Agenda 2030 and Product Development
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Material och Produktion
Sweden 2018: collapsing glaciers, forest fires, drought and emergency slaughter
Fashion for Global Climate Action

The recent Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5°C highlights the urgency and scale of action required to keep the planet safe. On the brink of dangerous climate change,
Global Warming Potential

The ocean must have occurred several centuries ago, as力争 became increasingly scarce in the Atlantic. This idea is that it is also consistent that humans may have been infected through contact with imported m. Agra, as these animals were prized for their fat and meat in human times (3). Our findings show that further surveys of animal reservoirs of syphilis itself are warranted, because economic factors from such reservoirs may contribute to the insufficiency stubborn plagues in the incidence of the human syphilis pandemic degree effect and widespread treatment with multiple therapy.

REFERENCES AND NOTES
2. D. N. Denning et al. (eds), Medical Microbiology, 6th Edition. 2015.

ARCTIC SEA ICE

Observed Arctic sea-ice loss directly follows anthropogenic CO₂ emission

Dirk Nottebohm1 and Julienne Stroeve1,2

Arctic sea ice is retreating rapidly, making prospects of a future ice-free Arctic Ocean during summer because climate model simulations of the sea ice loss offer a substantially, we used a robust linear relationship between monthly mean September ice area and cumulative carbon dioxide (CO₂) emissions to infer the future evolution of Arctic summer sea ice area.

The observed linear relationship implies a sustained rate of 3 ± 0.3 square meters of September sea ice area per metric ton of CO₂ emission. On the basis of this sensitivity, Arctic sea ice will be lost throughout September for an additional 1000 gigatons of CO₂ emissions. Most models show a lower sensitivity, which is possibly linked to an overestimation of the modeled increase in incoming longwave radiation and of the modeled transient climate response.

The ongoing rapid loss of Arctic sea ice has far-reaching consequences for climate, animal, and human activities alike. It includes rapid warming of the Arctic (1), possible breakdown of sea ice leads to mid-latitude weather patterns (2), changing habitats for flora and fauna (3), and changing prospects for human activities in the high north (4). To understand the consequences of these changes and their possible future manifestation, we need to understand the sensitivity of Arctic sea ice evolution to changes in the radiative forcing conditions. However, assessing this sensitivity has proven challenging. For example, climate model simulations differ widely in their emission of the loss of Arctic sea ice for a given trajectory of anthropogenic CO₂ emissions. Although in the most recent Climate Model Intercomparison Project 5 (CMIP5) (4), some models report a near-zero Arctic during the summer (5). Other models show an substantial amount of ice remaining in the next century or even for an external forcing based on large-scale anthropogenic CO₂ emissions as described by the Representative Concentration Pathway 8.5 (RCP 8.5).

To robustly estimate the sensitivity of Arctic sea ice to changes in the external forcing, we take five model simulations, using the Community Atmosphere Model (CAM), and the Community Land Model (CLM) (6). These models are fully coupled to account for interactive ice-ocean and ice-land feedbacks. We use bias-corrected simulations of the Coupled Model Intercomparison Project 5 (CMIP5) to provide a robust estimate of the sensitivity of Arctic sea ice to changes in the radiative forcing conditions.
We need to get climate neutral
- and ~90% of climate impact is caused by fossil fuels…

References: BP, Plastics Europe and Oerlikon
Excuse me: is this plastic spoon recyclable?

LCA differentiates between BIG and small issues…
2011-2019

~11 million euros

Multi-disciplinary team for multi-disciplinary solutions

- vision -

enable a systemic change in the Swedish fashion industry leading to sustainable development of the industry and society
Life cycle assessment (LCA)
Environmental impact from textiles in a life cycle perspective
Environmental impact from textiles in a life cycle perspective – catching all the relevant environmental aspects

Fibre production

Yarn spinning

Weaving / knitting

Wet treatment

Garment making

Retail

Use

Disposal

smog

climate change

acidification

resources

toxicity

Environmental aspects:

- Smog
- Climate change
- Acidification
- Resources
- Toxicity
Environmental impact of the Swedish yearly fashion consumption
(from 2015 - updated version will be released in April)

Fibres = fat, sugar and proteins!!!

http://mistrafuturefashion.com/shifting-the-focus-from-fiber-to-process/
Conclusion from scientific facts: There are no "sustainable" or "unsustainable" fibres! It is the suppliers that differ!
With one exception? In the future, what will conventional cotton cultivation look like?
The Aral sea disaster...
But, the sea's depth increased from 30 meters in 2003 to 42 meters in 2008.

The Kok-Aral Dam was built in 2005
Många gifter kvar i dina kläder

Tuentsals kemikalier användes vid klädkontaktnings. Forskare vid Stockholms universitet har nu undersökt om kemikalier också finns kvar i kläderna vi köper. Flera hälsofarliga ämnen identifierades och inte ens ekologisk bomull är en garanterad giftfri textil.

I den nya arbetenheten har 60 päpitr från svenska och internationella klädkedjor testats.

