



# The role and business case for existing & emerging fibres in sustainable clothing

James Copeland

Agri-Environment & Land Use Strategy

Central Science Laboratory

York, UK



# Background

- Need for a robust evidence base
- Previous review work identified key focus areas
- Key area highlighted
  - Limited availability of information on emerging fibres – their potential in the clothing sector and their environmental credentials



# Aims and objectives

- Identify the key fibres of interest in the textile sector, existing & emerging
- Current and potential future scales of production
- Assessment of sustainability impacts
- Identification of knowledge gaps



# Consortium

- Central Science Laboratory
  - Agri-environment and land use
    - James Copeland, David Turley
- De Montfort University
  - Textile Engineering and Materials
    - Matthew Horne, Jane Harwood
- University of Leeds
  - Centre for Technical Textiles
    - Richard Blackburn, Emily Stott



# The project to date

- Stakeholder interaction
  - Working with 80+ stakeholders
  - UK, Europe and Worldwide coverage
  - 11 member project steering committee
  - Representative of all stages of the clothing production supply chain



# The project to date

- Existing and emerging fibres:
  - Existing –

“are defined as those that currently have an **established role** as a raw material for the **manufacture of clothing**, as demonstrated by having a **significant annual fibre production** and share of the market for clothing fibres, and being **internationally traded**”
  - Emerging –

“are defined as those fibres that **do not yet have an established market share**, but whose fundamental **technical properties have been investigated** and **demonstrate potential** for use in clothing applications”



# The project to date

- Fibres of interest - EXISTING

Natural		Regenerated	Synthetic
Cellulosic	Proteinaceous	Cellulosic	
Conventional Cotton	Wool	Viscose	Poly(Ethyleneterephthalate)
GM Cotton	Silk		Nylon 6 and Nylon 6,6
Flax (line)			Acrylic

# The project to date

- Fibres of interest - EMERGING

Natural	Regenerated		Synthetic
Cellulosic	Cellulosic	Proteinaceous	
Flax (short fibre)	Lyocell	Soybean fibre	Poly(Lactic Acid) (PLA)
Hemp	Regenerated Bamboo		Poly(Trimethylene-Terephthalate) (PTT)
Nettle	Modal		
Ramie			
Spanish Broom			
Organic Cotton			
Jute			

# The project to date

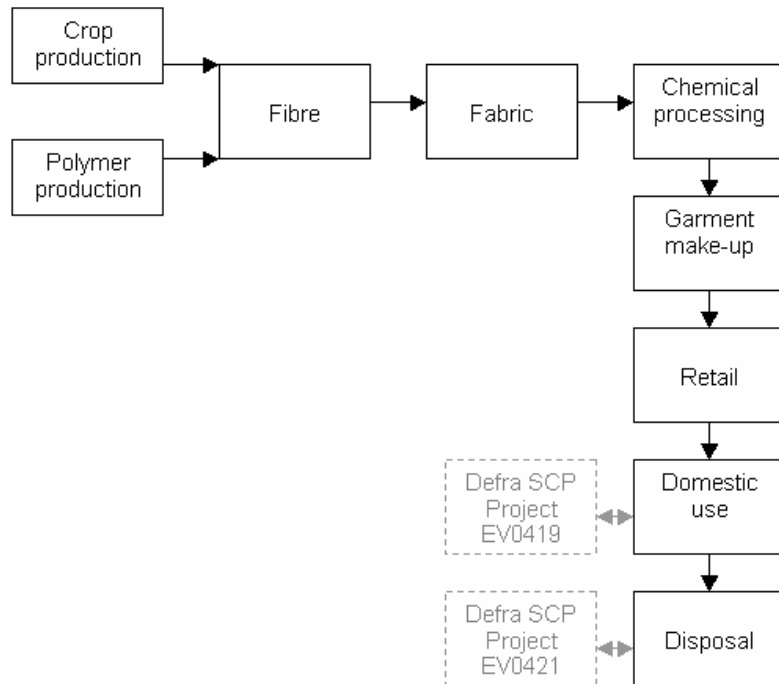
- Excluded fibres:

- Kapok
- Sisal
- Coir
- Pina
- Abaca
- Mohair
- Cashmere
- Llama
- Peanut or maize protein
- Milk fibre
- Chitin/Chitosan
- Chicken feather fibre
- Gelatine based fibre
- Polypropylene (PP)
- Nylon 11
- Elastane



