BioTrade2020plus

Supporting a Sustainable European Bioenergy Trade Strategy

Intelligent Energy Europe
IEE/13/577/SI2.675534

Deliverable 2.3

REPORT ON THE ASSESSMENT OF CRITERIA AND INDICATORS IN EXISTING SUSTAINABILITY SCHEMES FOR LIGNOCELLULOSIC FEEDSTOCKS

DRAFT ANNEX

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The BioTrade2020plus Project

Objectives

The main aim of BioTrade2020plus is to provide guidelines for the development of a **European Bioenergy Trade Strategy for 2020 and beyond** ensuring that imported biomass feedstock is sustainably sourced and used in an efficient way, while avoiding distortion of other (non-energy) markets. This will be accomplished by analyzing the potentials (technical, economical and sustainable) and assessing key sustainability risks of current and future lignocellulosic biomass and bioenergy carriers. Focus will be placed on wood chips, pellets, torrefied biomass and pyrolysis oil from current and potential future major sourcing regions of the world (Canada, US, Russia, Ukraine, Latin America, Asia and Sub-Saharan Africa).

BioTrade2020plus will thus provide support to the use of stable, sustainable, competitively priced and resource-efficient flows of imported biomass feedstock to the EU – a necessary pre-requisite for the development of the bio-based economy in Europe.

In order to achieve this objective close cooperation will be ensured with current international initiatives such as IEA Bioenergy Task 40 on "Sustainable International Bioenergy Trade - Securing Supply and Demand" and European projects such as Biomass Policies, S2BIOM, Biomass Trade Centers, DIA-CORE, and PELLCERT.

Activities

The following main activities are implemented in the framework of the BioTrade2020plus project:

- Assessment of **sustainable potentials of lignocellulosic biomass** in the main sourcing regions outside the EU
- Definition and application of sustainability criteria and indicators
- Analysis of the **main economic and market issues of biomass/bioenergy imports** to the EU from the target regions
- Development of a dedicated and **user friendly web-based GIS-tool** on lignocellulosic biomass resources from target regions
- **Information to European industries** to identify, quantify and mobilize sustainable lignocellulosic biomass resources from export regions
- **Policy advice on long-term strategies** to include sustainable biomass imports in European bioenergy markets
- **Involvement of stakeholders** through consultations and dedicated workshops

More information is available at the BioTrade2020plus website: **www.biotrade2020plus.eu**

About this document

This report corresponds to the Annex of the Deliverable 2.3 – Report on the assessment of criteria and indicators in existing sustainability schemes for lignocellulosic feedstocks. It has been prepared by: IINAS.

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Collaborations	

Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services):	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Acronyms and Abbreviations

CEC	Cation Exchange Capacity
EFI	European Forest Institute
INFRES	Innovative and effective technology and logistics for forest residual biomass supply in the EU
IPCC	Intergovernmental Panel on Climate Change
MCFPE	Ministerial Conference on the Protection of Forests in Europe
OWL	Other wooded land
SRC	Short Rotation Woody Crops
ToSIA	Tool for Sustainability Impact Assessment

1. About this Annex

This annex aims to complement the information provided in the main deliverable “Report on the assessment of criteria and indicators in existing sustainability schemes for lignocellulosic feedstocks”, Deliverable 2.3 of the BioTrade2020plus project.

It aims to provide complementary indicators to those depicted in the main report that could help enhance the sustainability approach to be elaborated in Deliverable 2.4 of the project (BioTrade2020plus Approach to Sustainability). Additional information from the following sources is provided:

- ToSIA – Tool for Sustainability Impact Assessment
- Infres project
- SRCplus project

2. Other considerations found in the revision in the S2Biom

Given the extensive work done under the S2Biom project, several sustainability requirements were found. These requirements are presented here as: complementary indicators and other provisions of particular interest for solid biomass.

2.1 Complementary indicators

This category summarizes other indicators or guidelines that complement the mid-point indicators (as found by Iriarte, Fritsche 2015a) and Totally, 39 indicators, grouped around 20 topics were found. The relevance of these indicators among the schemes analyzed is not discussed here but full details about this can be found in the original report.

