?
What You Told Us...

During the webinar we ran two polls. The first was to establish if people were already using sustainability assessment tools. The second (which we ran at the end of the webinar) registered people’s interest in using sustainability assessment tools in their business in the future.

Question 1:
Have you used LCA’s or other sustainability assessment tools in your business?

a) No
b) Thinking about it
c) Yes

How you voted....

Question 2:
Do you think sustainability assessment tools could help you better manage your business?

a) No – I can’t see how
b) Possibly
c) Yes – I can see the connect
d) Yes – We already use LCA to guide our business

How you voted....
Considerations When Calculating Impacts

Quick tips from our topic experts:

• Carbon is a great starting point – but there’s much more to take into account when assessing product impact and lifecycles. The goal is to move towards more holistic accounting.

• The scope of an assessment and its process boundaries need to be transparent; what’s in and what’s not must be clearly defined and factored into the interpretation of the results.

• Caution should be applied when extrapolating data from one product lifecycle study and making whole-sector assumptions, or even assumptions about your own supply chain.

• Data needs to be treated as “living” – it will always be in a state of flux in both time and space. Not all variables will be controllable but hopefully metrics improve each year as investments are made to address “hot spots” and improve practices.

• Data must also be set in context and not divorced from local characteristics; such as land, climate, water scarcity, socioeconomic factors and so on.

• Our understanding of how and what to measure, and the dynamics at play between different indicators, is still evolving – for example we know biodiversity is a key element of sustainability but incorporating it into an assessment tool has yet to be mastered.

• Sustainability assessment tools definitely have their place – they can help identify “hot spots” and be a useful way to engage supply chain partners in dialogue, collaborative solution finding, and performance improvement.

• For a fully holistic understanding of sustainability and impact, assessment should include social and economic indicators as well as environmental.
Whole Life Cycle Considerations
In this topic discussion we focus on on-farm impacts and metrics. Equally there are flags raised at other stages of the textile product life cycle including:

- **Textile manufacturing** - This phase of the life cycle can be further broken down into yarn production, knitting and weaving, and dyeing. “Hot spots” include materials bleaching, dyeing, finishing, and accessorising. Considerations also include solid waste, energy use, packaging, and transportation, but the biggest concerns are the many chemicals used and huge amounts of water. Greenpeace has now brought this to our attention via the “detox campaign”.

- **Consumer use** - The choices the consumer makes are hard if not impossible to control. The role of the retailer is through awareness-raising and education. If a consumer washes garments frequently in hot water and excessive detergent, tumble dries, and irons, the environmental impact at this stage of the product life-cycle can be one of the most significant (estimated up to 60%).

- **End of Life** - An interest in the impact at this stage of the product life cycle is leading to innovation in recycling, upcycling, reuse, composting and other ways to both avoid landfill and slow down the use of resources and new materials.

**Farm Level (Tier 4) – Cotton Growing Impacts, Indicators and Ratings**
As mentioned earlier a sustainability assessment needs to take into account site-specific variables, such as soil type, water availability, and cost of resources, etc. The impact of individual farms will also vary depending on choices made by the farmer (and the options available) such as the type of machinery, energy and water sources, and number and type of crops included in the farm system.

**Through the Lenses of the Higg Index**
Note the following comparison is a generalised account only of farm level “hot spots” and best practice. Organic cotton production systems tend to have lower environmental impacts than conventional production methods due to the increased use of natural inputs and ecosystem services (as opposed to the use of synthetic inputs, many made from fossil fuel based resources). Impact can only be truly quantified by carrying out specific on-farm assessment. Textile Exchange is currently engaged in this exercise.
### 1. Chemistry

**Potential Sources & Impacts from Conventional Practices**

- **Direct:** Use of synthetic agrochemicals (pesticides and fertilizers) can result in contamination of biota; aquatic life, flora and fauna. (A link to documentation of pesticides used in cotton production can be found in the Resource Library).

- **Indirect:** Leakage of agrochemicals from storage facilities and spray drift can result in environmental contamination, and increase the risk of human exposure.