En första analys lätta tuentsals kemikalier i kläderna och ett hundraltal identifierades problematiska. Flera av ämnenas fanns inte med på tillverkarnas listor och mållevägen var biforolster, restprodukter eller tillkomma under transport.

Att exponera för dessa kemikalier ökar risken för hudallergier, men de kan vara relaterade till mer allvarliga hälsovård och miljöeffekter. Några av de identifierade kemikalier är mutagener eller beväst cancergivande, samt giftiga för
Most Bangladesh mills ignore effluent treatment

108 out of 466 facilities had WWTP
Only 56 were being used…
Beer et al. No increase in marine microplastic concentration over the last three decades – A case study from the Baltic Sea, 2018

• **First** long term study (more are needed)
• Microplastics have been present in the Baltic environment and the digestive tracts of fishes for decades, the levels have **not changed** in this period.
• Microplastic pollution **may be more closely correlated to specific human activities in a region than to global plastic production and utilization as such.**
Effects?

- Particle effect
- Chemical effect

Mikrostora plastpartiklar kan INTE gå genom cellväggar!!! (men nanostora kan)
Results from MinShed

Sorbed vs textile concentrations

- Textile additive
- Sorbed pollutant

µg/kg

MinShed
Which fibre to select?

Biobased economy: "skip the fossil ones" (but use also renewable fuels!)
Which fibre to select?

Slow fashion: "use synthetics with long life span"
Which fibre to select?

Non-toxic environment: “skip the cotton”
Which fibre to select?

Circular economy: “use recycled or bio-based”
Differ between Market substitution vs. Technical substitution

- **Cotton**
  - Only market substitution possible for the foreseeable future
  - There are LOTS of alternatives but look out for green-washing!

- **Polyester**
  - Technical substitution: bio-based or recycled ”drop-in” solutions have the same performance
  - Market substitution also an option
Climate impact expressed as kg CO₂ equivalents and calculated for a hypothetical average garment of 0.5 kg. A doubled life length, from 30 uses of the garment (left) to 60 uses of the garment (right), decreases the climate impact by 48% - from 14.7 to 7.6 kg CO₂-eq. Modified from Roos et al. (2015).

Most important recommendation: Optimise the life span!
FIGURE 1: GROWTH OF CLOTHING SALES AND DECLINE IN CLOTHING UTILISATION SINCE 2000

INDEX 100 IN 2000  NUMBER OF TIMES AN ITEM IS WORN

WORLD GDP  CLOTHING UTILISATION

CLOTHING SALES

-50bn units (2000)

>100bn units (2015)

2x


1  Average number of times a garment is worn before it ceases to be used

Can we live within the Doughnut?

Solve the function more effectively!

Production focus

Total environmental impact

Environmental impact

\[
\text{Total environmental impact} = \frac{\text{Environmental impact}}{\text{Product}} \times \frac{\text{Number of products}}{\text{Person}} \times \text{Amount of people}
\]

(Commoner, 1972; Ehrlich and Holdren, 1972)

Consumption focus
Vision:
In 2030, we foresee that there is less volumes of textiles produced per capita (9 boxes instead of 11).

But, those that are produced, are done so with much less impact per produced garment.

In addition, garments will have better quality, which prolongs the life length and increases the revenues at first, second and subsequent sale points.
Outlook on on-going initiatives

LCA

not LCA
Trend towards less greenwash and more fact-based communication
"Mistra Future Fashion has proposed promising chemical assessment methodologies to the Sustainable Apparel Coalition. This work can lead to a better understanding of the apparel industry's toxicity impacts. While the complexities associated with textile chemistry are significant, we are hopeful that Mistra's methodology may further enhance the Higg Index in the future."

Julie Brown, SAC Director, Higg Index

Status:
The proposal to integrate chemicals data into Higg Index was approved by the SAC members at the May meeting in Vancouver. The project will be carried out during fall 2019.
# Garment ecodesign checklist

**LARGE IMPACT** and *small impact* indicated

<table>
<thead>
<tr>
<th>Action</th>
<th>Climate</th>
<th>Water</th>
<th>Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increase life span</td>
<td><strong>IMPACT</strong></td>
<td><strong>IMPACT</strong></td>
<td><strong>IMPACT</strong></td>
</tr>
<tr>
<td></td>
<td><strong>NUMBER OF USES</strong></td>
<td><strong>NUMBER OF USES</strong></td>
<td><strong>NUMBER OF USES</strong></td>
</tr>
<tr>
<td>2. Better production technology</td>
<td>LESS ENERGY</td>
<td>LESS WATER USE</td>
<td>WASTE WATER TREATMENT</td>
</tr>
<tr>
<td>3. Better energy sources</td>
<td>LESS FOSSIL FUEL</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Better chemicals selection and reduction of chemicals’ use</td>
<td>LESS CLIMATE IMPACT</td>
<td>LESS POLLUTED WATER</td>
<td>LESS TOXICITY</td>
</tr>
<tr>
<td></td>
<td><strong>IMPACT</strong></td>
<td><strong>WATER</strong></td>
<td></td>
</tr>
<tr>
<td>5. Better materials</td>
<td>-</td>
<td>LESS WATER USE</td>
<td><em>less toxicity</em></td>
</tr>
<tr>
<td>6. Avoid microplastics</td>
<td>-</td>
<td>less polluted water</td>
<td><em>less toxicity</em></td>
</tr>
<tr>
<td>7. Optimise transport and packaging</td>
<td><em>less fossil fuel</em></td>
<td>-</td>
<td><em>less toxicity</em></td>
</tr>
</tbody>
</table>
1. Increase the life span!