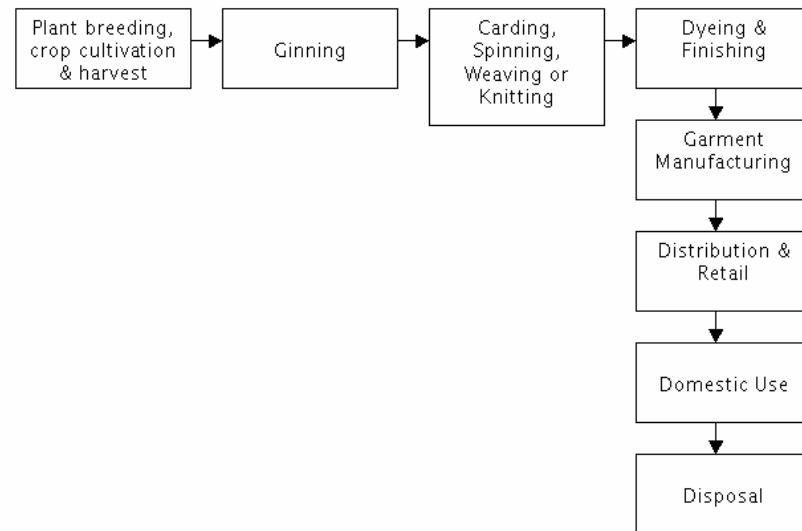
# The project to date

- Supply chain review:



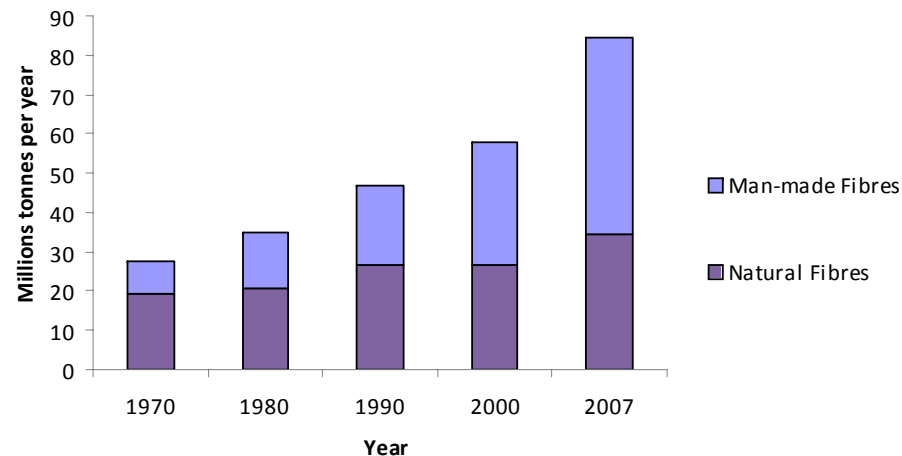
## COTTON (INCLUDING ORGANIC)

### SUPPLY CHAIN



# The project to date

- Consumption and production
  - 2020 fibre consumption elevated by 30Mt to 13.5 kg/head

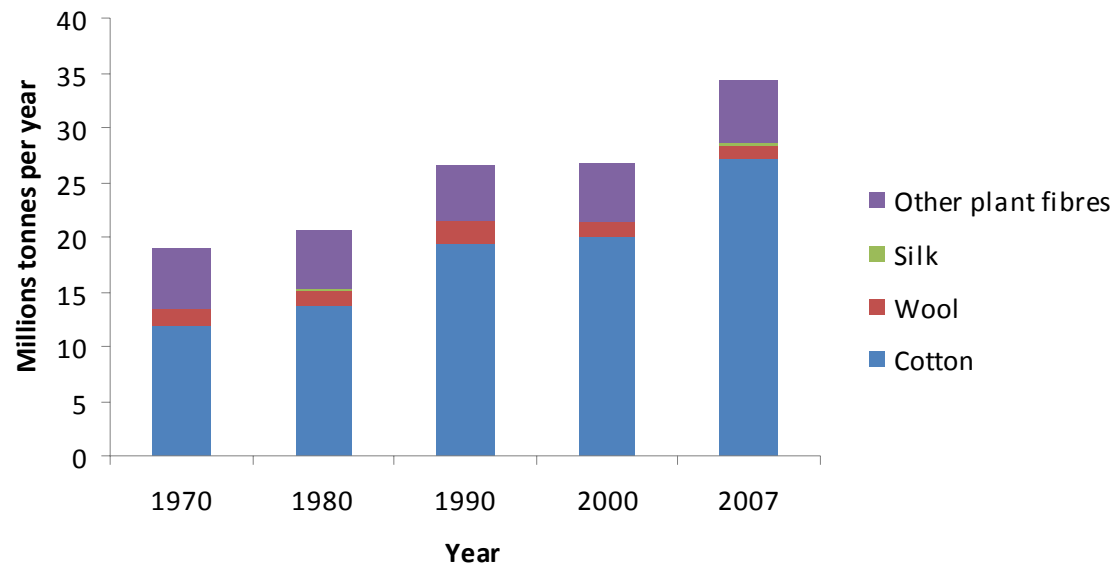


	1950	1960	1970	1980	1990	2000	2007
Population (billions)	2.56	3.04	3.71	4.46	5.28	6.08	6.64
Consumption kg/head	3.7	4.9	5.9	6.6	7.7	8.7	10.9