- **Indicator(s):** The chemical properties of the pesticides, annual rainfall and its relationship to leaching and runoff ([USDA](https://www.usda.gov)). Fertilizers (NPK): Acidification Potential (AP) and Eutrophication Potential (EP).

**Organic Best Practice / Reduced Impact**

- Organic production greatly reduces the use of synthetic chemicals; avoiding the production, transportation, application of potentially toxic, persistent, and bio-accumulating substances, avoiding exposure to biota; flora and fauna. No defoliants are used at harvest time.

Note, all substances in high quantities or used irresponsibly can be hazardous or impact negatively. Botanicals and other natural products used in organic production (ranging from farmyard manure to sulphur-based fungicides, for example) must be managed responsibly.
2. Energy Use & GHG Intensity (Climate Change)

Potential Sources & Impacts from Conventional Practices
- **Direct**: Fuel use for mechanical pickers, irrigation pumps, and other on-farm vehicles or machinery.
- **Direct**: Land management practices e.g. clearing, stubble burning, poorly managed soils and poorly managed compost can emit GHGs. Soil management practices can influence carbon emissions.
- **Indirect**: Manufacturing and transportation of synthetic agrichemicals results in embedded carbon. Likewise for organic inputs if not locally produced and are shipped from distant locations.
- **Indicator**: Fuel consumption and CO₂ equivalent (methane is 25 times more GHG generating and Nitrous Oxide 298). Some LCA methodologies give cotton a positive or net energy rating due to the energy embedded in the cotton seed).

Organic Best Practice / Reduced Impact
- **Carbon emissions**: Organic cotton is mostly harvested by hand; mechanical pickers are used on bigger farms in the more industrialised regions such as Texas where they rely on the first freeze to defoliate. Chemical defoliants are not used.
- **Carbon sequestration**: Can be more effective in organically managed soils - but the research is inconclusive. Much will depend upon the farming practices such as the type of tillage i.e. conventional, reduced (conservation) or zero tillage.
- **Climate Change**: Increased soil organic matter (that holds or drains water more effectively) can help save crops in times of prolonged dry periods or floods; thus contributing to climate change adaptation.
3. Water Intensity

Potential Sources & Impacts from Conventional Practices

- **Direct**: Diversion of water for irrigation. Cotton thrives in a hot dry climate however water at the right time in the right quantities will boost yields. Water abstraction for irrigation and diversion from meeting other needs (including environmental “in-stream” needs) can be an issue; particularly in water stressed regions. The inefficient use of water due to poor irrigation practices is another concern.

- **Indirect**: Overuse of synthetic (NPK) fertiliser creates nutrient-rich runoff into waterways and may cause acidification and eutrophication / BOD (high biological oxygen demand).

- **Indirect**: Contamination from pesticides. The grey water footprint - due to the need to assimilate agrichemicals.

- **Indicator(s)**: Water footprint - Green water use = rain transpired by the plant, Blue water = irrigation, and grey water = contaminated by agrichemicals.

Organic Best Practice / Reduced Impact

- Organic farming encourages the build up of soil organic matter (SOM); using biomass, compost and farmyard manure etc to increase fertility of soil and its water-holding capacity.

- The majority of organic is rain-fed (~80%) particularly in Africa, parts of India, Latin America, and Texas where water scarcity is an issue, or access to suitable water for irrigation is limited. Rain at the right time, innovative water retention technologies (such as field bunding, water harvesting, micro-catchment management, etc) are critical to maximising yields.
4. Land Use Change / Land Use Intensity

Potential Sources & Impacts from Conventional Practices

- **Direct**: A typical indicator for land use intensity is yield output i.e. the higher the yield per acreage, the “better” the land use rating. However, increased land use intensification often brings with it intensification of inputs and encourages industrialised farming practices.

There is a suggestion that genetically modified seed can increase yields (thus reduce land under production) due to reduced loss of crop to pests. Other research suggests that resistance is developing, that new pest infestations occur, and herbicide levels are still vast. Furthermore Land Use Intensification does not reduce the use of inputs such as water and fertiliser.

- **Indicator(s)**: Land under production. Yield and equilibrium between soil quality and yield.

