

A Technical Look at Material Development with Sustainability in Mind

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Textile & Apparel, Technology & Management

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Footwear Materials & Innovation Summit

Footwear

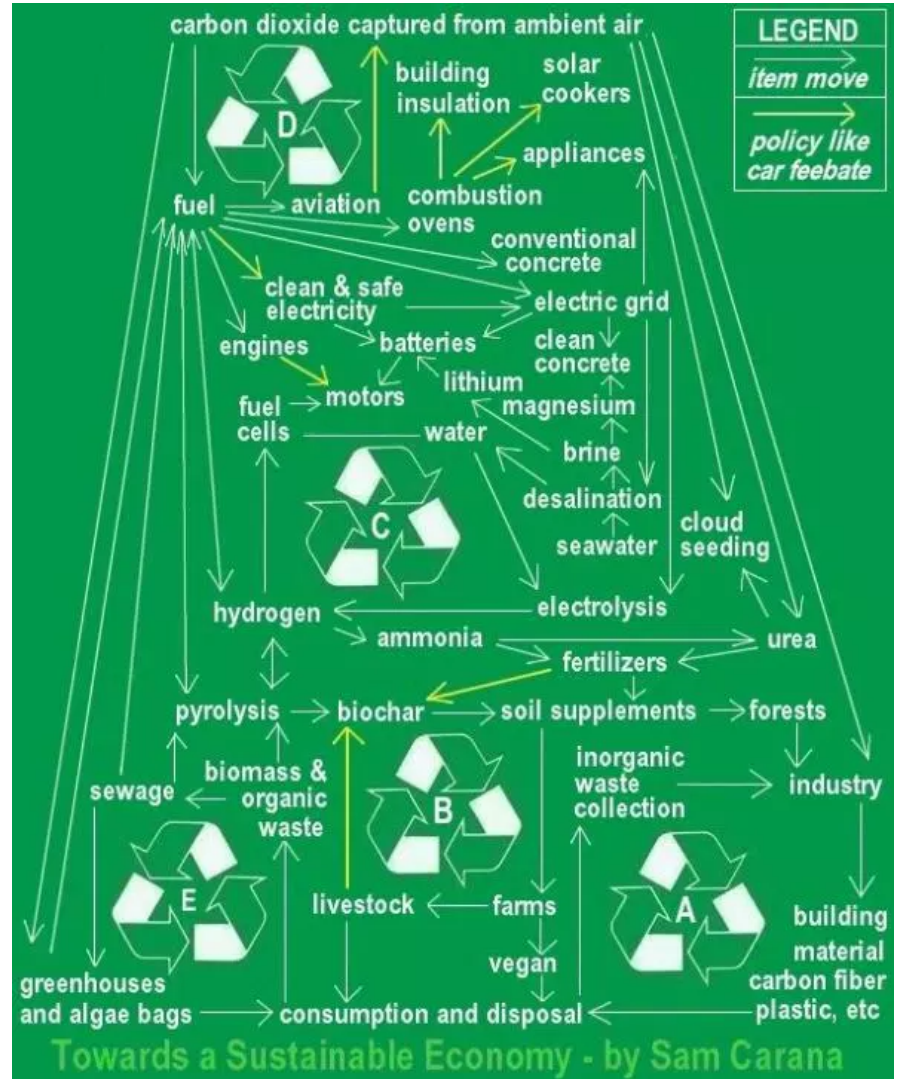
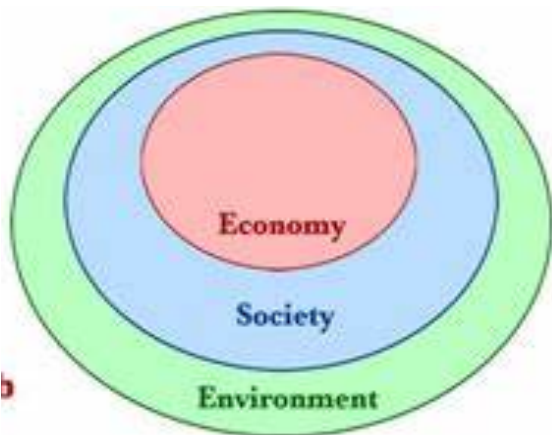
- “Fashion is always moving forward.....but one of the most interesting intersections between science and fashion is in shoes.”
- “In 2016 Increasing the use of **eco-friendly products** was identified as one of the top three emerging trends driving the athletic footwear market”
- Large, impactful industry
 - 20 BILLION pairs produced annually
 - 300 million pairs end-up in landfills



