

# S2Biom Summer School

Athens 17.5. - 20.5.2016

## S2Biom - delivery of sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe

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London



## Day 1 (17<sup>th</sup> May)

Session 1: Sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe

Session 2: Estimation of biomass availability for lignocellulosic biomass

## Day 2 (18<sup>th</sup> May)

Session 3: Biomass conversion technologies for energy and fuels

Session 4: Biomass conversion technologies for bio-based products

## Day 3 (19<sup>th</sup> May)

Session 5: Biomass logistics

## Day 4 (20<sup>th</sup> May)

Session 6: Policies & case studies

Session 7: Case study analysis to estimate biomass cost supply and logistics with the S2Biom toolset

Main objective: Delivery of sustainable supply of non-food biomass to support a resource-efficient Bioeconomy in Europe

- **Funding programme: 7<sup>th</sup> Framework Programme (FP7)**
- **Funding volume: 4 Mio € (EC co-funding)**
- **Duration: 36 Month (09/2013 – 08/2016)**
- **Participation: 31 Partners from 16 countries (EU28, Western Balkans, Moldova, Ukraine, Turkey)**
- **Project website: [www.s2biom.eu](http://www.s2biom.eu)**

# Project partners



No.	Institution/Organisation (original language)	Acronym	Country code
1	Agency for Renewable Resources	FNR	DE
2	Imperial College	Imperial	UK
3	Stichting Dienst Landbouwkundig Onderzoek	DLO	NL
4	University of Freiburg	ALU-FR	DE
5	Joanneum Research	JR	AT
6	International Institute for Applied Systems Analysis	IIASA	AT
7	European Forest Institute	EFI	FI
8	Natural Resources Institute Finland	LUKE	FI
9	VTT Technical Research Centre of Finland	VTT	FI
10	University of Bologna	UniBO	IT
11	Energy research Centre of the Netherlands	ECN	NL
12	Flemish Institute for Technological Research	VITO	BR
13	IINAS - International Institute for Sustainability Analysis and -Strategy	IINAS	DE
14	Clever Consult	CC	BE
15	SYNCOM Research and Development Consulting GmbH	SYNCOM	DE
16	WIP Renewable Energies	WIP	DE
17	Biomass technology group BV	BTG	NL
18	Central European Initiative	CEI	IT
19	Institute of Soil Science and Plant Cultivation, State Research Institute	IUNG	PL
20	International Centre for Sustainable Development of Energy, Water and Environment Systems	SDEWES	HR
21	Ege University Solar Energy Institute	EU-SEI	TR
22	National Institute for Agricultural Research	INRA	FR
23	Joint Research Centre	JRC	IT
24	CENER-CIEMAT Foundation	CENER	ES
25	Research Centre for Energy Resources and Consumption	CIRCE	ES
26	Slovenian Forestry Institute	SFI	SI
27	Centre for Research & Technology Hellas	CERTH	EL
28	Renewable Energy Agency	REA	UA
29	University of Belgrade - Faculty of Mechanical Engineering	UBFME	RS
30	Census-Bio	Census-Bio	UK
31	Biomass Research	Biomass Research	NL



- *In support of the **sustainable delivery of non-food lignocellulosic biomass at local, regional and pan-European level** through developing **Strategies, and Roadmaps** that will be informed by a “computerized and easy to use” **planning toolset (and **respective databases**)** with up to date harmonized data for EU28, western Balkans, Turkey, Moldova and Ukraine.*
- *Research covers the **whole biomass delivery chain** from primary biomass to end-use of non-food products and from logistics, pre-treatment to conversion technologies.*
- *Spatial level is NUTS1 to NUTS3 for the toolset and the database*

# We collaborate with:



- **EU projects: BEE, CEUBIOM, Biomass Futures, Biomass Policies, Biomass Trade Centres, CAPRI, Sector, Bioboost, Logistec, INFRES and EuroPruning;**
- **Biobased industries: close collaboration with key stakeholders from industry and market sectors.**
- **Energy Community: collaboration with Secretariat and Contracting Parties (e.g. Serbia, FYR of Macedonia, Moldova, Ukraine).**