Topic: Waste

- Waste management and reduction, recycle and re-use of waste
- Waste generation per ton of product

Topic: Best Environmental Practices

- “Responsible” management of wastewater
- No use of burning
- Responsible management infrastructural development, transport activities and silviculture

Topic: Land Use and Land Use Change

- Assure the permanence of vegetation (regenerate vegetation cover)
- Rehabilitate degraded ecosystems
- Land Use Change

Topic: Sustainable harvesting of forest products and non-wood forest products

- Harvest products and services from the Management Unit at or below a level which can be permanently sustained

Topic: Resource use

- Efficiency of systems of production and transformation
- Intensity of fossil fuel use

Topic: Best Practices for resource efficiency

- Energy saving practices

Topic: Best Environmental Practices for climate change mitigation

- Practices to diminish GHG emissions
- Practices to increase carbon dioxide sequestration

Topic: Climate Change

- Maintenance of forest contribution to global carbon cycles

Topic: Best Environmental Practices for biodiversity conservation

- Practices to diminish spread of invasive introduced species and new pests or diseases
- "Responsible" application of agrochemicals (in the case of forestry minimize or eliminate) and biological control agents
- Avoid harvesting of threatened or endangered plant species

Topic: Other indicators for biodiversity conservation

- Maintain or restore of areas of water influence
- Monitor periodically key biotic and abiotic factors that might affect health and vitality of ecosystems

Topic: Best Environmental Practices for soils

- Avoid planting in certain areas to protect soils

Topic: Other considerations for soils conservation

- Measures for soil conservation
- pH (percentage fields with samples showing analyses within acceptable limits for pH)

Topic: Best Environmental Practices

- Avoid natural water contamination

Topic: Gender equality

- Promote gender equality

Topic: Social wellbeing

- Availability of a mutually agreed and documented system for dealing with complaints and grievances, which is implemented and accepted by affected parties
- Use local processing, local services, and local value adding.

Topic: Benefit sharing mechanism

- Support to vulnerable people

Topic: Rights of indigenous peoples & local communities

- Rights of indigenous peoples & local communities -defined in the United Nations Declaration on the Rights of Indigenous Peoples (2007) and ILO Convention 169 (1989).
- Existence of conflict management mechanisms

Topic: Traditional knowledge

- Traditional knowledge

Topic: Documented system for participatory processes

- Negotiations concerning compensation for loss of legal, customary or user rights are dealt with through a documented system that enables indigenous peoples, local communities and other stakeholders to express their views through their own representative institutions as free, prior and informed consent and negotiated agreements

Topic: Employment and labor conditions

- Fair pricing and transparent contracts

Topic: Training of workers

- Training and requalification of the workforce

Topic: Economic

- Value of products (includes value and volume of production and/or value added per ton)
- Means for research
- Incentives for investments

The S2Biom project found other requirements that might be also of interest, even if they were not meaningfully considered in the schemes.

- Renewable and recycled materials consumption
- (Reduction) of intensity of material use
- Conversion of abandoned agricultural and treeless land into forest

- Promote the use of fallow areas
- Minimum separation of production areas from natural terrestrial ecosystems
- Fallen dead wood, hollow trees, old groves and special rare tree species shall be left in quantities and distribution necessary
- Process of residue removal minimizes harm to ecosystems.
- Use of locally adapted varieties and breeds

2.2. Other indicators found in the S2Biom project with respect to solid biomass

This section includes a broad range of indicators from different schemes and regulations targeting lignocellulosic biomass as well as other indicators included in other research projects.

In addition to the systemic analysis about sustainability requirements for non-food biomass carried out in S2Biom (see Section 3.2.1), the S2Biom project also identified requirements in other schemes and guidelines. These requirements are synthesized around 6 topics, with a total of 14 indicators:

Topic: Sustainability assurance:

- Material produced under Sustainable Forest Management (for instance, FSC, PEFC or equivalent) (In Belgium, according to the PelletNorm; Pelkmans et al. 2012)

Topic: Cascading use of materials:

- Exclude certain biomass when it can be used by the wood processing industry (in Belgium-Flanders) (Pelkmans et al. 2012)
- Exclude certain biomass for energy purposes such as roundwood (in Poland) (Pelkmans et al. 2012).
- Assure that waste cannot be used for other purposes than fuel (in Hungary) (Pelkmans et al. 2012).
- Raw materials-efficient use of biomass (NEN 2014)
- Chemical composition of wastewood when it is for combustion (Alakangas 2014)

