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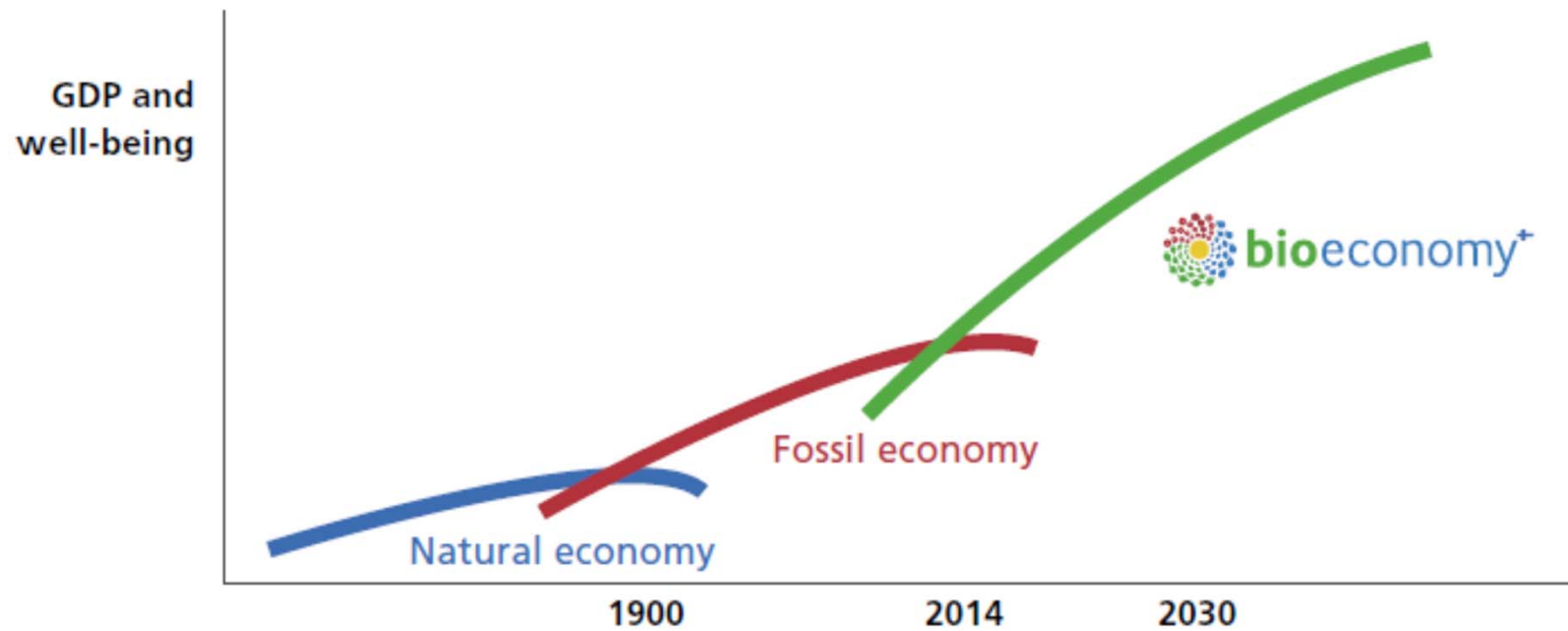
Opportunities and challenges towards a forest-based bio-economy in the EU: available resources and impacts of technological solutions for increased harvesting

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Bioeconomy of the future



Source: Finnish Ministry of Employment and the Economy

Bioeconomy of the future



“The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries.



