RE SOURCE LAB

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Rehap

Universität Augsburg
Wirtschaftswissenschaftliche Fakultät

Agroforestry residue potentials in the European Union: current status and future perspectives

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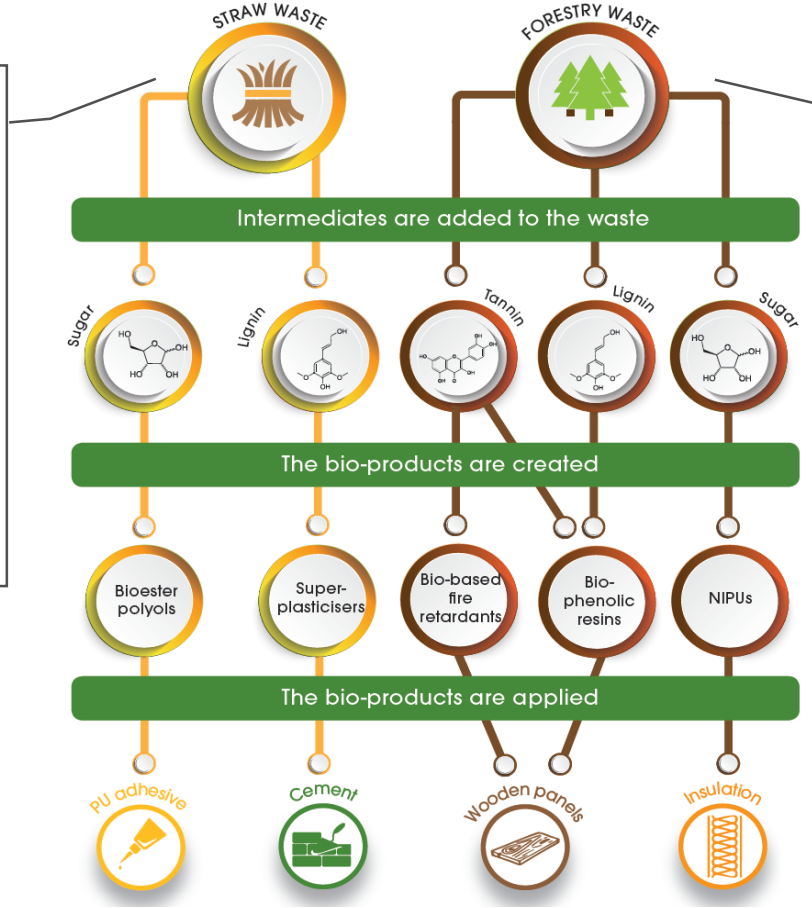
Motivation

REHAP: '*Systemic approach to reduce energy demand and CO_2 emissions of processes that transform agroforestry waste into high added value products*'



Rehap

http://www.rehap.eu/

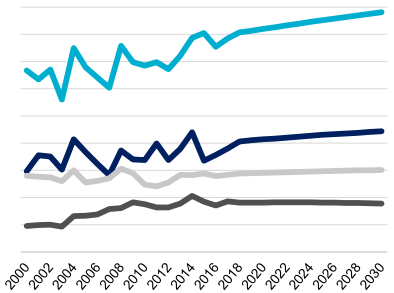
Funded by European Union's Horizon 2020 research and innovation programme under grant agreement No 723670, with the title "Systemic approach to reduce energy demand and CO2 emissions of processes that transform agroforestry waste into high added value products (REHAP)

Research questions

Which are the most abundant lignocellulose residues in the EU?

Where are the lignocellulose residues regionally distributed?

How will the lignocellulose residues potential develop in the future?