Organic Best Practice / Reduced Impact

- Land is not necessarily cleared to make way for organic production as it may be for monoculture production (to help maximise yield of a single crop), when using genetically modified seed, and on highly mechanised farms. In organic, border crops or trees are often grown as a refuge for pests, shelter and protection. Best practice is to use/keep local vegetation and native species.

- Due to the mixed cropping approach, use of border crops etc, and the potentially lower yield of organic in some circumstances, land use intensity may not score as well as for conventional production - particularly if “yield/ha” of cash crop/cotton is the only consideration.

- Organic encourages eco-functional intensification. This can lead to greater yield variety, and increase yields of calories and protein (even when the primary cash crop is fiber). This approach can support food and nutritional security in some areas. Improved income and less risk can also result from crop diversification due to a broader market offering.
5. Biodiversity

Potential Sources & Impacts from Conventional Practices

- **Direct**: Land clearing and monoculture.
- **Direct**: Overuse of broad-spectrum and toxic agrichemicals - kills beneficials and soil biota as well as disruptive to ecological balance. There is a rising concern about the effect of neonicotinoid insecticides on bee populations.
- **Indirect**: Genetically modified organisms (GMOs) reduce cultural diversity (seed saving, traditional varieties) as well as crop species diversity.
- **Indicator(s)**: Monitoring of biodiversity (beneficial insects, bees, entomopathogens, birds, etc.) and shelters of biodiversity. (Further work on biodiversity indicators in development).

Organic Best Practice / Reduced Impact

- Biodiversity is often higher on organic farms. Further, organic farming often relies on high biodiversity to maintain an ecological balance to keep soil fertile and to avoid pest outbreaks i.e. use of predatory insects, polyculture, trap crops and vegetative borders to suppress pests.
- Genetically modified organisms (GMOs) are not used in organic agriculture. “Straight” seed varieties (non-GMO, non hybrid) can be saved by farmers, thus contributing to farmer independence, and cultural as well as biological diversity.
6. Waste

Potential Sources & Impacts from Conventional Practices

- **Direct:** Cotton stalks and other biomass removed from the farm is sometimes discarded as waste. Sometimes it is mulched or burnt. Farm practices can influence the extent of GHG emissions.

- **Indirect:** Leaking, discarded or unused agrichemicals (fertilizer, pesticide) and packaging can be a source of waste and pollution – can be solid, liquid, or gas.

- **Indicator(s):** Can result in diffuse or point sources of contamination. See indicators for Chemistry and Water Intensity earlier.

Organic Best Practice / Reduced Impact

- Organic agriculture bans the routine use of toxic, man-made agrichemicals.

- Organic farm systems aim to be “closed loop” as far as possible, meaning the system should reduce external inputs (fertilizer, water, energy) and waste; organic systems also recycle elements (such as carbon and nitrogen) through the system.

Through the lenses of the Higg Index we can expect organic cotton to score well overall. Through the application of Life-Cycle Analysis and other footprinting excersises we can build our knowledge and understanding of impact. Meta-analysis of research can also be a constructive exercise. Textile Exchange is collaborating with other stakeholders to help contribute to this body of knowledge.

For more information on the Higg Index visit: [http://www.apparelcoalition.org/msi/msi-information/msi-environmental-impact-areas.html](http://www.apparelcoalition.org/msi/msi-information/msi-environmental-impact-areas.html)

“What is given by the land should be returned to the land.”

- Ancient Maori Proverb
Resource Library  Sustainability Assessment Information & Tools

Below is a list of sustainability assessment guidelines, tools, and a small number of consultancy organisations/companies and documented research – this is by no means an exhaustive list. Nor is it intended to be a preferred supplier list. The small number of consultancies listed here are ones who have supported this program by kindly providing information for our topic write-up.