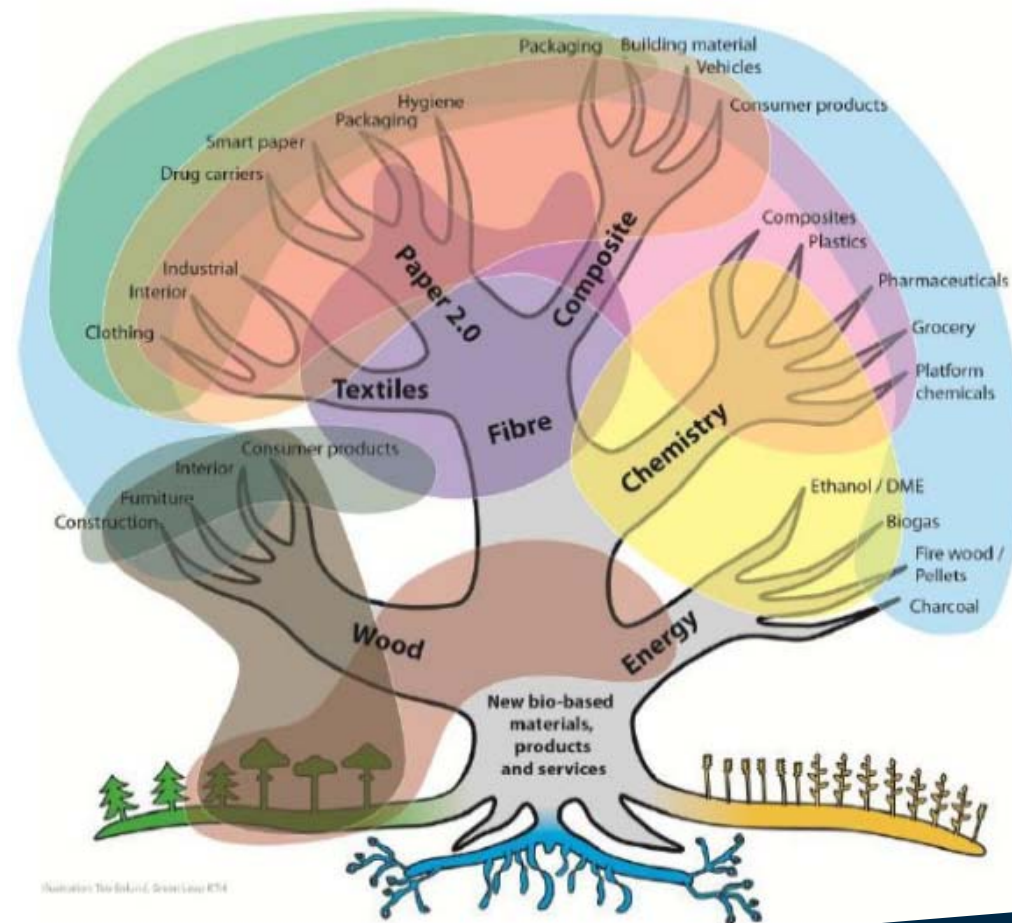
Its sectors have a strong innovation potential due to their use of a wide range of sciences (life sciences, agronomy, ecology, food science and social sciences), enabling and industrial technologies (biotechnology, nanotechnology information and communication technologies (ICT), and engineering), and local and tacit knowledge” (European Commission 2012).



The Bio-economy Challenge

“Understanding bioeconomy from a value chain perspective (...), “biomass processing and conversion” is the most prominent approach in Europe. The most frequent specific value chain approaches are “bio-energy and fuel from biomass” (74% of all indications) and/or “food and beverages” (60%).”

Source: Spatial Foresight, SWECO, ÖIR, t33, Nordregio, Berman Group, Infyde (2017): Bioeconomy development in EU regions. Mapping of EU Member States'/regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy for 2014-2020.



