UNECE

Food and Agriculture Organization of the United Nations

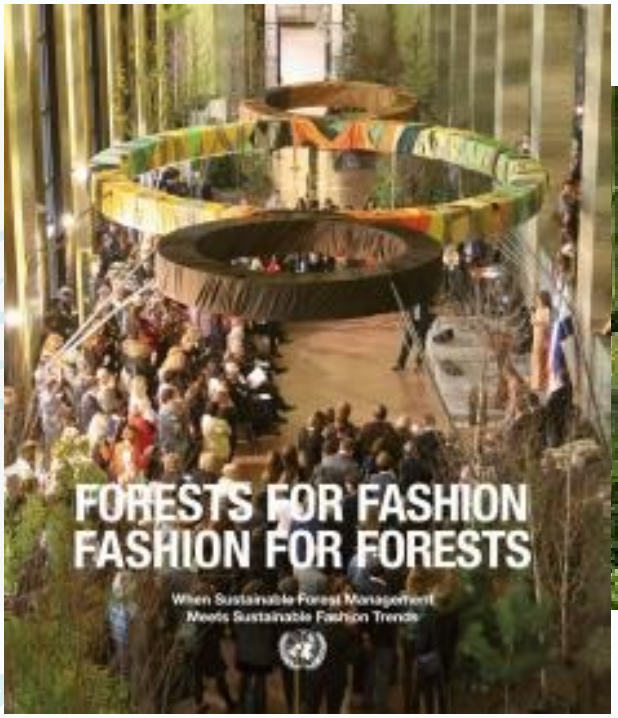
# CIRCULARITY OF CELLULOSIC FIBERS

## Future of forestry and forest-based industries in a sustainable bioeconomy

*21-23 SEPTEMBER 2023*

21-23/9/2023

# UNECE/FAO Joint Forestry and Timber Section work







UNECE

Food and Agriculture Organization of the United Nations

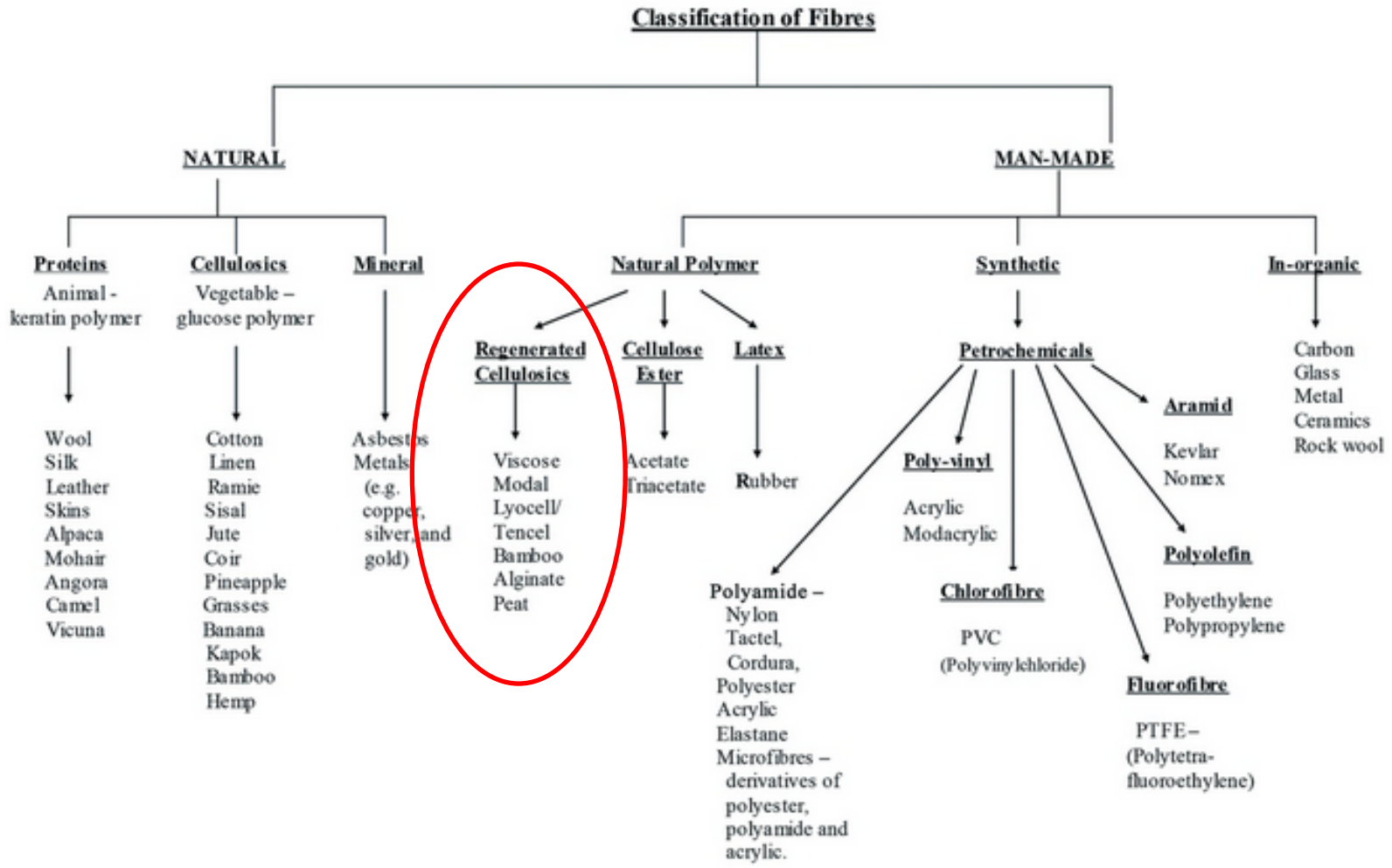