Assessment of potentials

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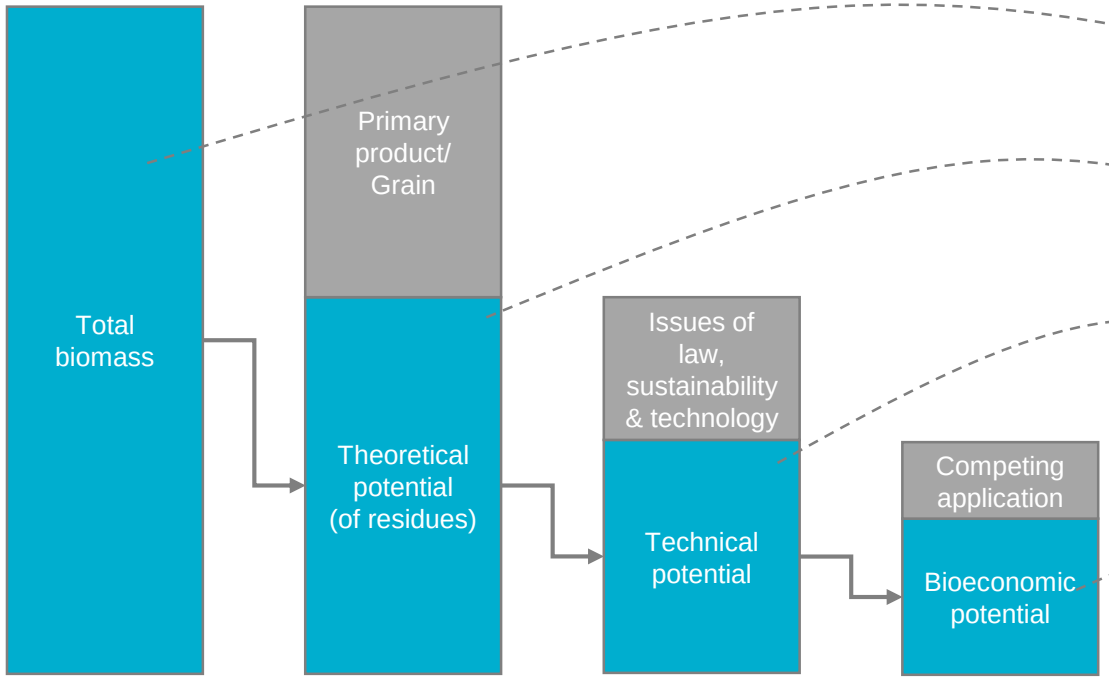
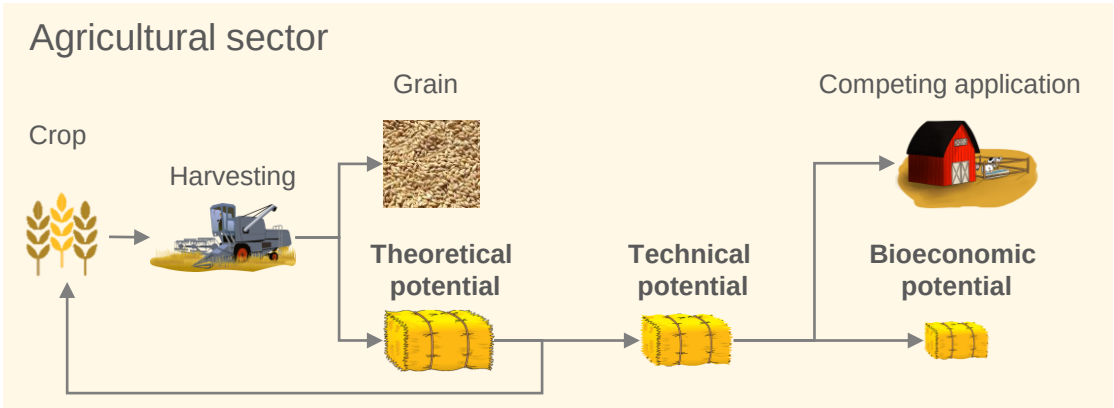