## Theme 1: Data & Tools (WPs 1-4)

- Current and future sustainable lignocellulosic biomass costs and supply (domestic and from imports) in EU28; Western Balkans, Moldova, Ukraine and Turkey.
- Common operating data, models, and tools representing the entire biomass supply chain
- Incorporation of models and tools for technical, environmental, economic and social impact analysis

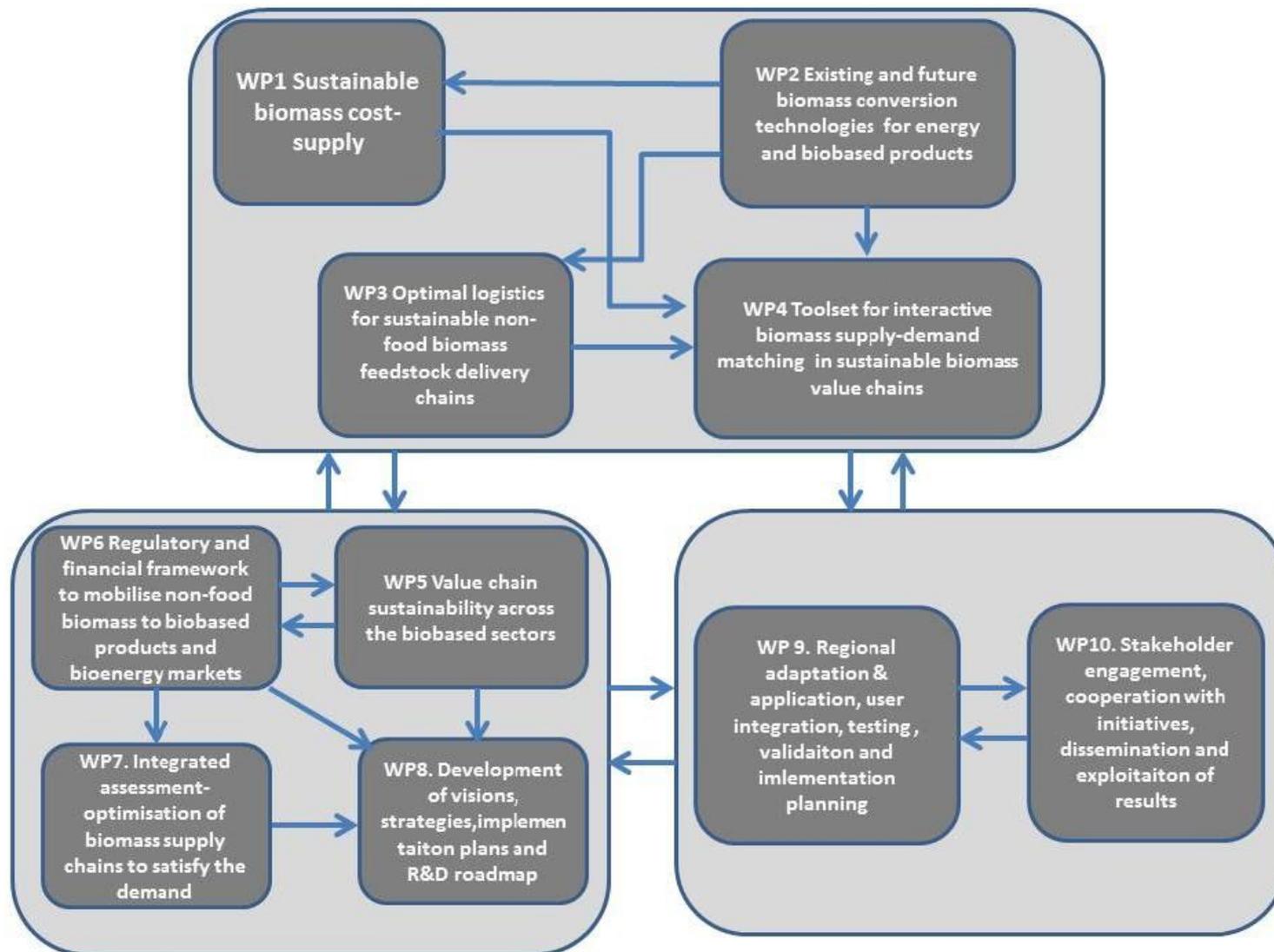
## Theme 2: Strategies & Roadmaps (WPs 5-8)