# Structure

## MMCF characteristics

## MMCF circularity

Photo: Gabriel Farias

# Classification of textile fibers



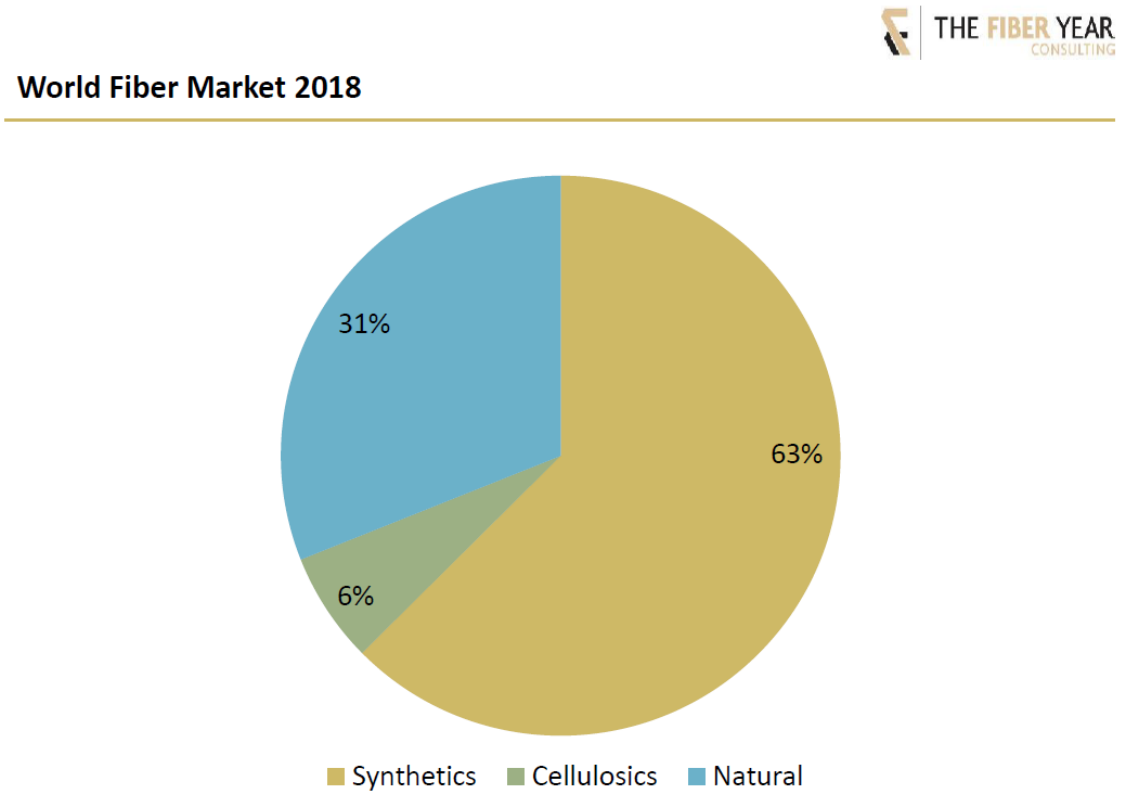
# Man made cellulosic fibers

Man made cellulosic fibers, are semi-synthetic fibres because they are derived from natural raw materials but are chemically processed to create the fibres.

They can be classified into a few different categories based on the manufacturing process and properties.