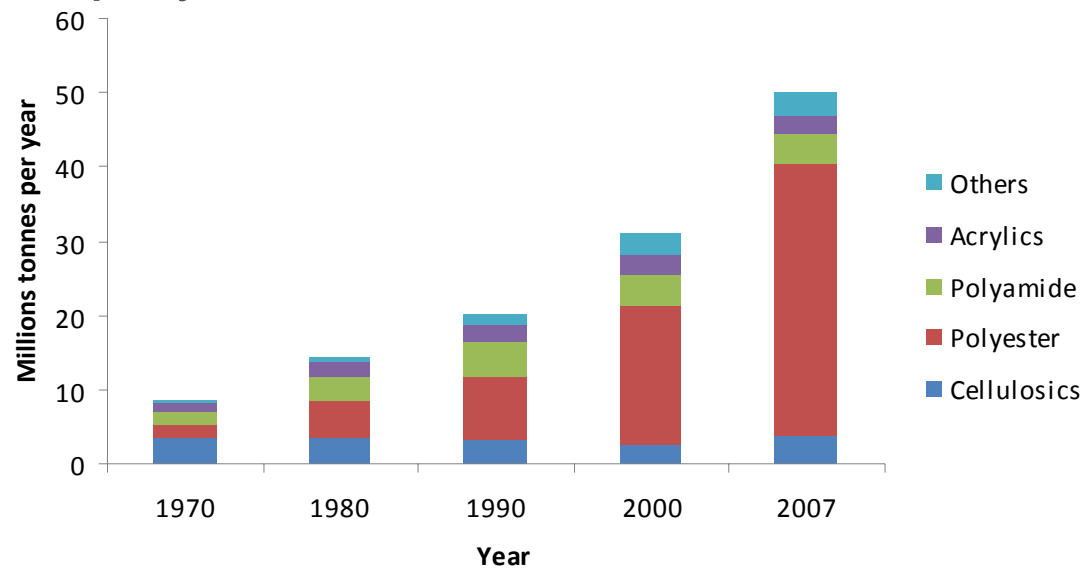
# The project to date

- Consumption and production
  - Natural fibre production
  - More cotton? Cotton alternatives? Less wool?



# The project to date

- Consumption and production
  - Manmade fibre production
  - More polyester? More cellulosic fibres?



# The project to date

- Capacity & Market Potential  
SUPPLY
  - What is required in terms of land?
    - Existing? New?
  - What is required in terms of processing operations?
    - Existing? New?
  - What is driving expansion or reduction in production capacity (by fibre type and location)?



# The project to date

- Capacity & Market Potential

## DEMAND

- What does the market want from an emerging fibre in addition to sustainability? (retailers and consumers)
- How much does it cost?
- How much can it cost?
- What is the potential market share by (emerging) fibre type?
- How much potential is there for substitution?



# The project to date

- LCA is a technique for assessing the environmental aspects associated with a product over its life cycle product cycle
  - Analysis of the contribution of life cycle stages, product parts or processes
  - Comparing between products or design alternatives












# The project to date

- An agreed impact scale will allow a comparative analysis between fibres
- The scale will be similar to a traffic light system used on food
- The scale will be developed through informal discussions and interaction with stakeholders to determine a range of possible impacts



# The project to date

	Cotton		PLA		Viscose	
Energy	49 MJ/kg		54 MJ/kg		35 MJ/kg	
Water	20,000+ l/kg		???		500 l/kg	
Chemicals	16 g/kg		Low		Large quantities of harsh chemicals	



# The project to date

- A matrix for identification of overall positive (green) and negative (red) impacts

		Crop/ polymer production	Fibre Production	Fabric Production	Chemical Processing	Garment make-up	Domestic use	Disposal
CELLULOSES	Bamboo	1	3	5	4	6	4	5
	Nettle	7	4	5	6	1	4	9
	Ramie	5	7	4	5	3	6	8
	Flax	2	6	3	5	6	6	2
	Hemp	5	3	4	5	1	6	9
	Organic cotton	1	2	4	6	5	3	2
	GM cotton	2	4	9	6	1	6	8
	<i>Conventional cotton</i>	1	1	6	4	2	6	7
FIBRE-FIBRE	Lyocell	5	4	3	6	3	3	5
	Modal	3	2	5	2	4	5	8
	Bamboo (viscose process)	5	3	5	6	9	4	9
	Viscose	5	5	6	1	6	1	6
SYNTHETIC	Poly(lactic acid) (PLA)	5	8	3	6	8	6	2
	<i>Poly(ethylene terephthalate) (PET)</i>	7	4	5	1	6	2	6
	Acrylic	9	5	4	3	4	6	7
	<i>Nylon 6 and nylon 6,6</i>	2	5	2	5	5	5	2
	<i>Secondary and tertiary cellulose acetate</i>	9	3	4	4	6	1	5
PROTEINACEOUS	Wool	1	4	5	4	2	4	7
	Silk	3	1	5	4	2	5	9

# Thank you

- Central Science Laboratory
  - [j.copeland@csl.gov.uk](mailto:j.copeland@csl.gov.uk)
- De Montfort University
  - [MHorne@dmu.ac.uk](mailto:MHorne@dmu.ac.uk)
- University of Leeds
  - [emily.stott@cantab.net](mailto:emily.stott@cantab.net)