Source: Swedish Forest Industries Federations (2013)

Background

- Forest residual biomass is the largest source of renewable feedstock for energy in Europe. Several studies indicate that EU's forests could supply ca. 200 million m³ (400 TWh) more woody biomass for energy annually in coming decades.
- New technology and logistics are needed to mobilize this potential. True competitiveness can not be based on expensive subsidy measures for biomass.
- Efficient and responsible use of virgin and used renewable materials are crucial. Optimisation and inter-sectoral exchange of material stream logistics needed to avoid loss and inefficient treatment
- New solutions must be taken into practice. Research is important, but it only starts to effect when practice adapts it

EU-wide impacts of new innovative solutions to forest biomass supply in the EU

INFRES:

"Innovative and effective technology and logistics for forest residual biomass supply in the EU"

The logo for INFRES, featuring a stylized green leaf icon to the left of the text 'inFRes'. The 'in' is in purple, 'F' is in green, and 'Res' is in a lighter green.

TECH4EFFECT is a collaborative research project to increase **access to wood resources**. **Data and knowledge** based management will enable more efficient **silviculture** and **harvesting**, but also reduction of **soil and environmental impact** from forest operations with the TECH4EFFECT **benchmarking** system.

EU-wide impacts of new innovative solutions to forest biomass supply in the EU



Innovative machine systems for increased biomass harvest for energy:

Increased mechanisation throughout EU
Antti Ranta, enlarged truck space (69t)
Swedish HCV (74t and 90t) (Skogforsk)
Pezzolato (chipper)
Narva EF28 multitree harvester head
Press-collector: extended space forwarder
MAMA felling head
Kesla hybrid chipper

More on the machine systems: Alakangas E, Routa J, Asikainen A, Nordfjell T (Ed.) 2015. Innovative, effective and sustainable technology and logistics for forest residual biomass. Natural Resources Institute Finland, Joensuu, Finland. 40 p.

Innovative machine systems for increased wood production and forest yield (all assortments):

Work ongoing

Systematic Sustainability Impact Assessment approach by ToSIA*



ToSIA is a flexible tool, based on three concepts:

1. Alternative process chains
2. Material flow along the chain
3. Indicators per process multiplied with the material flow

ToSIA assesses the sustainability impacts of alternative supply chains.



Source: EFI

More info to ToSIA under:

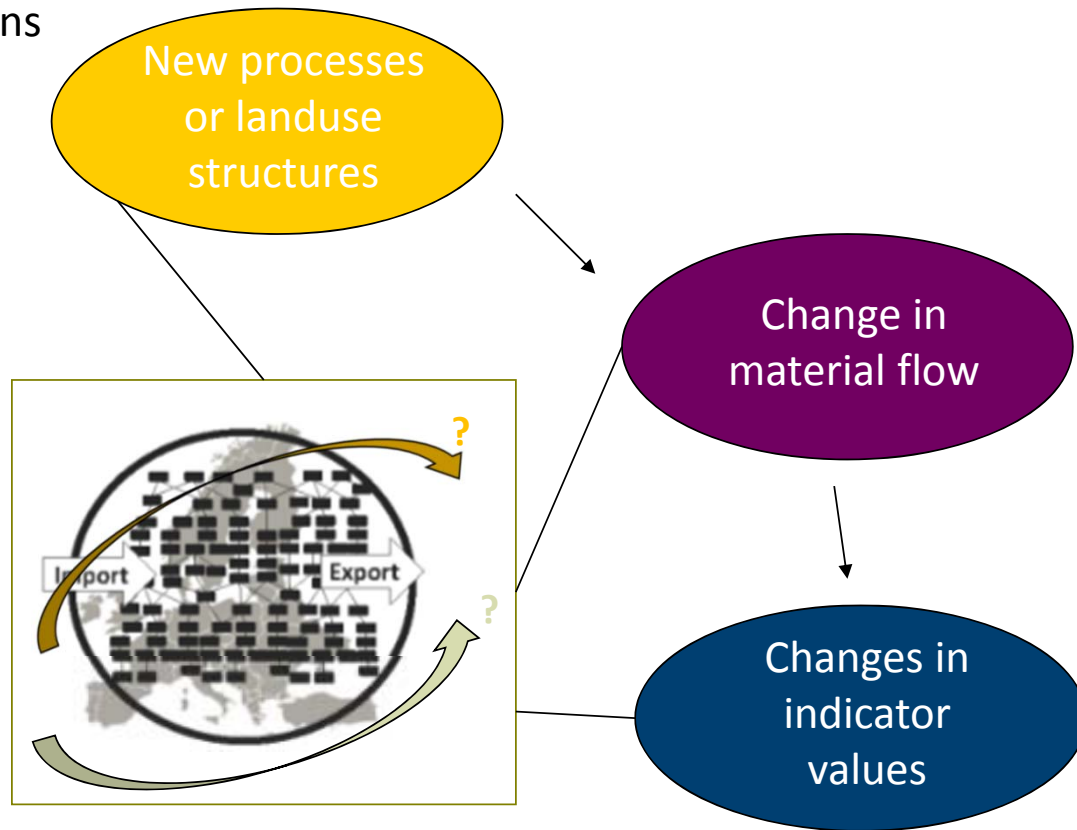
<http://tosia.efi.int>

tosia@efi.int

* ToSIA = Tool for Sustainability Impact Assessment

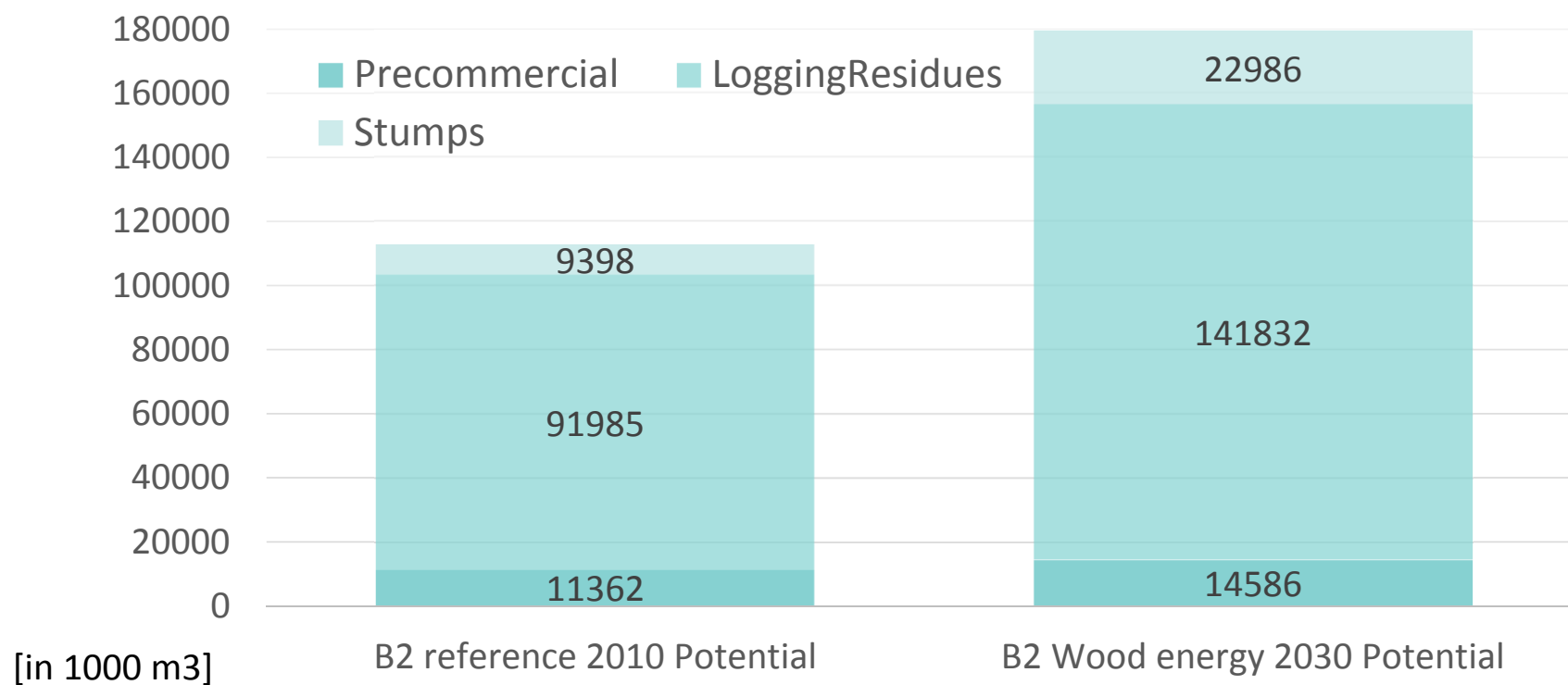
Alternative supply chains may focus on

1) Technological
machine innovations
(INFRES and
Tech4Effect)

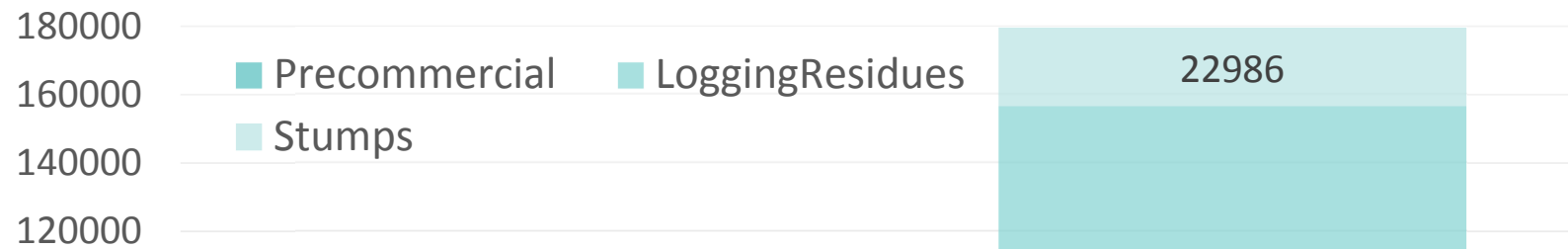


2) Increased
harvesting of forest
biomass for energy
(adapted from EFSOSII
bioenergy scenarios)

Potential to be mobilised in EU



Potential to be mobilised in EU



	B2 reference 2010 Potential	B2 reference 2010 (removal)	B2 wood energy 2010 (removal)	B2 wood energy 2020 (removal)	B2 wood energy 2030 (removal)
EU27 (total removal)	714150	548735	575903	713624	743280

[in 1000 m3]

B2 reference 2010 Potential

B2 Wood energy 2030 Potential

Direct impacts: turnover from feedstock supply

Production cost for additional small-dimension timber removal	CEU	SEU	NEU	EEU	EU
pre-commercial extra cost [EUR/m3]	56	12	15	19	28
harvest residue extra cost [EUR/m3]	44	6	8	13	22
stump extra cost [EUR/m3]			16		16

Direct impacts: turnover from feedstock supply

Production cost for additional small-dimension timber removal	CEU	SEU	NEU	EEU	EU
pre-construction [EUR/m ³]	This service value was multiplied with the volumes provided, and yielded 0.9 Mio EUR in 2010 up to 3.4 Mio EUR in 2030.				28
harvest [EUR/m ³]	44	6	8	13	22
stump extra cost [EUR/m ³]			16		16

Direct impacts: increase in employment

Extra employment per region and assortment chain	Pre-commercial extra FTE [FTE/m3]	Harvest residue extra FTE [FTE/m3]	Stump extra cost FTE [FTE/m3]
CEU	0.00039	0.00033	
SEU	0.00017	0.00008	
NEU	0.00018	0.00009	0.00018
EEU	0.00024	0.00018	
EU	0.00098	0.00069	0.00018