Agriculture & Industry Assessment Frameworks, Guidelines & Standards

- **Sustainable Agriculture Network**: [http://sanstandards.org/sitio/](http://sanstandards.org/sitio/)
Sustainability Assessment Tools, Software & Consultancy Services


- **Organic Research Centre:** Public Good: Farm Sustainability Tool assesses performance against 11 spurs, covering a range of environmental, economic and social criteria (ORC) [http://www.organicresearchcentre.com/?go=Research and development&page=Resource use and sustainability&i=projects.php&p_id=20](http://www.organicresearchcentre.com/?go=Research and development&page=Resource use and sustainability&i=projects.php&p_id=20)


- **Soil & More:** Carbon & Water Footprints [http://www.soilandmore.com/](http://www.soilandmore.com/)

- **Sustainable Food Lab:** Commissioned the Cool Farm Tool [http://www.sustainablefoodlab.org/](http://www.sustainablefoodlab.org/)

Sustainability Assessments  Research on Organic & Other Materials

- **Accenture:** Life Cycle GHG Assessment of Organic Cotton Value Chain 2012 (Chetna / Armstrong value chain, India)


- **Carbotech:** Life Cycle Assessment of Rémi AG- Organic Cotton Textiles 2008

- **Carbon Trust Footprint Company:** Continental Clothing Earth Positive 2011 [http://www.continentalclothing.jp/pdf/EarthPositive%20Apparel%202011.pdf](http://www.continentalclothing.jp/pdf/EarthPositive%20Apparel%202011.pdf)

- **Cool Earth:** Executive Report: Carbon, Water, & Waste Profile Footprints 2011 (Pratibha, India)

- **ECOS:** Switcher Climate Project: CO2-neutral T-Shirt 2006

- **FiBL:** The Impact of Organic Cotton Farming on the Livelihoods of Smallholders, Evidence from the Maikaal bioRe project in central India, 2005
**Sustainability Assessments**


**Company Led Environmental Assessment & Reporting**


**NGO / Trade Association Research**


**Helvetas**: Frank Eyhorn, The viability of cotton-based organic farming systems in India, 2007

**Helvetas**: Jens Soth, Organic cotton and climate change, 2009

Textile Industry Working Groups & Assessment Tools

- **Nike:** Materials Sustainability Index [http://www.apparelcoalition.org/storage/Nike_MSI_2012_0724b.pdf](http://www.apparelcoalition.org/storage/Nike_MSI_2012_0724b.pdf)
- **Outdoor Industry Association:** EcoIndex (evolved into Higgs Index) [http://www.outdoorindustry.org/responsibility/indexes/index.html](http://www.outdoorindustry.org/responsibility/indexes/index.html)
- **Sustainable Apparel Coalition:** Higg Index [http://www.apparelcoalition.org/msi/](http://www.apparelcoalition.org/msi/)
- **Sustainability Consortium** (clothing, footwear, textiles sector working group) [http://www.sustainabilityconsortium.org/clothing-footwear-textiles/](http://www.sustainabilityconsortium.org/clothing-footwear-textiles/)

**TE Blog**

For more comments from Textile Exchange on organic cotton metrics and links please visit the Textile Exchange blog series on The Eco-Index and Organic Cotton

- Eco-Indexing Organic Cotton
- The Organic advantage through the lenses of the Eco-Index - Waste
- The Organic advantage through the lenses of the Eco-Index - Toxics
- The Organic advantage through the lenses of the Eco-Index - Biodiversity
- The Organic advantage through the lenses of the Eco-Index - Land Use Intensity
- Life Cycle Assessment: an effective or overly complex solution?
Creating a Learning Community at Textile Exchange

Textile Exchange aims to create an inclusive learning community; drawing on the expertise and experiences within this community to share and promote a collaborative learning environment. Our hope is that there will be learning to be gained from within and also from outside our immediate networks. Collaborative Learning breaks down the barrier that can exist between teacher (or expert) and pupil (or learner) to result in a truly two way exchange of information.

In this Series, each of the 6 topics includes:
• A thought starter blog and links to further reading
• A webinar introduced by our topic leaders where the contributions by learning participants will be a vital part of the exchange
• We hope that our Collaborative Learning Series will be an incubator for ideas, and can naturally lead into pre-competitive collaboration where the whole industry benefits. At the same time individuals within participating companies can improve their skills and knowledge, feeding this back into their workplace.

http://farmhub.textileexchange.org/learning-zone/collaborative-learning-series