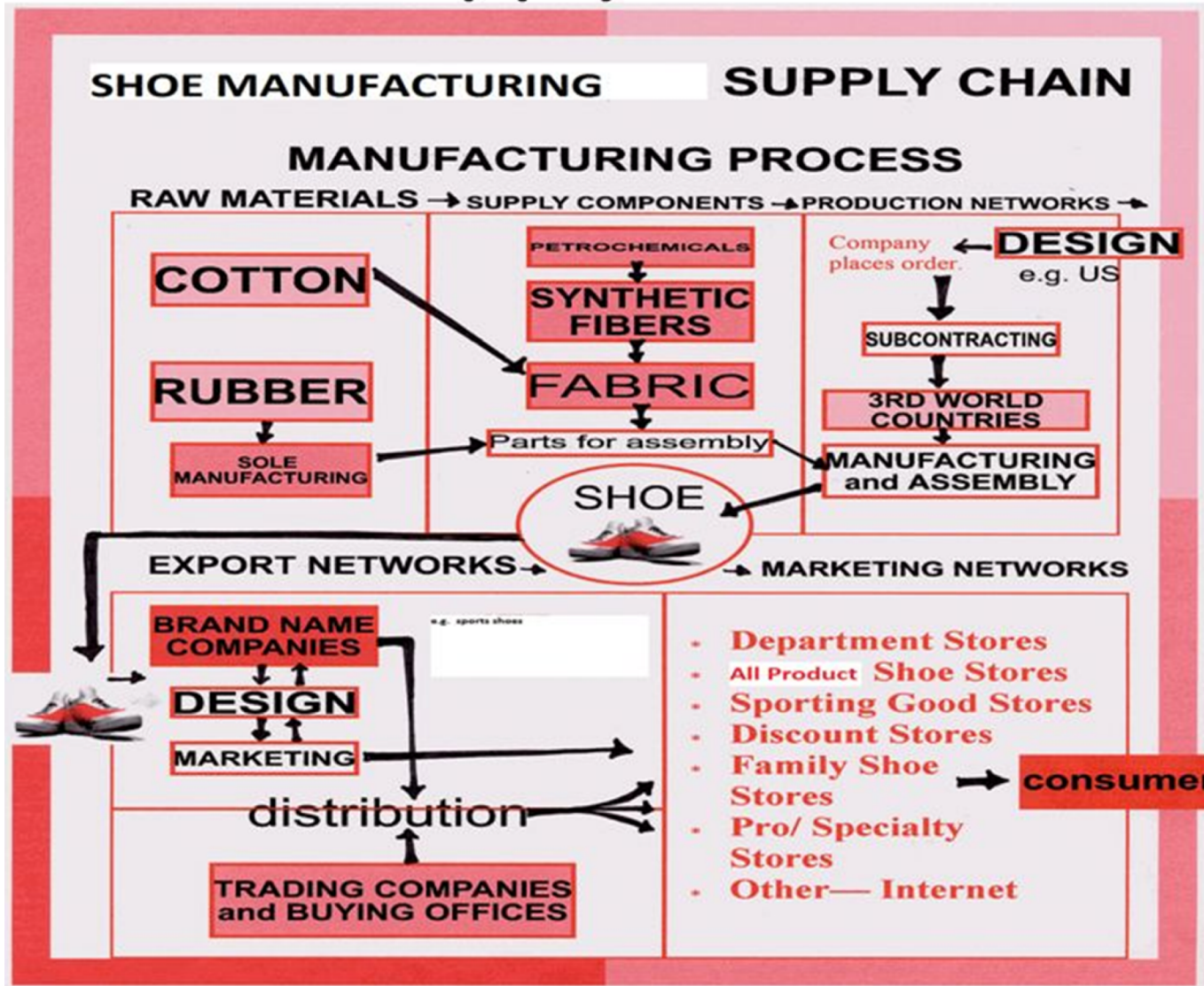
Every year
21,000,000,000,000
pairs of shoes are
produced worldwide
and **95%** of those ends
up in the landfill. On
average, you will buy
310 pairs of shoes as
you walk through life