Topic: Competition and displacement

- Promote the use of local biomass for energy (Pelkmans et al. 2012)
- Competition with food and local applications of biomass (NEN 2014), including: Local prices, Promote iLUC low risks

Topic: Landscape

- Maintain (or create) diverse land structures for farming (EU **bioeconomy** action plan and working document; EC 2012a+b)

Topic: Protect or enhance biodiversity (EU Biodiversity Strategy; EP 2012)

- Promote the development of Forest Management Plans
- Restoration, by 2020, of at least 15 % of degraded ecosystems.
- Identification and prioritization of Invasive Alien Species (IAS) and their pathways are identified and prioritized, control and eradication of priority species, and manage pathways to prevent the introduction and establishment of new IAS, by 2020.

Topic: Specific considerations for selected feedstocks

- Amount of forest residues to be harvested without negative impacts on biodiversity or soils (Fritsche et al. 2014). This topic is deeply discussed in the Infres project
- Ash recycling: Sweden has guidelines with recommendations on amount and quality of ashes to be recycled when forest residues are harvested (Swedish Forest Agency 2008).

3. ToSIA "Tool for Sustainability Impact Assessment"

ToSIA selected indicators for the BioTrade2020plus Project are shown in Table 1.

Table 1 Selected Indicators from ToSIA for the BioTrade2020plus Project

Theme	Full indicator name	Sub-indicators	Units
Economic	Production of goods and services	Goods classified by a) volume and b) value	t; kg; m^3
		Forest services (marketed)	€
	Use of renewable and non-renewable materials, classified by virgin and recycled material	Volume of renewable materials in total, of which a) wood-based material in total - of i) virgin and ii) recycled origin b) other renewable materials in total - of virgin and recycled origin	kg
		Volume of non-renewable materials in total - of virgin and recycled origin	kg
Social	Frequency of occupational accidents and occupational diseases	Occupational accidents classified by: non-fatal occupational accidents fatal occupational accidents	absolute number per 1000 employees
		Occupational diseases	frequency of cases per number of persons exposed multiplied by

Theme	Full indicator name	Sub-indicators	Units
			number of years of exposure and in absolute numbers per 1000 employees
	Forest holdings and forest-based enterprises with third-party certified management and share of wood sourced from third-party certified sustainable production	Forest holdings and forest-based enterprises with third-party certified management a) forest certification schemes b) environmental management system	number of enterprises
		Share of wood sourced from third-party certified sustainable production per NACE category	% of total volume sourced
Environmental	On-site energy generation (from renewables) and energy use classified by origin including the share of self-sufficiency	On-site energy generation from renewables in total and classified into a) heat b) electricity c) fuel	TeraJoule (TJ)
		Energy use in total and classified by a) heat in total classified by origin (renewable/non-renewable) b) electricity in total classified by origin (renewable/non-renewable) c) fuel in total classified by origin (renewable/non-renewable)	TeraJoule (TJ)
	Greenhouse gas emissions and carbon stock	Greenhouse gas emissions in total	CO_2 equivalents
		Carbon stock in a) forests [classes as per IPCC guidelines] b) wood products c) landfill	CO_2 equivalents
	Transport volume and distance per mode of transport	Total tonnes and share of modal split	t, %
		total tonne-km and share of modal split	t-km, %
	Water use	Water use (freshwater intake by industry)	m^3
		Water use of the forest ecosystem a) evapotranspiration from the forest ecosystem Groundwater recharge	m^3/ha
	Area of forest and other wooded land and related growing stock classified by type and by	Area of forest and area of other wooded land	ha
		Growing stock classified by: a) forest types (predominantly conifers, predominantly broadleaved, mixed)	m^3 (growing stock is