- **Viscose rayon fibres**: These fibres are made by **dissolving wood pulp** or cotton linters in a solution of **sodium hydroxide and carbon disulfide**, and then extruding the solution through a spinneret to form fibres. They are known for their softness, drapability, and ability to absorb moisture.
- **Cuprammonium rayon fibres**: These fibres are made by **dissolving wood pulp** or cotton linters in a solution of **copper salts and ammonium hydroxide**, and then extruding the solution through a spinneret to form fibres. They are known for their high strength and resistance to shrinking and wrinkling.
- **Modal fibres**: These fibres are made by **dissolving beech tree pulp** in a solution of **sodium hydroxide and carbon disulfide**, and then extruding the solution through a spinneret to form fibres. They are known for their softness, drapability, and moisture-wicking properties.
- **Lyocell fibres**: These fibres are made by **dissolving wood pulp** in a solution of **amine oxide**, and then extruding the solution through a spinneret to form fibres. They are known for their high strength, excellent drapability, and moisture-wicking properties.

# World Fiber Market 2018

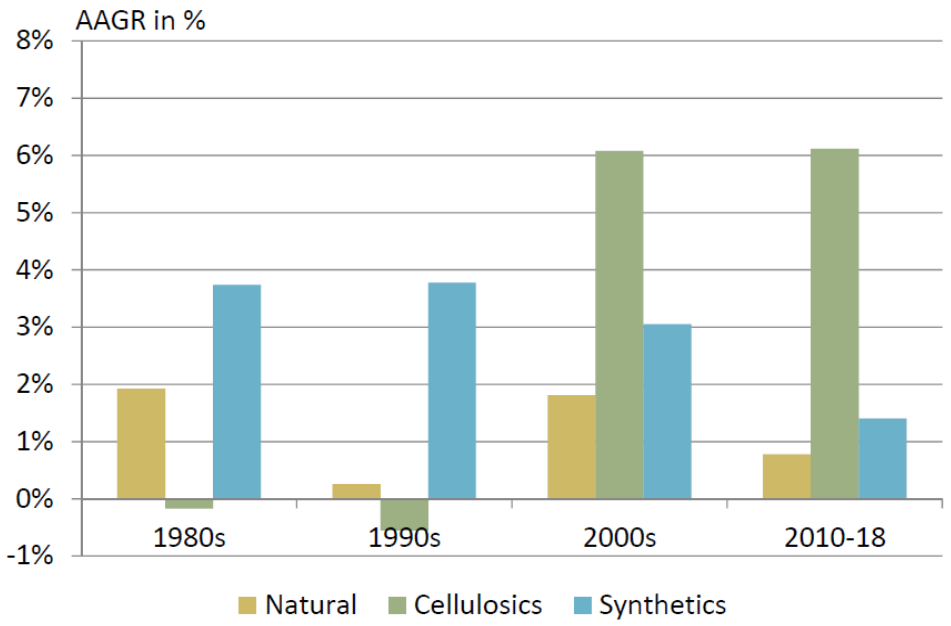



Source: Andreas Engelhardt, Status and Outlook on Textile Fiber Markets, 2020

# Global annual average growth rate

THE FIBER YEAR CONSULTING

**Dynamics in Staple Fibers**




**2025 Forecast**

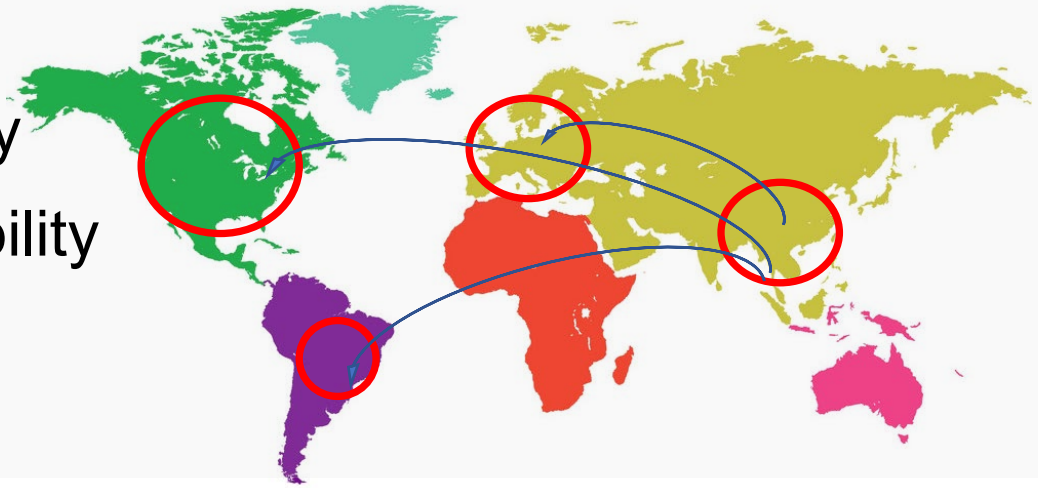
- Cotton 0,75%
- Polyester 3,75%
- Cellulosic 4,75%