© 2013 World & World of Merchandise
and its affiliated companies

‘Sustainability’ is a Complex Topic and many, if not all of the issues, are connected.



Identifying areas in the supply chain to reduce environmental impact

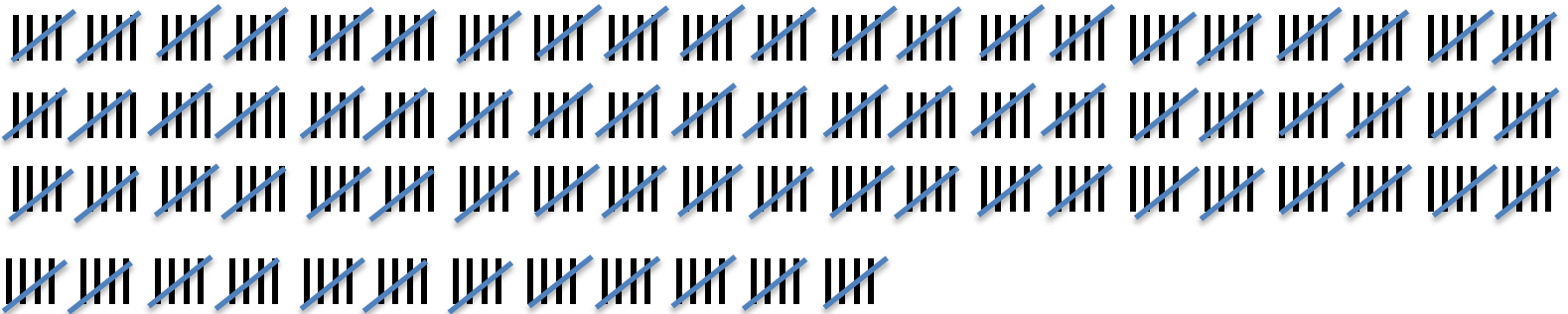


Footwear Production

- 65 discreet parts

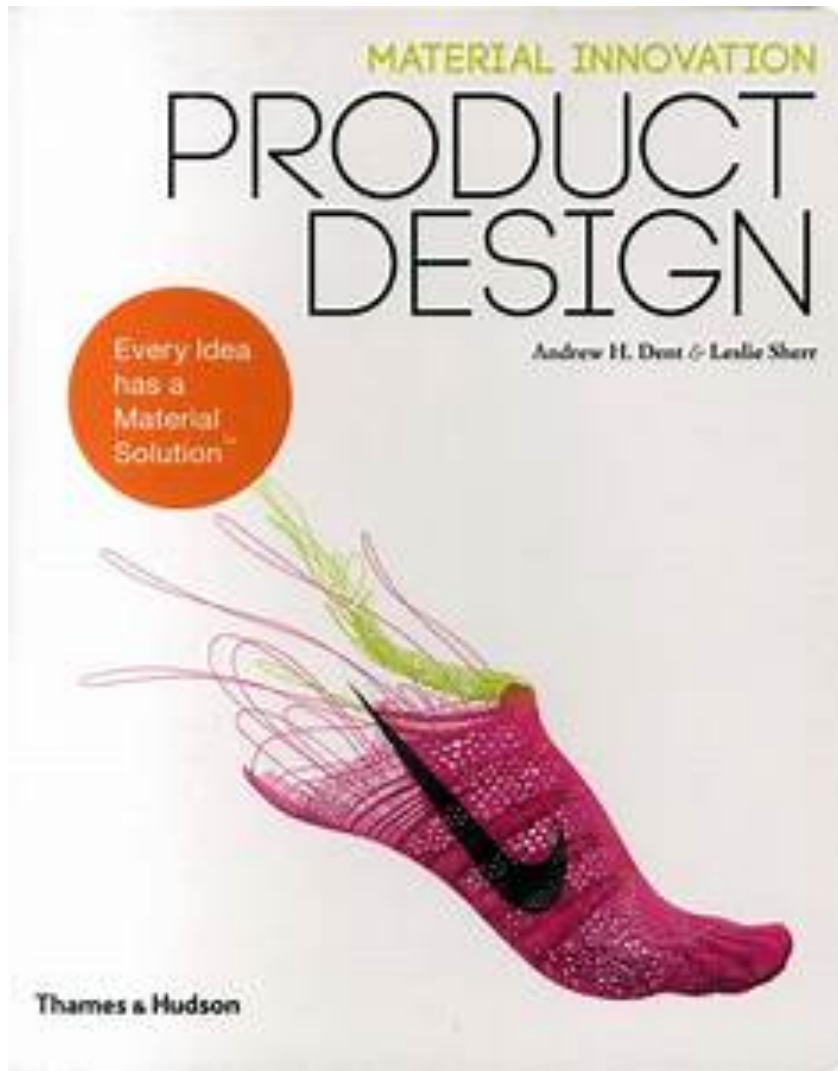
– 

- 360 processing steps to assemble

– 

- Cutting, sewing, injection molding, foaming, heating, other

Designers



- Materials
- Fabrication Methods

*“In 2016 Increasing the use of **eco-friendly** products...
top 3 emerging trends”*



Traditional Products

- leather, synthetic rubber, nylon, polyurethane, polyester, EVA, and other synthetic materials

Eco-Friendly

- organic cotton, recycled rubber, plastic materials, and water-based adhesives

<https://theshoeindustry.weebly.com/disposal-alternatives.html>

Eco-Friendly Materials – Innovation!



- “Innovation in materials many are incremental not disruptive”
- *“When you go into the disruptive area, it comes down to chemistry. And when you go into the chemistry industry, they say ‘textiles are a miniscule part of our business.’ So the amount of R&D chemists puts into materials is minute.” Hannah Jones*

Materials

“...60% of environmental impact from a pair of Nike shoes is it’s materials”