Theme	Full indicator name	Sub-indicators	Units
	availability of wood supply as well as balance of increment and fellings	b) forest available for wood supply (as defined by UNECE/FAO)	measured over bark)
		Net increment (balance between increment and fellings)	m^3
	Soil condition as expressed by chemical soil properties and soil compaction	Chemical soil properties related to soil acidity and eutrophication classified by main soil types a) pH b) CEC c) C:N ratio d) organic C e) base saturation f) site nutrient budget averaged over total rotation period (N, P, K, Ca, Mg)	a) pH classes b) cmol/kg c) ratio d) g/kg e) % (calculated as sum base cations CEC)*100 f) % difference over total rotation period
		Soil compaction from machine operations	soil density in kg/d m^3
	Area of forest and other wooded land (OWL) classified by number of tree species occurring and by forest type and by protection status	Area of forest and OWL classified by a) number of tree species occurring b)forest types (predominantly conifers, predominantly broadleaved, mixed)	total number per 1000 ha
		Total volume of deadwood on forest and OWL and classified by a) standing deadwood b) lying deadwood	m^3/ha
		Protection status of area of forest and OWL	area per 1000 ha (according to MCPFE assessment guidelines)
	Forest area with damage and damage induced wood supply	Area with damage classified by damaging agent a) biotic - i. insects and diseases or ii. wildlife and grazing b) abiotic - i. fire; storm;wind; snow, drought, mudflow and other identifiable abiotic factors c) human induced	ha
		Damage-induced wood supply	m^3
	Generation of waste - total, hazardous, and categorised by type of waste management	Generation of waste in total, and the proportion of which is hazardous waste	kg
		Waste management a) waste to material recycling b) waste to incineration c) waste to landfill	m^3

Source: own elaboration from ToSIA (EFI 2013)

4. Infres project

The Infres project (Innovative and effective technology and logistics for forest residual biomass supply in the EU) suggests potential impacts of forest residues harvesting and provide some recommendations:

- Results from the peer-reviewed literature clearly show that whole tree harvesting (WTH) has the potential to reduce forest production at the stand level, primarily due to the additional removal of nutrients with nitrogen being the most important in the boreal and northern temperate forest. This can be compensated for by adding a fertilizer or other silvicultural means to increase forest production.
- Increased risk for soil compaction and rutting
- Increased harvesting of biomass decreases the nutrients stocks at a site, but not
- Necessarily in the soil. Removal of logging residue does not clearly decrease soil N, P or base cations stocks in short and medium term.
- Fertilization can be used to sustain nutrient availability, but leaving residue needles and leaves on site is beneficial as regards the maintenance of organic matter in the soil and returning nutrients to the soil.
- The most vulnerable site and soil types are rather easy to identify. Still, there is a need for long-term WTH experiments as well as for the modelling studies that cover a large range of different site types and tree species and extend over a whole rotation period.
- Harvesting of logging residues can also have a positive influence to tree growth as absence of logging residues makes soil preparation and planting easier and results in denser and more uniform stands.
- In order to get a realistic overview of the effects of WTH compared with SOH, soil stocks and processes, forest growth and new vegetation, and nutrient and leaching losses should be studied at the same site concurrently.
- For water balances, whole tree harvesting has a small positive effect on nutrient transport into watercourses. (i.e. less nutrients are transported in catchments where WTH is carried out.)
- No measurable increase in mercury or methyl-mercury was recorded as a result of
- Intensive residue extraction however this was the result of one study in a high mercury area and hence may be worthy of further investigation.
- A measurable and substantial negative response of intensive residue extraction has been recorded in acid sensitive water catchments in the boreal zone. Whole tree harvesting caused a reduction in base cations, pH and acid neutralizing capacity in the medium term (ca. 30 years) and large scale residue extraction may work against any attempts to reduce acidification through control of emissions.
- For biodiversity aspects fuelwood harvesting had clear negative impacts on both fine and course woody debris thereby affecting diversity of species which are dependent on dead wood such as mosses, liverworts and wood-decaying (saproxylic and fungivorous) beetles. Other groups of organisms had a more varied response. For instance, diversity of ground-dwelling beetles, plants and stand structural diversity showed both positive and negative as well as neutral impacts of bioenergy harvesting.
- It would be recommendable to exclude sensitive sites from intensive residue extraction, such as Biodiversity hotspots, which are areas where biodiversity is still rich. This includes buffer zones around nature reserves with high biological values associated with dead wood. Further it is important to retain old deciduous living and dead deciduous trees which are

important to biodiversity. Especially species such as oak, lime and aspen are associated with a rich flora and fauna.