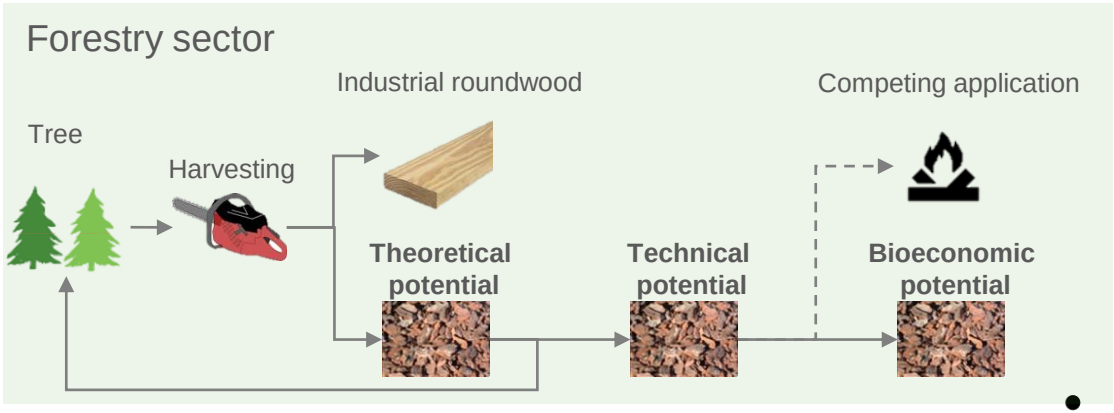
Total biomass = whole plant

Theoretical potential = total residues

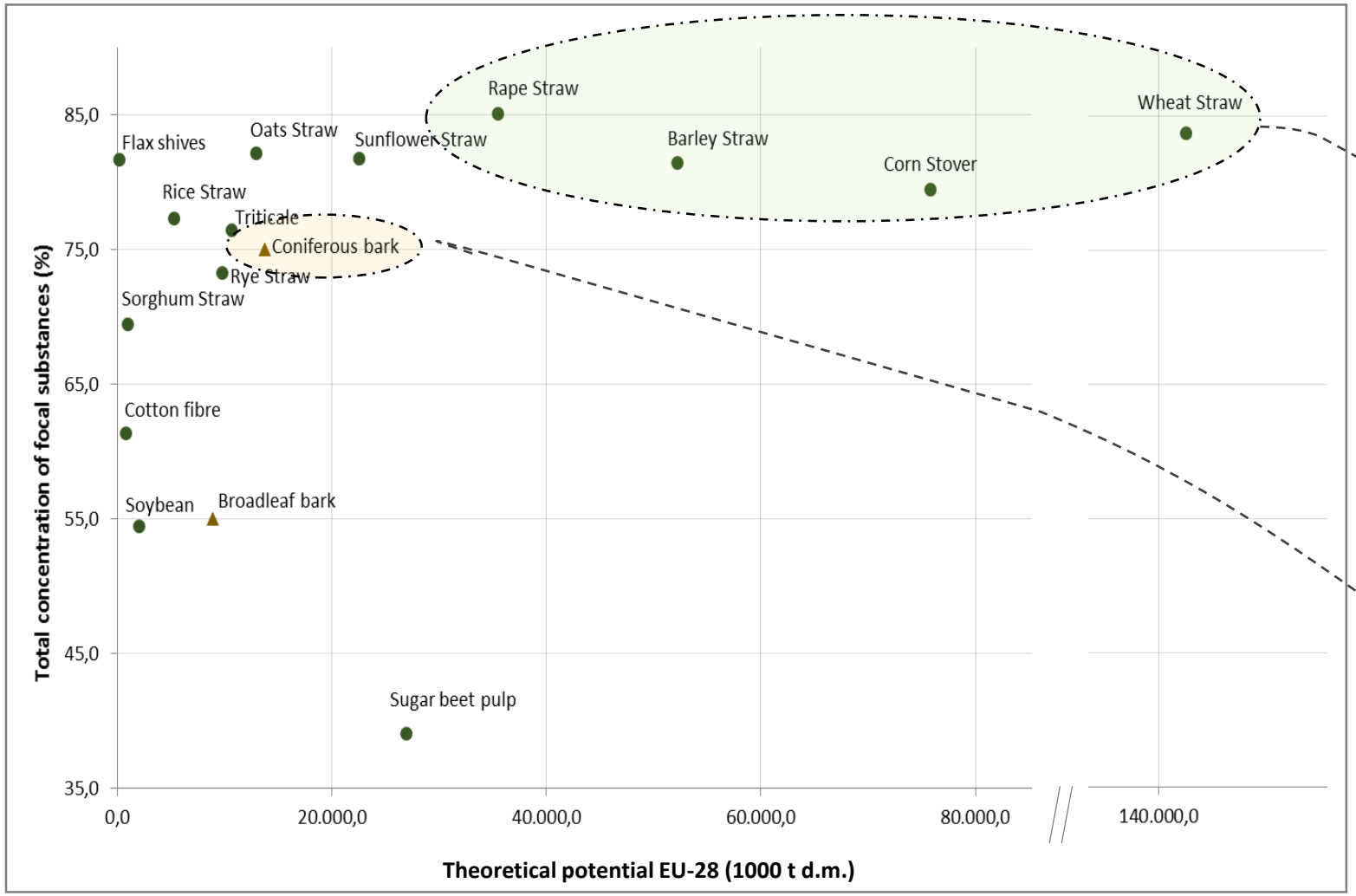
Technical potential = theoretical potential – issues of law, sustainability & technological limitations