- Recycled Fibers/Products
- Renewable Resources

<https://www.youtube.com/watch?v=iBROc4ptPGQ&feature=youtu.be>

Recycling Fibers –Polyester & Nylon

Mechanical Recycling Commonly used with PET & Nylon 6,6

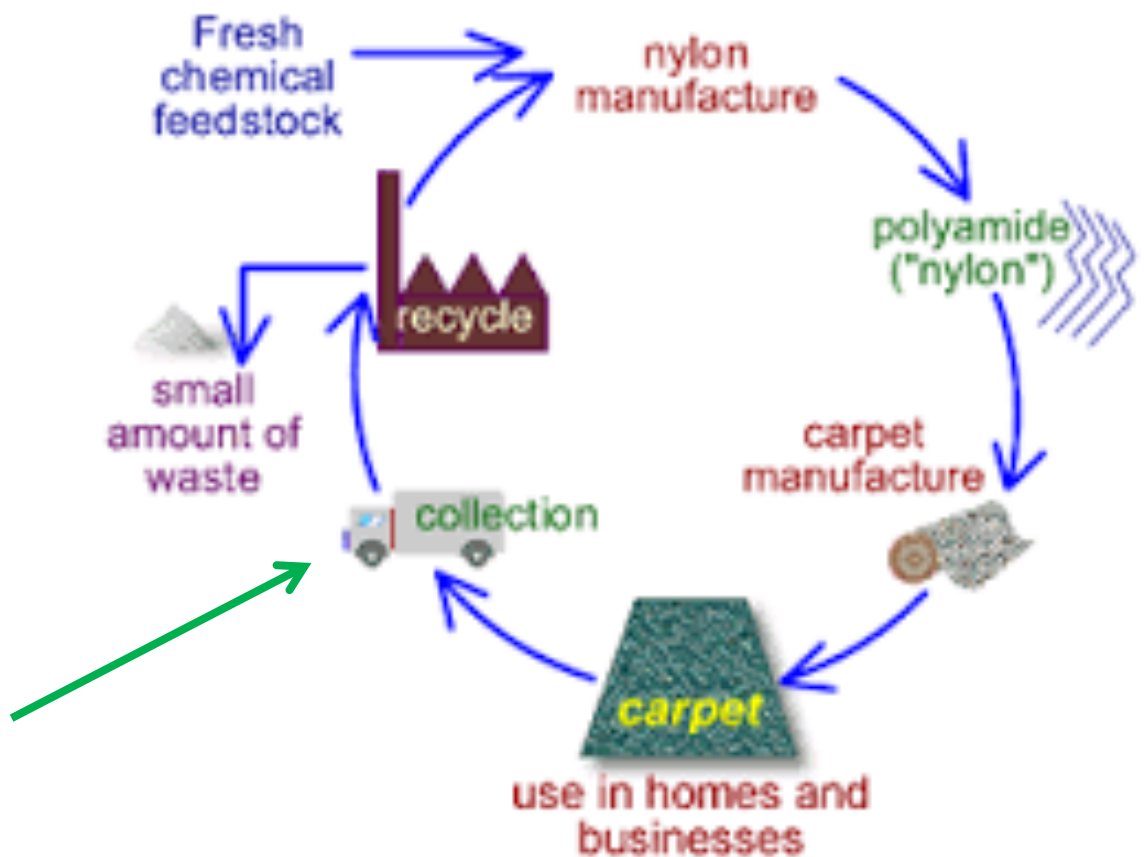
Collect & Clean & Separate → Chop/Shred → Clean & Separate → Melt → Chop into pellets → Extrude



Recycling Fibers –Polyester & Nylon

Chemical Recycling Commonly used with Nylon 6

Collect & Clean & Separate → Chemically de-polymerized to monomer components → Re-polymerized



Innovations in Eco-Friendly Materials

Reebok Corn & Cotton Initiative

- 75% bio-based content
- Uppers 100% cotton
- Soles – Corn based
 - also heel tab, tongue label
- Insoles – castor bean oil
 - Can't provide cushion effect
 - use open lattice design to create cushioning effect



Innovations in Eco-Friendly Materials

Rothy's

- Repurposed 13 million plastic water bottles
- Knit uppers post-consumer plastic,
- Foam components other recycled shoes
- 3D knitting machines



Adidas x Parley

- Plastic waste from beaches
- Goal to make all shoes from recycled plastic by 2020



Innovations in Eco-Friendly Materials

All Birds

- Merino wool
- Eucalyptus fibers
- Recycled plastic (laces)

allbirds



Adidas

- Biosteel – (Adidas) collaborative replication of natural silk crafted in conjunction with AM silk – 100% naturally biodegradable



+





- Elastopan® and Elastollan® manufactured based on renewable resources
- bio-based TPU or PU system derived from sebacic acid
- substitution of fossil raw materials



https://www.basf.com/documents/corp/en/news-and-media/news-releases/2015/02/P145e_%20SIMAC%201601%20.pdf

Just a word about leather....

