Cotton & Water: Understanding Metrics & Use in Industry Tools

PART TWO
With hundreds of easily searchable resources, we’re your go-to textile tool for discovering what’s possible with cotton.

cottonworks.com
Type your questions in the Q&A window at any time during the webinar.

Find the presentation slides and other resources at cottonworks.com at the conclusion of the webinar.

Please turn off your pop-up blocker to participate in this webinar.
Cotton and Water
Cotton’s Global Water Use

Cotton production uses 3% of the world’s agricultural water

Drought Tolerance

Tap Root Development
Seasonal Water Use - Arizona

Seasonal Water Use (cm)

- Sweet corn
- Broccoli
- Soybean
- Barley
- Sorghum
- Flax
- Navel Oranges
- Sugarbeets
- Bermuda Lawn
- Castor Beans
- Safflower
- Blue Panic Grass
- Alfalfa

USDA, ARS CR Report #29
• 60% of U.S. cotton land requires no irrigation
• Only 4% of land is fully irrigated
Cotton's Agricultural Water Summary

• Relative to other crops, cotton is not an excessive water user.

• It is heat and drought tolerant, so it can be grown in water limited regions.

• Modern technologies have greatly increased cotton productivity and decreased cotton's irrigation water use.

• Based on current research progress, the trend towards increased water productivity will continue.
Water Metrics
In the last century, our use of water worldwide has grown at more than twice the rate of human population growth.
How do we interact with water?
Water Cycle

Source: https://www.noaa.gov/education/resource-collections/freshwater/water-cycle
Interactions with Water

Water Use/Water Withdraw

Water that has been withdrawn or required for a process/product regardless of whether it is returned or removed from the watershed.

Water Consumption

Withdrawn and removed from a water basin through evaporation, imbedded in a product or through other means.
Water “Consumption” vs. “Use”

**Power Plant Example**

**Consumption** = water that evaporates and is not returned to the river.

**Use** = withdraw = All water that goes into the power plant.
Water Consumption and Use Hotspots Cradle to Grave

• Collared shirt
  • ~87% water consumption in seed to bale
  • ~14% water use in seed to bale

Water Consumption vs. Use

How do we measure the impacts of our interactions?
Methods for Measuring Impacts

1. Water footprint (WFP)
   waterfootprint.org/en

2. Available water remaining (AWARE)
   wulca-waterlca.org/aware.html
Water Footprints: Blue, Green, and Grey
The water footprint of a product is an empirical indicator of how much water is consumed, when and where, measured over the whole supply chain of the product.
**Water Footprint Network**

**Green water footprint**
- Volume of rainwater evaporated or incorporated into product

**Blue water footprint**
- Volume of surface or groundwater evaporated or incorporated into product

**Grey water footprint**
- Volume of water needed to assimilate pollution

Source: Water Footprint Network
Available WAter REmaining (AWARE)

Asking the Right Question…

What is the potential of depriving another user of water (human or ecosystems) when consuming water in this area?

Developed by a multi-stakeholder initiative
Water Use in Life Cycle Assessment (WULCA)

wulca-waterlca.org/aware.html
ISO 14046 Water Footprint Guidance

• Should be life-cycle based
• Could be “stand-alone” or part of a full life cycle assessment
• Results should include impact assessment (volumes not sufficient) and address regional issues
• Both quantity and quality should be considered
• Comprehensive impact assessment related to water
• Can result in one or several indicators

Source: Anne-Marie Boulay, CIRAIG; Samuel Vionnet, Quantis, San Francisco, 10-8-2014
Why Location Matters

Annual Mean Total Precipitation

Source: https://celebrating200years.noaa.gov/visions/climate/image4.html
**Impact Assessment: Characterization**

**Characterization factor:** factor derived from a characterization model which is applied to convert an assigned life cycle inventory result to category midpoint indicators and to category endpoints [ISO 14044:2006E]

Source: [http://www.epa.gov/RDEE/energy-resources/calculator.html#results](http://www.epa.gov/RDEE/energy-resources/calculator.html#results)
Relating Water Consumption to Impacts

Relative User Deprived Potential

\[ m^3 \text{ of water equivalents} \times \text{Quantity of water removed from watershed} \times \text{Characterization factor} \]

Characterization factor is related to water stress.