Source: O. Landsell-Hawkins, *The Outlook for Dissolving Pulp Supply and Demand*, 2020

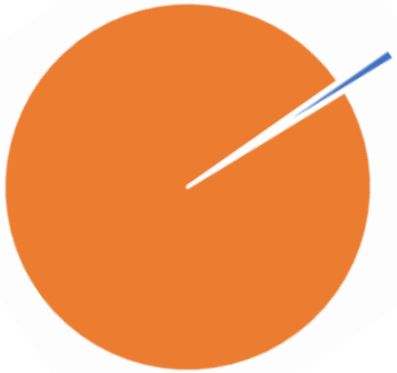
Source: Andreas Engelhardt, *Status and Outlook on Textile Fiber Markets*, 2020

# General market characteristics

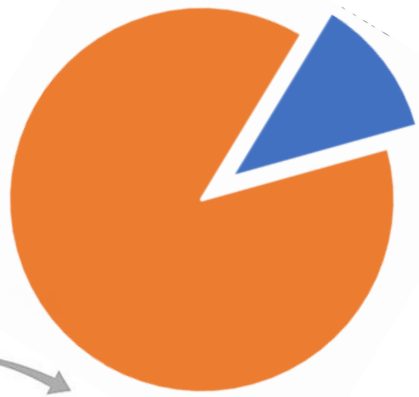
- Textile fibers demand is growing (apparel & home textiles)
- Geographic extension of value chains at the global scale
- Fashion driven
- Fast fashion creates waste
- Waste can be recycled
- Recycling ≠ circularity
- Circularity ≠ sustainability



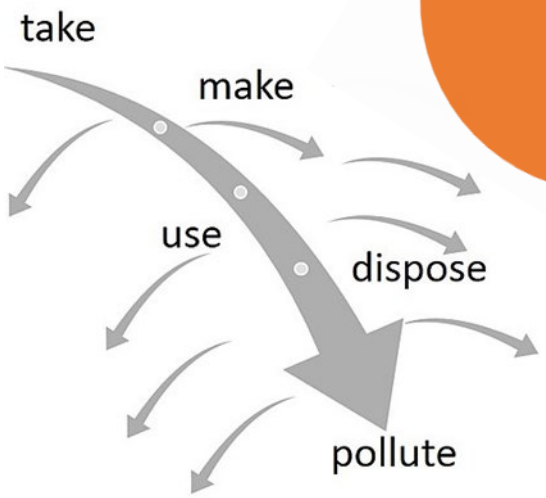
# Reuse of textile fibers



< 1% of textiles is recovered for the production of new clothing



< 12% of textiles is recovered for cascading (insulation, mattress stuffing, wiping clothes etc.)




73 % of textiles is landfilled of incinerated

Source: Ellen MacArthur Foundation, 2017

# Textile fibers

- Cellulosic fibers may deliver resource efficiency compared to
  - synthetic fibers in terms of biodegradability
  - cotton in terms of land and water footprint.
- However, circularity of cellulosic fibers value chains depends on the emphasis on different criteria in lifecycle analysis studies.
- They are often prepared by the respective businesses themselves and not independent bodies.
- Variety of labels and regulations fogs the understanding of circularity and sustainability.

# Textile fibers - consumption

- Production and consumption are particularly interlinked in the fibers industry (apparel/home textiles).
- Production is subject to demand generated by fashion and the fast fashion is shaping consumption patterns.
- Before considering other circular approaches, reducing production and consumption is key.
- Increased traceability improves trust in brands and helps consumers become aware of the environmental impact of the products they buy.

# Circularity of cellulose based fibers

- Current recovery technologies allow for 50 % of the raw cellulose fibers to be replaced with alternative feedstocks. They can be recovered from agriculture, forestry and municipal residues, recycled textiles and other sources.
- Most garments are produced from a mix of synthetic and natural fibers. Improving capacity to recycle such fibers is therefore essential.
- The content of elastane is an important feature, evidence say that above 7% of elastane is a technical obstacle for recovery of fibers.
- Economic viability and environmental sustainability of the recovery of irregular material streams with inconsistent quality need to be evaluated case by case.
- There use of hazardous chemicals is also extensive. Therefore, the treatment and dyeing of textiles can cause significant pollution, also during the recovery of fibers.

UNECE

Food and Agriculture Organization of the United Nations

# THANK YOU

ALICJA.KACPRZAK@FAO.ORG



Alicja Kacprzak
alicja.kacprzak@fao.org