Clothing, Textile and Footwear Committee

Leather Toolkit that addresses some sustainability issues



Manufacturing

Carbon Footprint



Manufacturing – Carbon Footprint

- Creating shoe generates ~ 30 lbs of CO₂
 - Two-Thirds is in manufacturing process
 - Powering manufacturing plants
 - Many are produced in China where coal is used
 - Energy intensive processes (cut/sew/injection molding.....)
 - Extracting raw materials (PET & PU)
 - Less energy intensive than manufacturing but does contribute



Material Waste

Consider the 3 R's

Post Industrial Waste – Pre Consumer Waste

- Waste produced during manufacturing –
 - Unused materials
 - Scrapes
 - Could these be recycled?
- Rethink construction to eliminate cutting and welding steps
 - Whole garment knitting
- Zero Waste to landfill manufacturing facilities

Water Use

Environmental Impacts of Wet Processing

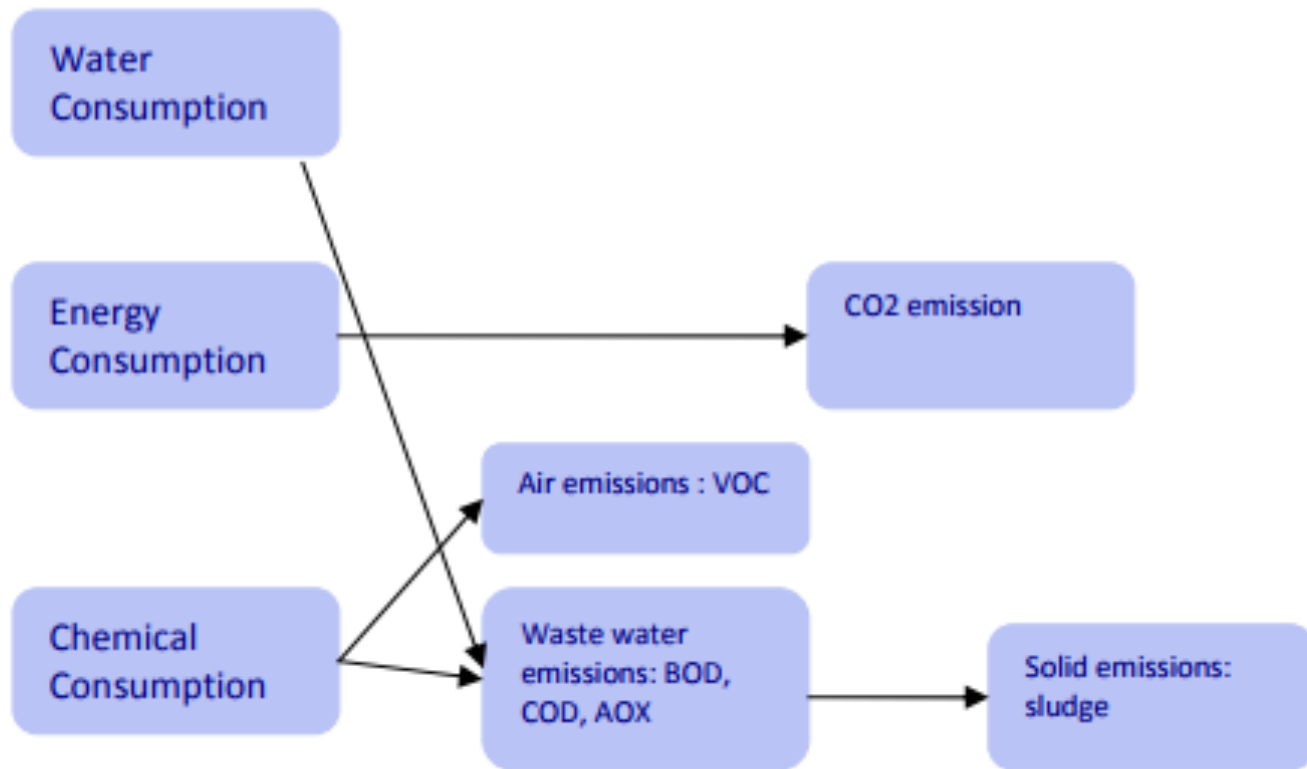


Fig. 3 Environmental Impact and Emissions, Authors own.