A. Analyze which factor(s) decides the life span:
  • Do you know how many times does the average customer use the garment?
  • Do you analyse return causes? (both unused garments and claims made after use)

B. Improve by:
  • Make the design more timeless/classic
  • Guarantee the life length (minimum 10 years?)
  • Use fibers with good durability
  • Use dyestuff with good durability
  • Select better options for parts that are likely to be worn out first:
    • Zippers
    • Reflecting tapes
    • Optimal colour for gussets, collars and other sensitive parts (shade/dyestuff)
    • Childrens’ trousers (knee)
  • Provide spare buttons and other trims (often simpler if trims are standardized/carry over)
  • Offer mending services for customers
  • Take back and resell garments second-hand
2. Better production technology

A. Improve efficiency:
   • Reduce cutting rates
   • Reduce rework

B. Improve by:
   • Use solution dye / dope dye / spin dye / e.dye technology (no rework, colour match between batches)
   • Automated dosing systems
   • Waste water treatment plant (WWTP) with mechanical, chemical and biological treatment

C. Select suppliers that:
   • Keep their waste water treatment plant (WWTP) turned on (also after audits…)
   • Offer transparency regarding
     • Sub-suppliers
     • Energy use and sources
     • Social sustainability and labour conditions
3. Better energy sources

A. Drive change at your suppliers’ facilities to more sustainable energy sources:
   - Solar panels or wind turbine installation
   - Use of biofuels
   - Electric trucks at warehouses

B. Select suppliers that are already using better energy sources:
   - E.g. at Laos, high amount of water power

<table>
<thead>
<tr>
<th>Global warming potential for different electricity sources (g CO₂-eq./kWh*)</th>
<th>Global warming potential for state grid electricity in different countries (g CO₂-eq./kWh*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal power plant 1,057</td>
<td>China 1,140</td>
</tr>
<tr>
<td>Oil power plant 916</td>
<td>Korea 638</td>
</tr>
<tr>
<td>Natural gas power plant 600</td>
<td>Laos 211</td>
</tr>
<tr>
<td>Wind power plant 14</td>
<td>Lithuania 195</td>
</tr>
<tr>
<td>Solar panel 84</td>
<td>Sweden 11</td>
</tr>
</tbody>
</table>

*gram carbon dioxide equivalents per kWh
4. Better chemicals selection and reduction of chemicals’ use

A. Phase out (unless essential use):
   • Persistent organic pollutants (POP)
   • Durable Water Repellent treatment – use fluorine/silicon free unless PPE* applies
   • Antibacterial treatment – why?
   • Transport fungicide – keep dry and cool instead

B. Improve by:
   • Use solution dye / dope dye / spin dye / e.dye technology
   • Reduce rework
   • Automated dosing systems
   • Are there any unnecessary effect chemicals in the garments? (softeners, “easy care” etc.)

C. Select suppliers that:
   • Offer safety data sheets
   • Offer transparency about what chemicals they use
   • Have a good chemicals management work in place

*Personal Protective Equipment Regulation (EU) 2016/425
5. Better materials

A. Replace conventional cotton:
   • Can you use e.g. 50/50 forest fibre and cotton fibre?
   • Can you use polyester instead?

B. Select sustainable fibres:
   • Set the fibres’ life-cycle performance at centre stage – including their fit-for-purpose and effects on subsequent production, user behaviour and end-of-life options.
   • Avoid GMO cotton
   • Use fibres with good durability
   • Use fibres that can be solution/dope dyed
   • Watch out for green-wash!

C. Avoid unnecessary materials:
   • Are there any unnecessary functions in the garments?

D. Standardize trims, attachments, hang tags etc.:
   • Increase control for “high risk” materials
   • Simplify exchange of buttons etc. in the use phase.
6. Avoid microplastics

A. Reduce microplastics generation in the production of the garment:
   • Are there any unnecessary brushing operations?
   • Use laser or ultrasound cutting if possible

B. Reduce the amount of microplastics being carried by the garment:
   • Ensure good air quality in the facilities
7. Optimise transport and packaging

A. Reduce air freight:
   • Can there be a total ban of air freight in the company?

A. Reduce anti-mould agents (fungicides):
   • Pack and store in dry conditions
   • Keep dry and cool
   • Unpack as soon as goods arrive
     (humidity, temperature and time drives mould growth)

B. Optimise packaging materials:
   • Make sure the packaging does its work and protects the goods
   • Reduce the size of the packaging
   • Do not use hazardous chemicals
Thank you!!!

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