Bioeconomic potential = technical potential - competing application





Preselection *Thorenz et al., 2018*



Preselection of most important residues

- wheat straw
- corn stover
- barley straw
- rapeseed straw

→ make up to 80% of cereals and oil crops harvesting residues in the EU

- spruce bark
- pine bark

→ main bark residues in the EU

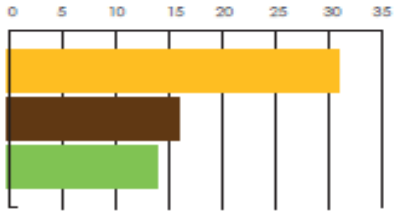
Results

Agriculture

Approx. **110 Mt** of bioeconomic straw potential

Cellulose	~ 35%
Hemicellulose	~ 30 %
Lignin	~ 15 %

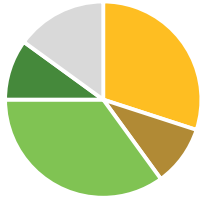
Wheat straw is the most promising source at **46 Mt**



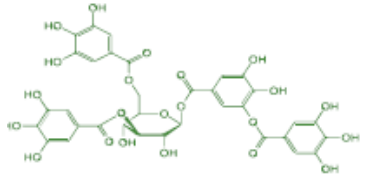
corn stover	(31 Mt)
barley straw	(16 Mt)
rapeseed straw	(14 Mt)

Forestry

Spruce and **pine bark** with approx. **15 Mt** bioeconomic potential



Cellulose	~ 25 %
Hemicellulose	~ 10 %
Lignin	~ 30 %
Tannin	8 – 12 %

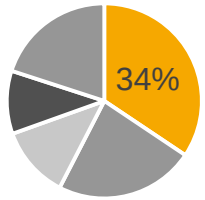


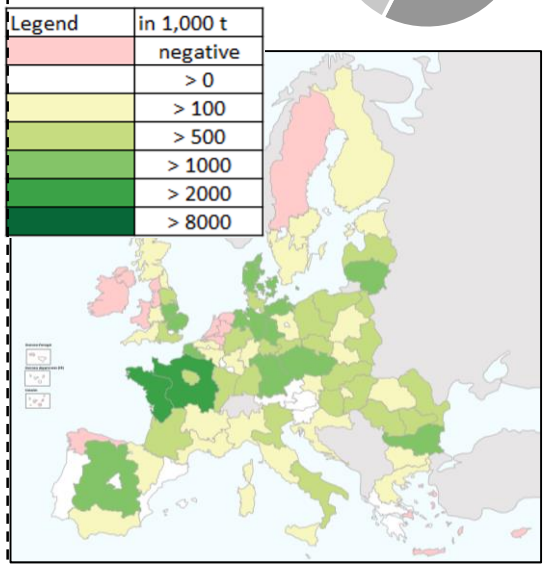
Additionally a considerable amount of extractable **tannin**