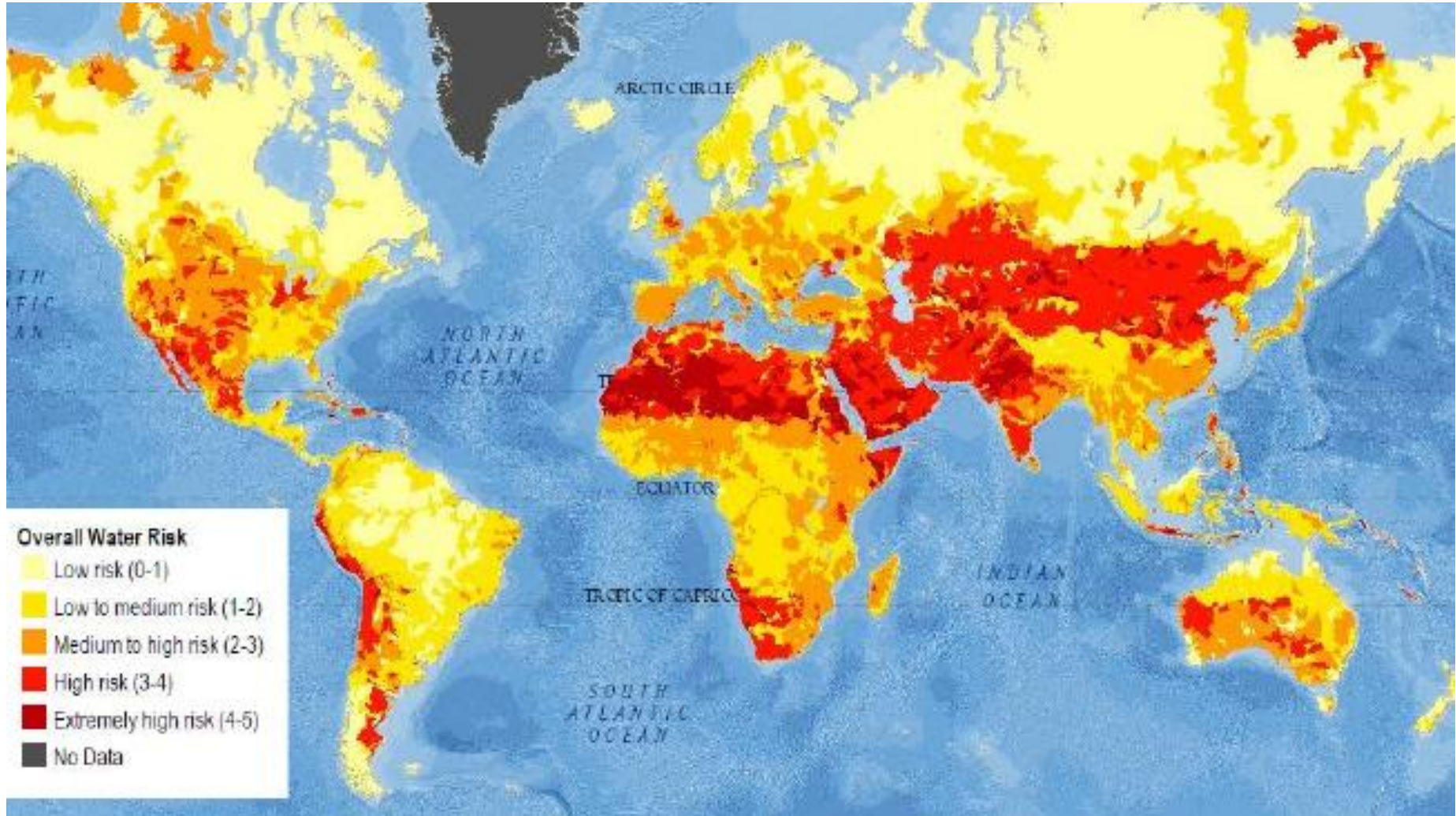
Water Use

Consider the 3 R's

Intensive Water Use in dyeing/finishing operations

- Water Scarcity is a DRIVER to reduce water use

Water Scarcity Map



Water Use

Consider the 3 R's

Intensive Water Use in dyeing/finishing operations


- Water Scarcity is a DRIVER to reduce water use
- Reducing Liquor Ratio
- Low or No Water dyeing technologies
 - ScCO₂
- 3 R's - Reduce, Reuse, Recycle
- Cost
 - Scarcity drives up cost
 - Water use related to energy use (heat H₂O, dry wet textiles)
 - Clean up effluent