5. SRCplus project

Herein recommendations of the project “Short Rotation Woody Crops (SRC) plantations for local supply chains and heat use Project” have been selected for each topic:

For land use changes

- The cultivation of SRC on high valued wetlands and peatlands (with no agricultural use) shall be avoided. However, on wetlands and peatlands that are intensively used, SRC is a good measure to capture carbon.
- In general, poplar and willows grow better than many annual crops on marginal agricultural land that is characterized by very humid soils and frequent floods. These areas are suitable for SRC, as they have various environmental benefits
- The cultivation of SRC in intensive agriculturally used landscapes with only few forest areas and structural elements (hedges) shall be promoted. In general the cultivation of SRC on this land is positive, as it adds a structural element; however, some species depend on the openness of the landscape (e.g. great bustard).
- Most appropriate areas for SRC are intensive agricultural land, but leads to displacement of other crops.
- High structural heterogeneity provides habitats for different plant requirements and thus increases diversity. High structural diversity at one SRC location can be achieved by:
- Planting different tree species and clones
- Harvesting at different times so that the trees have different rotation ages within one area
- Edges of SRCs have great species diversity, and planting several smaller plantations instead of one big SRC is advised because smaller plantations have longer edges for their size than larger ones. If that is not possible, planting long rectangular plantations can provide more benefits considering increased phytodiversity.
- An increase in forest ground species can be achieved by reducing the irradiance reaching the ground vegetation. This can be done by long rotation periods, high plant densities and planting willow instead of poplar. Another possibility is aligning planting rows in the east-west direction to reduce radiation reaching ground vegetation by shading the planted crop.
- The plantations edges needed to enable easier harvesting should be as wide as possible to allow e.g. indigenous flowering plants that attract insects. The mowing cycle of the headers should be adjusted in order to maximize environmental benefits.

For Zoodiversity

- Impacts of SRC cultivation on extensively used grassland are often rather negative. Thus the impacts need to be carefully assessed and in case that the impacts are negative these areas shall be avoided.
- The shape and the size of the plantation shall consider the overall characteristics of the landscape. In general, from the environmental viewpoint, smaller and heterogenic shaped plots are preferable.
- If cultivated on grassland, the set-up of SRC without previous ploughing (direct planting) shall be preferred.

- SRC is very suitable for the remediation of contaminated soils (e.g. landfills, excavation areas) as it “recycles” land.
- In water protection areas, the cultivation of SRC can contribute to increase the groundwater quality.
- On land that borders water bodies, SRC can contribute to mitigate soil erosion and to provide a structural element.

For Phytodiversity

- Where possible SRCs should be designed with a large edge to interior ratio.
- A mix of varieties and clones should be used.
- Huge blocks of SRC should be separated, e.g. by rides and hedges
- A percentage of the SRC area should be reserved for small habitats like strips of grass and stepped wood boundaries.

For Soils

- SRC could be cultivated in fields with low initial soil organic matter content to increase this content and with this the fertility and C storage of the soil.
- SRC should be cultivated especially in areas with a high risk of erosion (wind or soil), e.g. with relief, to lower the loss of fertile topsoil and nutrients by water and wind.
- Application of municipal residues such as sewage sludge for recycling of nutrients to SRC can be encouraged, since SRC can contribute to prevent nutrient losses and can extract heavy metals efficiently.
- SRC should be used to remediate soils with increased Cd concentrations caused e.g. by the long-term use of Cd-containing P-fertilizers or other sources of environmental pollution.
- SRC fields should be established at the same location for at least three cutting cycles to achieve soil quality improvements concerning C storage and Cd uptake.
- SRC should be harvested in winter in countries when soil is frozen to avoid soil compaction.

For Water

- SRC could be cultivated in fields located close to N sources (e.g. animal farms, N vulnerable zones, wastewater treatment plants etc.) to decrease N outflow to adjacent water bodies.
- SRC should be cultivated in areas where low groundwater level is anticipated (potentially flooded areas and areas near water bodies which can potentially flood).
- Application of solid municipal residues such as sewage sludge for recycling of nutrients does not affect water quality, and should therefore be encouraged.
- More frequent harvests lead to a higher average groundwater recharge, and therefore should be encouraged to ameliorate possible negative impact of groundwater recharge reductions.