Sources:

AWARE Characterization Factor (CF)

- Unused water remaining = (Availability - Demand)
- Demand includes
  - Human requirements
  - Aquatic ecosystems
- CF maximal value when Demand > availability

<table>
<thead>
<tr>
<th>Characterization Factor</th>
<th>Value of 1</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Higher value</td>
<td></td>
</tr>
</tbody>
</table>

More water Remaining

Less water Remaining
AWARE Characterization Factor

• Characterization factors in water remaining per area per time
  • Value of 1 = world average
  • Value <1 water less scarce than world average
  • Value >1 water more scarce than world average

• Upper cutoff of 100
  • Represents 38% of the world consumption

• Lower cutoff of 0.1
  • Less than 1% of world consumption

Sources:

AWARE Characterization Factors

Sources:

# Method Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>WFP</th>
<th>AWARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes blue water</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Includes green water</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Includes gray water</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Focuses on water consumption</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Inventory data includes water volume</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Accounts for water availability in a region</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Accounts for water scarcity/stress in a region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High resolution inventory data</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Inventory data separates geographic regions</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Addresses water quality</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Measures water impact</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Takes into account both human and ecological needs</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Created with LCA framework and ISO standards</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Includes a characterization factor</td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Sources:
Water and Higg MSI
Higg Index Impact Categories

- Global warming potential (kg CO2 eq.)
- Eutrophication (kg PO4 eq.)
- Water scarcity (m^3 H2O eq.)
- Abiotic depletion (MJ eq.)
- Chemistry (certifications)

Higg Single Score Method

- Emissions flows divided by normalization factor then multiplied by a weighting factor
- All impact categories weighted equally

### Objective
- Emissions environmental flows

### Subjective
- Mid-point impact
- Several impact values
- Tradeoffs exist
- No clear best option

- Single score
- One value
- Clear winner

Higg MSI Methodology

Is water consumption as important as...

- Climate change?
- Fossil fuel use?
- Water quality?

Higg Material Sustainability Index

For 1 kg Cotton

<table>
<thead>
<tr>
<th>Impact area</th>
<th>MSI Score</th>
<th>Midpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Warming</td>
<td>2.2</td>
<td>2.1711 kg CO₂ eq</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>9.1</td>
<td>0.0091 kg PO₄⁻³ eq</td>
</tr>
<tr>
<td>Water Scarcity</td>
<td>-47.6</td>
<td>1.4409 m³</td>
</tr>
<tr>
<td>Abiotic Resource Depletion, Fossil Fuels</td>
<td>1.7</td>
<td>22.6769 MJ eq</td>
</tr>
</tbody>
</table>

Total Points 60.6


These results were calculated using the Higg Materials Sustainability Index (Higg MSI) developed by the Sustainable Apparel Coalition (SAC). The Higg MSI assesses impacts of materials from cradle-to-gate for a finished material (i.e. to the point at which materials are ready to be assembled into a product). The Higg MSI scores or percent calculations provided herein account for a single production stage within the Higg MSI scope (e.g. fiber or raw material). They do not provide a holistic view of the impacts involved with material production. SAC does not verify results of user customized materials.
Water Consumption Vs. Use

Caution in Interpretation of Higg MSI

• MSI Score are reported in “points” which are based on subjective weighting

• MSI points do not have a physical meaning

• Higg MSI assumes all 4 impact categories are equal in importance

• Water footprint and use is not considered in MSI
  • Advantages textile processing and energy intensive fibers

Other Limitations...

Full webinar on plastic leakage by Quantis at Cottonworks™
Conclusions

• Cotton is a drought tolerant crop and uses only 3% of the agriculture water and 3% of agriculture land
• Water used for cotton cultivation is cycled through the natural water cycle and is not “lost” or destroyed
• Both water consumption and water use are important measures
• Irrigation drives water consumption, but textile processing and consumer use drive water use scores
• Higg MSI scores are based on the AWARE method and report m³ water equivalents and not actual water use/consumption
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Cotton Sustainability

Topics > Sustainability > Cotton Sustainability

Recycled Cotton
The use of recycled materials is a growing topic of interest. Recycled cotton can find new life in many different products.

Biodegradability of Cotton
What happens when your favorite cotton shirt finally reaches the end of its functional life? Explore this natural fiber's ability to biodegrade.

Life Cycle Assessment of Cotton
This presentation will identify key impact areas and elaborate on environmental benchmarking for cotton.

Consumer Perceptions
Explore consumer perceptions relating to cotton and cotton sustainability using ongoing research from Cotton Incorporated.

Cotton LEADS™
The Cotton LEADS™ program strives to make sure cotton is produced responsibly now and for years to come.

U.S. Cotton Traceability
Learn about what makes U.S. cotton stand out from the rest with 100% traceability.

Interested in sharing this content with a colleague?

Find this webinar and more at cottonworks.com/sustainability.
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Submit all final questions now using the Q&A box on your screen. Please take our brief survey on today’s presentation prior to exiting the webinar.