- Policy and regulations for supplying the future bioeconomy
- Support for future industrial investments
- Clarity on cross sector sustainability
- Strategies & Roadmap
- Ex ante impact assessment

## Theme 3: Validation & project outreach (WPs 9-10)

- Support for policymaking at local, national, regional and EU28 levels by visualizing the outcomes of proposed policies
- Case Studies
- Stakeholder engagement
- Information Campaign
- Improvement of public awareness, education, and outreach

# Thematic structure - Overview



- **Database with sustainable cost supply biomass potentials (current, 2020, 2030)**
- **Roadmap for regional end-users**
- **Atlas with regional cost-supply data**
- **Overview of relevant projects, sources and tools on biomass cost supply**

- **Method for standardized biomass characterisation and minimal biomass quality requirements for each biomass conversion technology**
- **Selection method to match biomass types with the best conversion technologies**
- **Database of conversion technologies**

- **Report on main logistical components**
- **Report on existing and new logistical concepts and conceptual designs (assessment of their economic performance and GHG emission impact)**
- **Database with data characterising logistical components along the delivery chain**

- **GUI for the different tool sets and database, which are developed within the project**
- **Database with all data, accumulated within the project**
- **Data viewer, download and analysis tool for biomass cost-supply**
- **Technical description and user guide for the integrated tool sets, databases and GUI**

- **Report on benchmark and gap analysis of criteria and indicators**
- **Report on environmental footprint method for non-food biomass supply chains**
- **Report on sustainability aspects of bioeconomy value chains**
- **Guidelines on assessing bioeconomy value chain sustainability performance**

- **Database on EU and national level regulatory and economic framework in relation to the mobilisation of sustainable non-food biomass**
- **Benchmarking of country policy approaches**
- **Report on policy options and advisory document on fields of cooperation and potential synergies between countries and at international level**

- **Description of existing scenarios**
- **Market analysis for the bio-base industry, including biochemical and bioplastics**
- **Syntheses report detailing the outcomes of the scenario analysis of biomass supply chains to satisfy the demand**

- **Overview of current status of biomass in Europe**
- **Vision document for the future development of the sustainable delivery of non-food biomass feedstock**
- **Strategies and implementation plans**
- **Roadmap for sustainable biomass supply**

- **Stakeholder engagement plan with consultations, working groups and workshops**
- **Testing the tool sets with stakeholders and validation**
- **Case study implementation (strategic and advanced case studies)**

- **Dissemination activities**
- **Website, project presentation material, newsletters**
- **PUDF - plan for the use and dissemination of foreground**
- **Review paper on the state-of-the-art of “Sustainable supply of non-food biomass”**
- **Summer school**

- **Project management**
- **Summary reports on project meetings**
- **Key performance indicators**
- **Stakeholder engagement**
- **Reporting to the Commission**