For Landscape change

- Planting SRC in agricultural fields close to forest stands gives a feeling of a natural continuation in the landscape and should be preferred. However, planting in only forest areas should be avoided since the landscape would become very forest-homogenous.
- Planting of SRC near cultural sites of importance should be avoided.
- Clusters of SRC fields are preferred for economic reasons enabling lower prices for management activities.

- SRC is very suitable to be grown alongside roads with heavy traffic, as this land is often not used. However, it must be considered, that, depending on the given road, safety issues need to be considered. In order to allow drivers to have a good view e.g. at bends and crossings, SRC fields edges in these cases needs to be broader.
- SRC fields should be planted close to the end users to achieve better economy due to low transport costs.
- SRC should be in general planted in areas with the less perceived landscape impact (e.g. close to forest, in hilly areas, away from culturally important sites) and in a way that will fit to the surroundings (e.g. smaller patches in forest areas, bigger fields in open agricultural areas, adjusted to the hill variation in hilly areas).

References

Alakangas E 201 4: Classification of wastewood for combustion based on ISO 17225-1 standard DEMOWOOD Conference; 6 May; Munich VTT Technical Research Centre of Finland

Dimitriou I et al. 2014: Sustainability criteria and recommendations for short rotation woody crops WP 2 –D 2.3; SRCplus project; Short Rotation Woody Crops (SRC) plantations for local supply chains and heat use Project No: IEE/13/574 http://www.srcplus.eu/en/publications.html

EC (European Commission) 2012a: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Innovating for Sustainable Growth: A Bioeconomy for Europe; COM(2012) 60 final; February 13; Brussels http://ec.europa.eu/research/bioeconomy/pdf/official-strategy_en.pdf

EC (European Commission) 2012b: Commission Staff Working Document. Accompanying the document Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe http://ec.europa.eu/dgs/home-affairs/e-library/documents/basic-documents/docs/an_open_and_secure_europe_-_making_it_happen_swd_en.pdf

EP (European Parliament) 2012: Our life insurance, our natural capital: an EU biodiversity strategy to 2020; 2011/2307(INI); Brussels http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/EP_resolution_april 2012.pdf

EFI (European Forest Institute) 2013: ToSIA sustainability indicators; Available at: http://tosia.efi.int/sustainability-indicators.html

Fritsche U R et al. 2014: Extending the EU Renewable Energy Directive sustainability criteria to solid bioenergy from forests; in: Natural Resources Forum vol. 38, no. 2, pp. 129-140

Iriarte L, Fritsche U R 2015a: Benchmark and gap analysis of criteria and indicators (C&I) for legislation, regulations and voluntary schemes at international level and in selected EU Member States Main Report; Deliverable 5.2: of the S2Biom project: Delivery of sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe; Madrid, Darmstadt; www.s2biom.eu

NEN (Nederlands Normalisatie-instituut) 2014: Draft NTA 8080-1 (en) Sustainably produced biomass for bioenergy and biobased products — Part 1: Sustainability requirements; Delft http://www.nen.nl/NEN-Shop/Vakgebieden/Energie-Distributie/Nieuwsberichten-Energie/NTA-8080-for-comments.htm

Pelkmans L et al. 2012: Benchmarking biomass sustainability criteria for energy purposes; Contract ENER/C1/495-2009/SI2.572581; Mol etc. http://ec.europa.eu/energy/renewables/studies/doc/2014_05_biobench_report.pdf Swedish Forest Agency 2008

Tuomasjukka D et al. 2013: Description of the INFRES Sustainability Impact Assessment Framework with Indicator and Scenario Specifications - D5.1; Joennsu, etc. http://www.infres.eu/en/results/

Tuomasjukka D et al. 2014: Impact Assessment on Carbon dynamics, forest growth and productivity, water quality, and biodiversity – D5.2; INFRES – Innovative and effective technology and logistics for forest residual biomass supply in the EU (311881); Joennsu, etc. http://www.infres.eu/en/results/

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