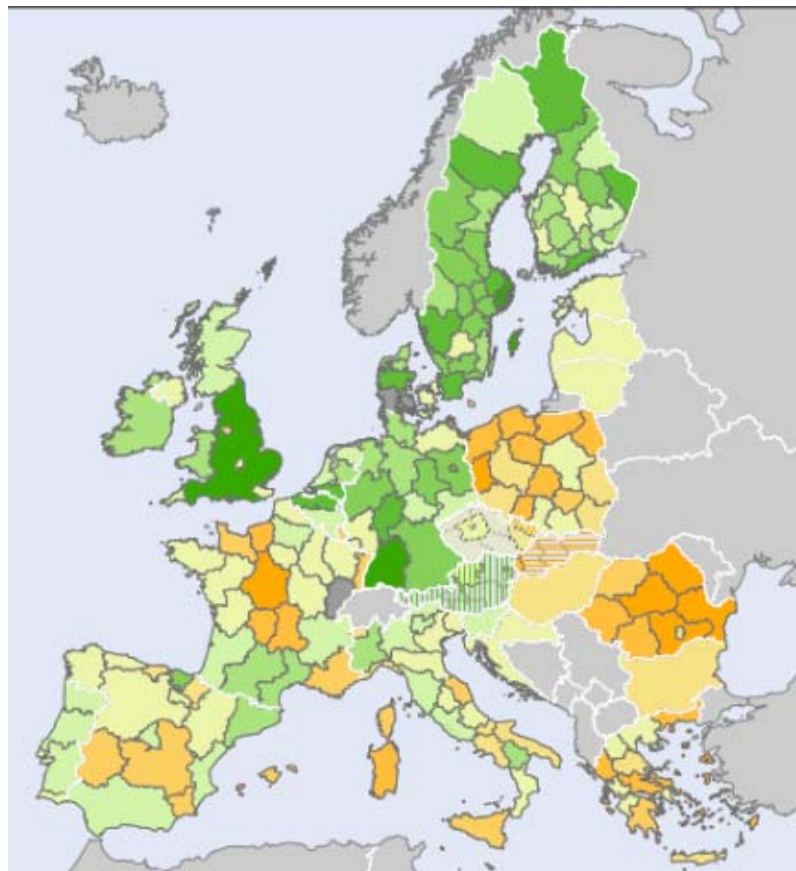
Direct impacts: increase in employment

Extra employment per region and assortment chain	Pre-commercial extra FTE [FTE/m3]	Harvest residue extra FTE [FTE/m3]			Stump extra cost FTE [FTE/m3]
		2010 (BAU)	2015	2020	
Increased manpower from additional volumes and improved harvesting technology	+74.938 FTE	+211.461 FTE	+297.980 FTE	+311.132 FTE	
EU	0.00098	0.00069	0.00018		

Outlook: opportunities and challenges

- Results give a very rough estimate for the EU for potential labour force needs
- Uptake of machine innovations is dependant on many factors, such as knowledge transfer, practical acceptance, availability of suitable machinery and skilled workers.
- Uptake depends on knowledge transfer and openness to innovation in European regions

Outlook: opportunities and challenges



Maturity of EU-28 regions/Member States in Bioeconomy R&I

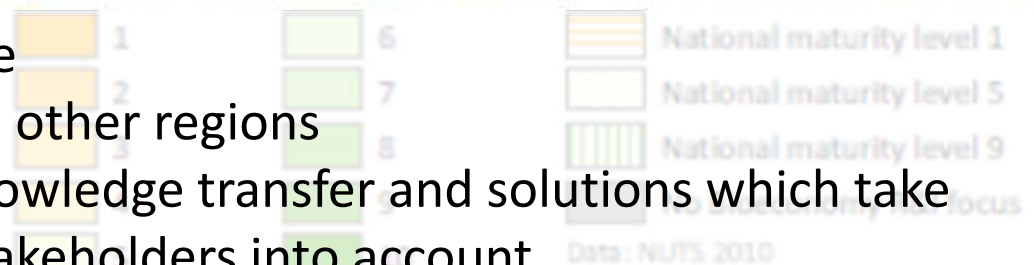


Source: Spatial Foresight, SWECO, ÖIR, t33, Nordregio, Berman Group, Infyde (2017): Bioeconomy development in EU regions. Mapping of EU Member States'/regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy for 2014-2020.