Waste Water

Consider the 3 R's

Intensive Water Use in dyeing/finishing operations

Over 200 chemicals can be used in textile processing
– many are toxic to ecosystem

- Regulations on water effluent quality
 - In place but not consistently enforced
- Water treatment
 - at manufacturing plant
 - municipality for treatment
- Waste Water Tool Kit in development
 - Clothing, Footwear & Textile
 - TSC 
- ZDHC has guidelines on this



Processes
Certifications
Guidelines
Organizations

Processes - Life Cycle Assessment

“Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its lifecycle”

ISO 14040 – Environmental Management – Life cycle assessment – Principles and Framework

Phases of LCA

- Goal and Scope of LCA
- LCI phase
- LCIA phase
- Interpretation phase



Sustainability Certifications for a Variety of Industries

- Travel & Tourism
- Building
- Dolphins
- Marine
- Real Estate
- Agricultural/Food
- Transportation/Shipping
- Appliances
- Plants/Flowers
- Recycling
- Supply Chain
- Home Furnishings
- Fair Trade



EARTHCHECK



sourcemap



- bluesign®
- Degree of Green®
- Eco proof
- EU Ecolabel
- Global Organic Textile Standard
- AAFA RSL
- Cradle to Cradle
- Global Recycle Star
- Made –by
- Nike Considered Design
- NSF Sustainability Certified Product

- Oeko-Tex
- SteP
- SMaRT



Resources



Clothing, Footwear & Textile Committee

Toolkits include:

- Mixed Materials
- Leather
- Waste Water (in development)
- Sustainability Index

Ø ZDHC

Roadmap to Zero Programme

- MRSL & Conformity Guidance
- Wastewater Quality
- Audit Protocol
- Research
- Data & Disclosure
- Training

Resources

Sustainable Apparel Coalition



- https://apparelcoalition.org/wp-content/uploads/2017/10/Jason_LinkbyLink_Final-for-SAC-Website.mp4
- Track progress
- Connect with business partners
- Benchmark results against industry peers
- Identify areas for improvement
- 8,000+ global Higg users

Resources

Outdoor Industry Association SWG



A FORCE FOR SUSTAINABILITY

[GET INVOLVED](#) ▶

[VIEW STORIES](#) ▶



**LEADING IN SUSTAINABLE
BUSINESS: THE STATE OF
SUSTAINABILITY IN THE**



**WEBINAR: COVESTRO -
SUSTAINABLE CHOICES FOR
PU-COATED FABRICS**



**BLUESIGN 101: INTRO TO
SUPPLY CHAIN INTEGRITY**

Jill Dumain of bluesign will provide an

Resources



- This event!
- The Industry's Podcast
- Footwear Compliance Forum
- Comprehensive Footwear Product Safety Program



A screenshot of the FDRA website's 'Interactive Guide to Chemical & Physical Testing for Footwear' page. The page features the FDRA logo at the top left. The main heading is 'Interactive Guide to Chemical & Physical Testing for Footwear'. Below this, there are two main sections: 'Search by Chemical' and 'Search by Physical'. Each section has a corresponding blue button: 'Chemical Testing Search' and 'Physical Testing Search'. Below these is a section titled 'Catalog of Global Legal Requirements' with a blue button labeled 'Access Catalog'. At the bottom of the page, there is a footer that reads 'FDRA's Comprehensive Footwear Product Safety Program' and a TUV logo.

The logo for FootwearInnovation.com. It features a stylized atom symbol with three red dots representing electrons. To the right of the atom, the text reads 'This site is powered by FDRA' in a small font, followed by 'FootwearInnovation.com' in a larger, bold font. Below the website name is the tagline 'The info hub for all things footwear innovation' in a red, cursive-style font.



Thank you!

Questions?

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