Agricultural results *Thorenz et al., 2018 & Wietschel et al., 2019*

Wheat straw

Bioeconomic potential = 46 Mt

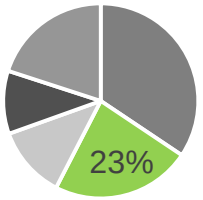


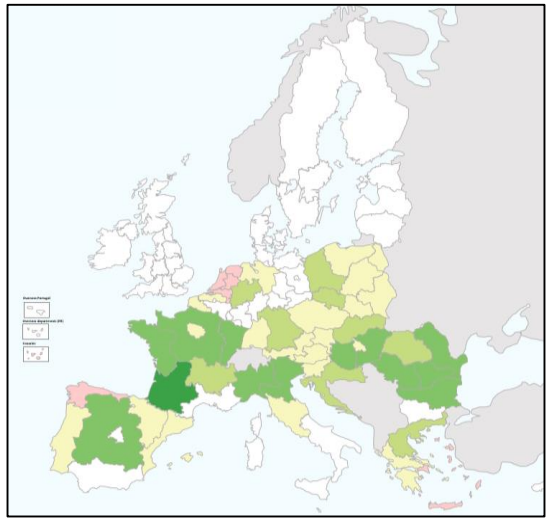


- Cultivated all over the EU
- Central EU with the highest potentials

Maize stover

Bioeconomic potential = 31 Mt

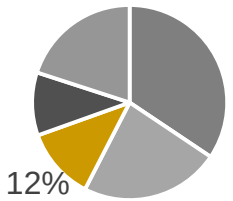


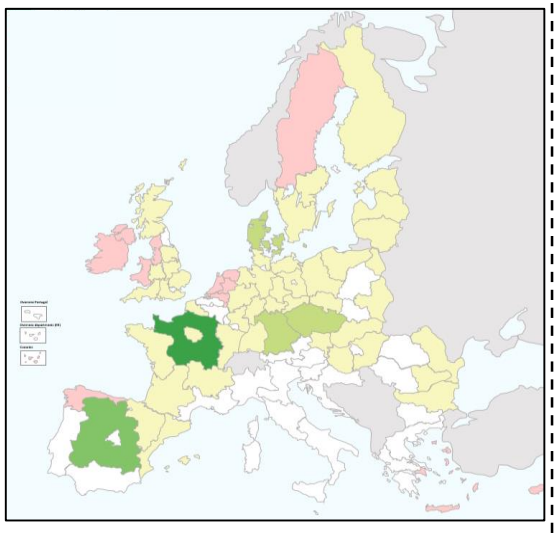


- Hardly cultivated in northern regions
- Central EU with the highest potentials