Outlook: opportunities and challenges

- Innovation transfer throughout Europe
- Adjust to local realities and learn from other regions
- European regions need tailormade knowledge transfer and solutions which take regional specifications and regional stakeholders into account
- Regional strategy development, role of forest owner associations and SME support are critical for wide-spread uptake
- Further innovations are under assessment to cover wider European aspects and more assortments (Tech4Effect)

Maturity of EU-28 regions/Member States in Bioeconomy R&I



Source: Spatial Foresight, SWECO, ÖIR, t33, Nordregio, Berman Group, Infyde (2017): Bioeconomy development in EU regions. Mapping of EU Member States'/regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy for 2014-2020.

Further readings:

Diana Tuomasjukka, Salvatore Martire, Marcus Lindner, Dimitris Athanassiadis, Martin Kühmaier, Jan Tumajer, Martijn Vis, Raffaele Spinelli, Matthias Dees, Robert Prinz, Johanna Routa and Antti Asikainen:

"Sustainability impacts of increased forest biomass feedstock supply – a comparative assessment of technological solutions"

International Journal of Forest Engineering. 2018. (accepted)

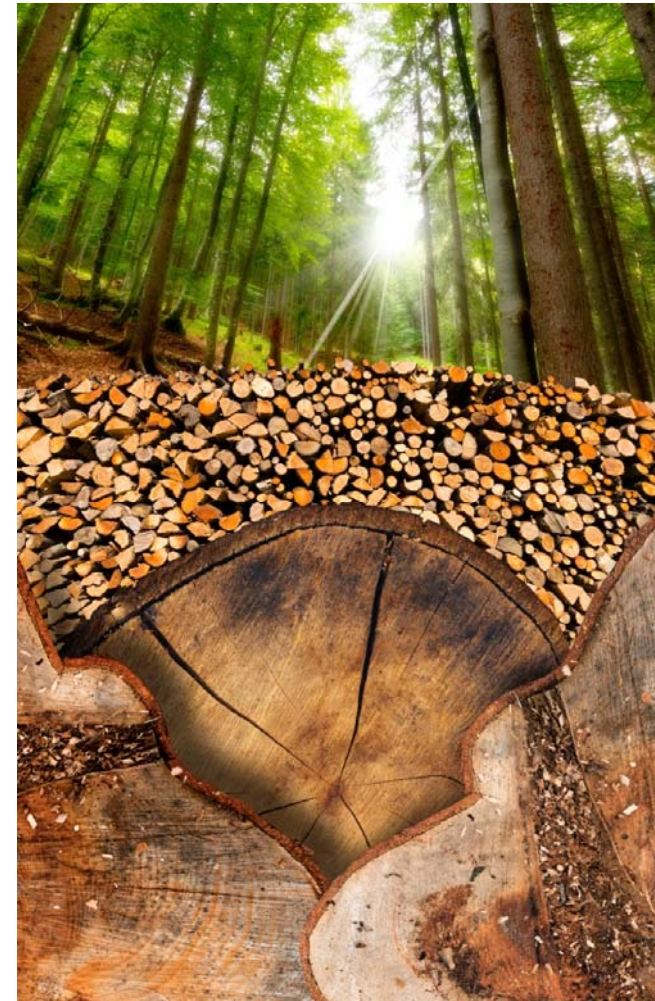
<https://doi.org/10.1080/14942119.2018.1459372>

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Horizon 2020
European Union Funding
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Thank you for your attention!

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*Connecting
knowledge
to action*