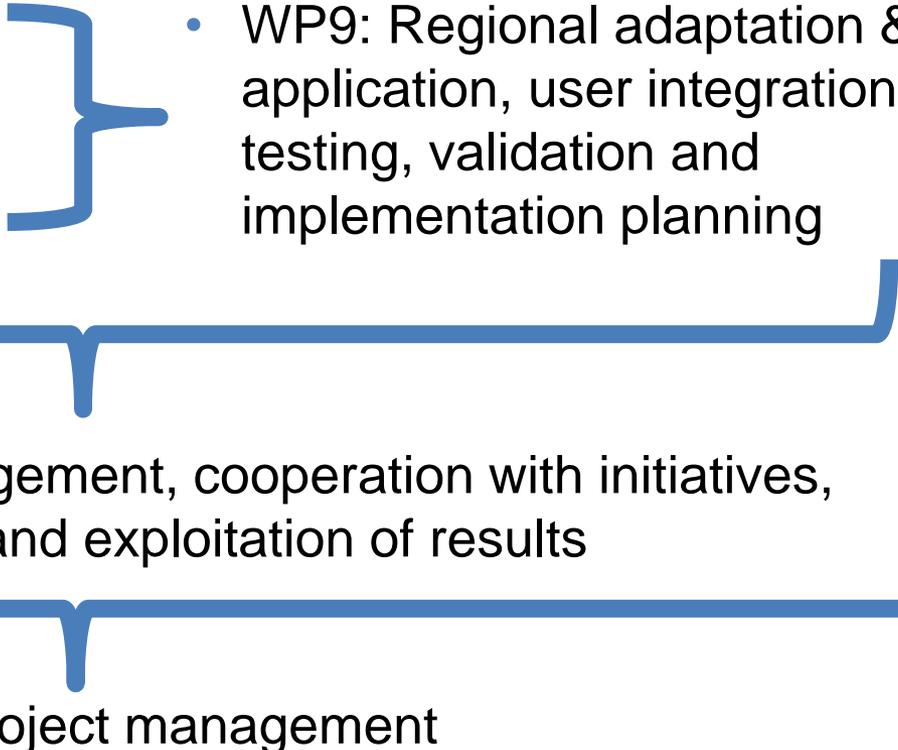
## Theme 1 (WP1 – WP4)

- **WP1: Sustainable biomass cost-supply**
  - **WP2: Biomass conversion technologies for energy and bio-based products**
  - **WP3: Optimal logistics for sustainable non-food biomass feedstock delivery chains**
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- A large blue bracket on the right side of the slide, grouping the first three work packages (WP1, WP2, and WP3) together.
- WP4: Toolset for interactive biomass supply – demand matching in sustainable biomass value chains

## Theme 2 (WP5 – WP8)

- **WP5: Value chain sustainability across the bio-based sectors**
  - **WP6: Regulatory & financial framework to mobilise non-food biomass to bio-based products & bioenergy market**
  - **WP7: Integrated Assessment-Optimisation of biomass supply chains to satisfy the demand**
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- A large blue bracket on the right side of the slide groups the three bullet points on the left (WP5, WP6, and WP7) together, pointing towards the WP8 bullet point on the right.
- WP8: Development of a vision, strategies, implementation plans and a R&D roadmap

## Theme 3 (WP9 – WP10) + Project management (WP11)

- **Theme 1: Results**
  - **Theme 2: Results**
- 
- A diagrammatic structure using blue brackets to group work packages. A vertical bracket on the right groups "Theme 1: Results" and "Theme 2: Results" with "WP9: Regional adaptation & application, user integration, testing, validation and implementation planning". A horizontal bracket below "Theme 1: Results" and "Theme 2: Results" groups them with "WP10: Stakeholder engagement, cooperation with initiatives, dissemination and exploitation of results". A horizontal bracket below "WP10" and "WP11" groups them together.
- WP9: Regional adaptation & application, user integration, testing, validation and implementation planning
  - WP10: Stakeholder engagement, cooperation with initiatives, dissemination and exploitation of results
  - WP11: Project management

## Large datasets in databases

- Sustainable cost supply of solid lignocellulosic biomass (forestry, biomass crops, agricultural residues, and secondary residues from wood and food industry, wastes) at NUTS3 level
- Characteristics of biomass for thermochemical and biochemical conversion pathways
- Pre-treatment technologies and logistics components
- Market techno-economic data for biobased product to market combinations
- Policies and support mechanisms for energy, agriculture, waste, environment, etc.