Barley straw

Bioeconomic potential = 16 Mt

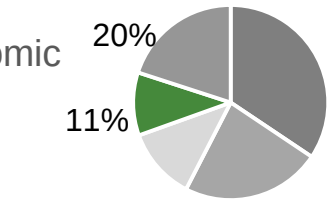


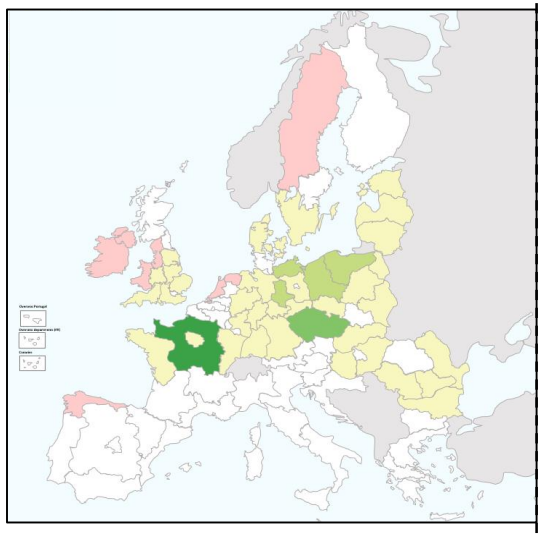


- Hardly cultivated in southern regions
- Central EU with the highest potentials

Rapeseed straw

Bioeconomic potential = 14 Mt



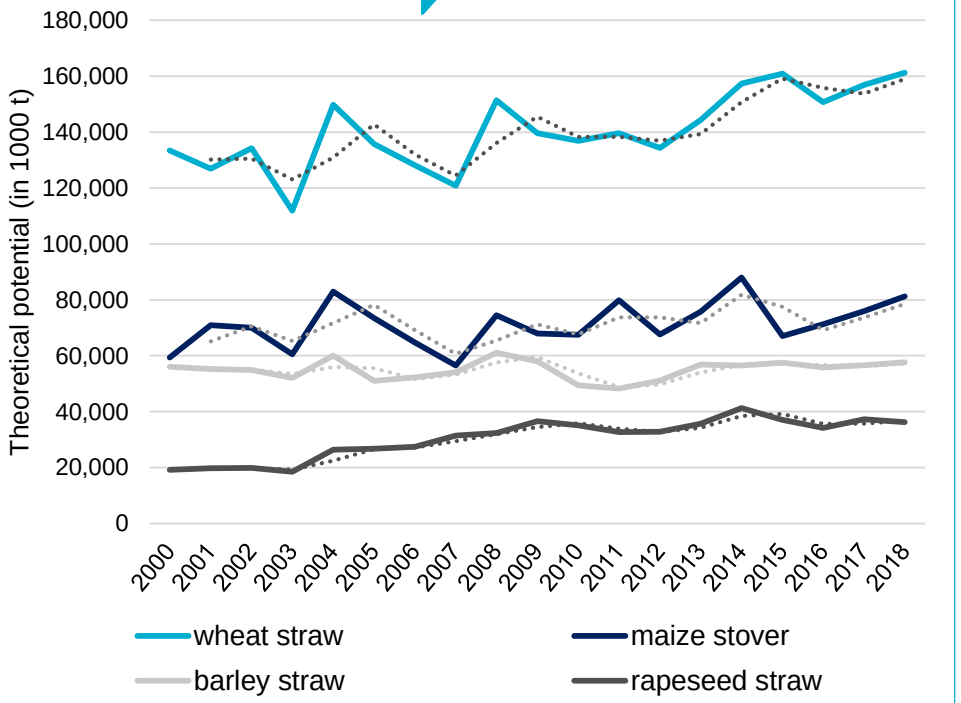


- Hardly cultivated in southern regions
- Central EU with the highest potentials

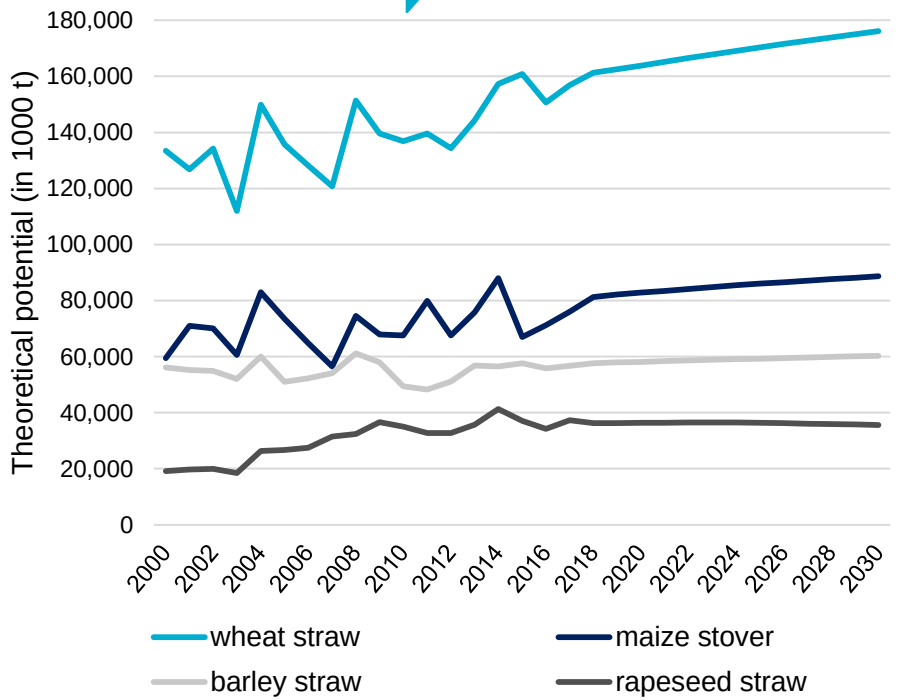
Agricultural results *Wietschel et al., 2019*

Prediction of agricultural residue potentials

Analysis of historic time series of underlying variables & consideration of market forecasts



Time series and literature based forecast



Agricultural results

Prediction of agricultural residue potentials

Wheat straw

With a growth of **10%**, wheat straw remains the most important agricultural residue in the EU. Due to still improving farming patterns, Bulgaria, Estonia, Poland and Romania show high growth rates.

Maize stover

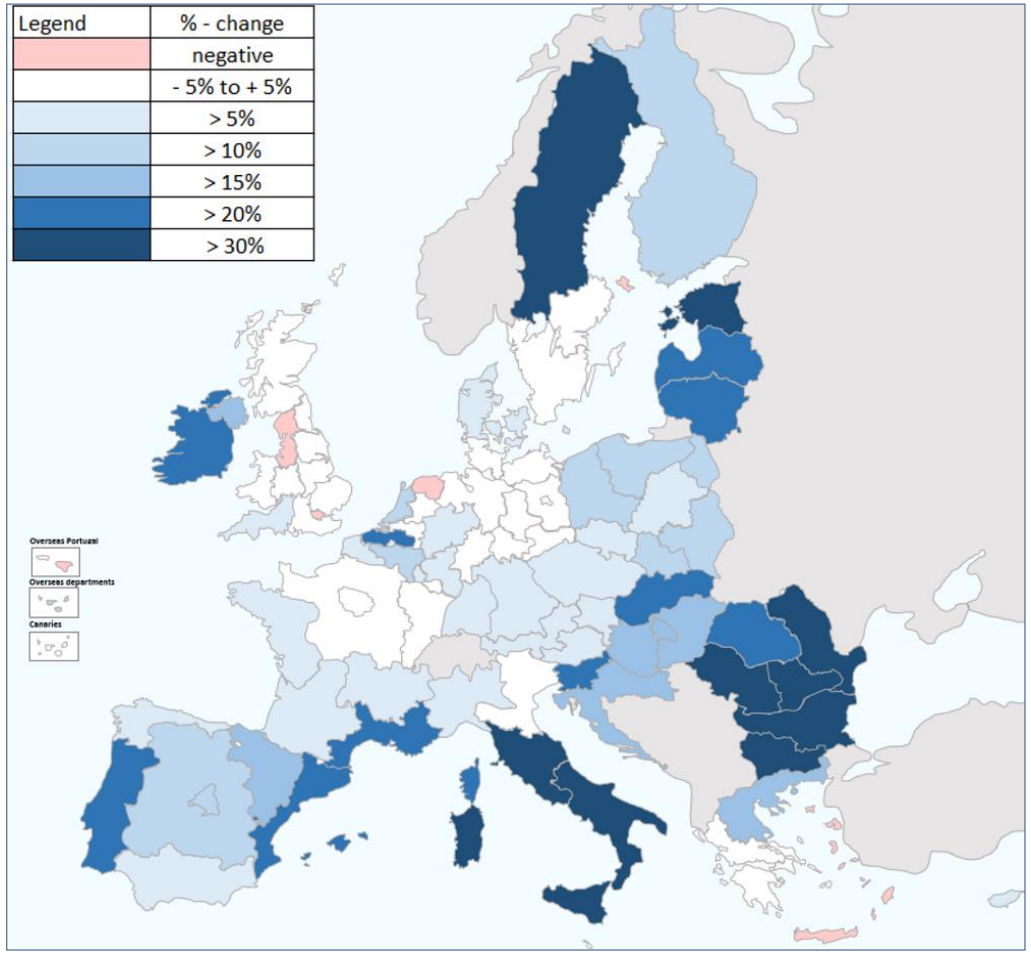
Maize growth rate is forecasted to be about **15%**. Also for Maize, increasing yields in Central and Eastern European countries are the driving force for increasing residue volumes.

Barley straw

Barley straw tends to be more or less stable in the years to come (**+6%**). The cultivated area for barley tends to be stable until 2030.

Rapeseed straw

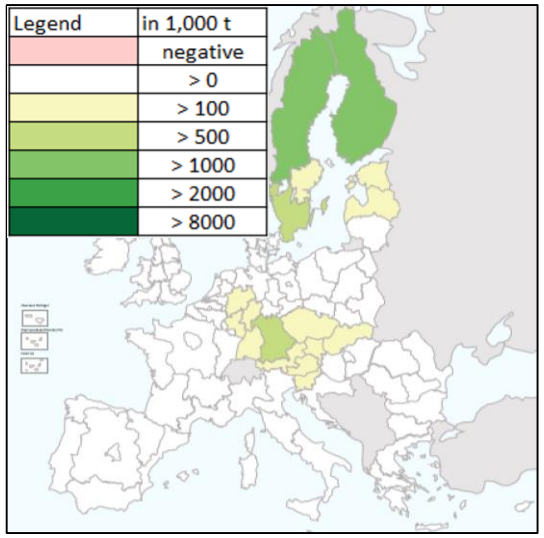
Rapeseed straw is the only feedstock with a decrease of **-5%**.The contraction of the demand for vegetable oil and 1G EtOH will lead to an decrease in the cultivated area.



Forestry results

Spruce bark

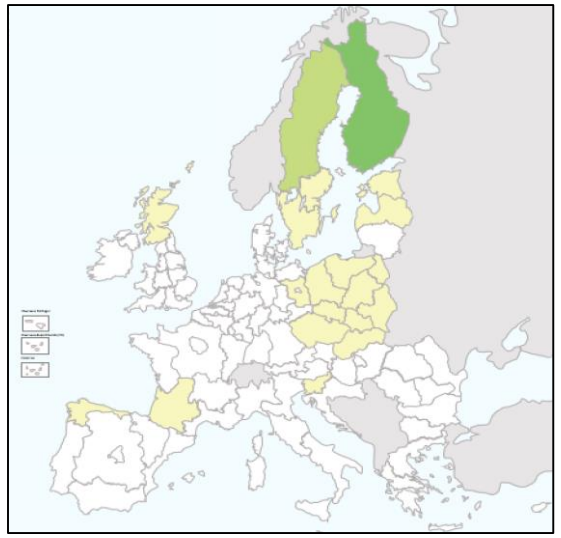
Bioeconomic potential = 7 Mt



Country	Spruce bark	Share
Sweden	2,189	28.21%
Germany	1,501	19.34%
Finland	1,263	16.27%
Austria	519	6.69%
Czech Republic	384	4.95%
United Kingdom	261	3.37%
Latvia	214	2.75%
Other	670	19.5%

Pine bark

Bioeconomic potential = 7.7 Mt



Country	Pine	Share
Poland	1,417	20.08%
Sweden	1,264	17.91%
Finland	1,166	16.52%
France	520	7.37%
Germany	482	6.83%
Spain	306	4.33%
United Kingdom	261	3.70%
Austria	1,870	27.7%