## Harmonised methodologies to assess biobased economy

- Biomass cost supply assessment: building on BEE, EUWood, Biomass Futures, Biomass Policies - in collaboration with JRC, BISO and in discussion with BeO
- Standardized biomass characterisation and quality requirement for each biomass conversion technology
- Characterization of main logistical components, i.e. storage, pre-treatment and transportation technologies.
- Life-cycle based environmental sustainability assessment with sustainability criteria and indicators.
- Policy analysis

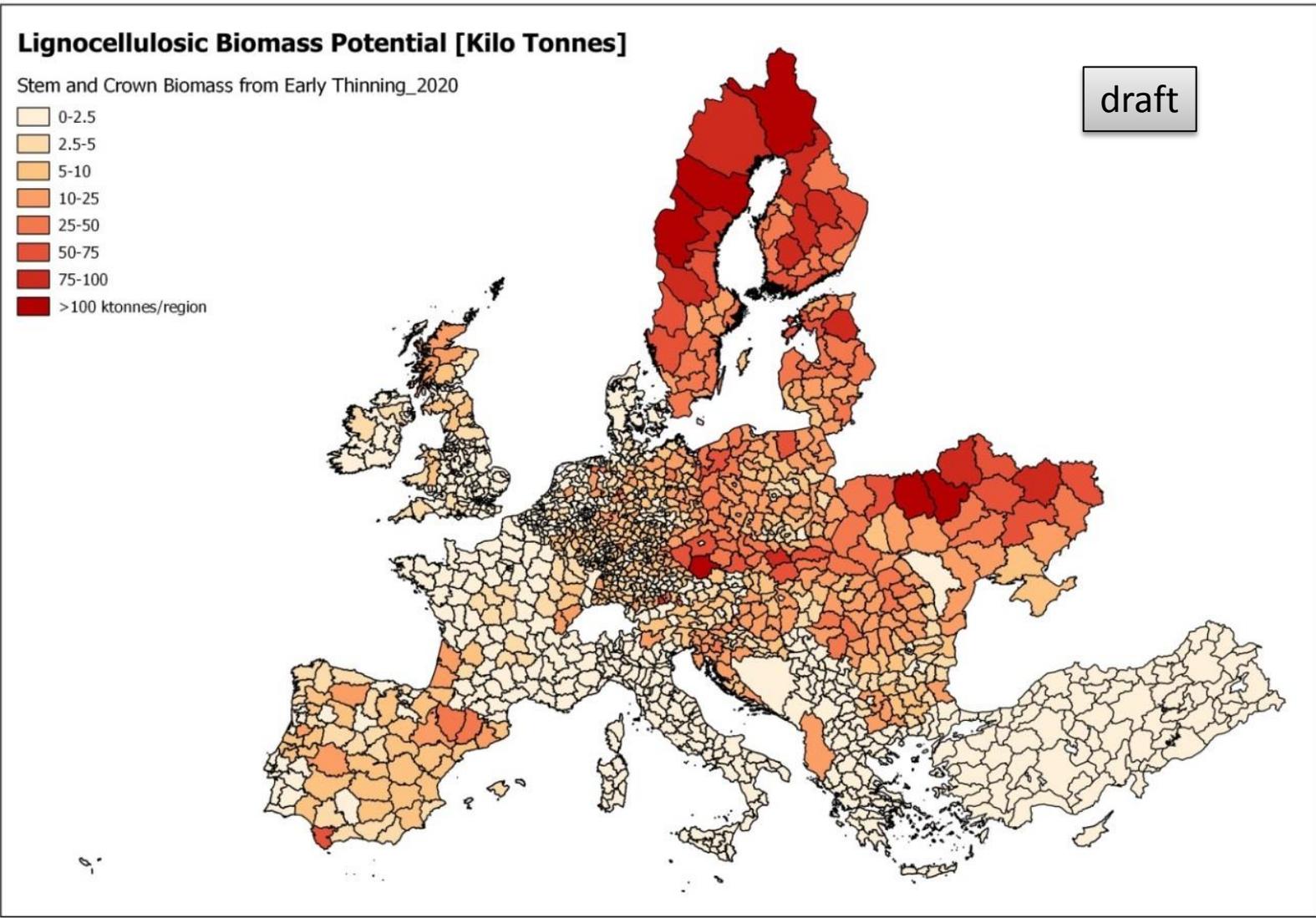
## Types of potentials

- **Technical potential**
  - Technical constraints &
  - Current uses for food, feed, biobased products, energy & fuels
- **Base potential**
  - Sustainable potential – RED criteria
  - Considering agreed and established sustainability standards at EU & intl level
- **User-defined potentials**
  - Vary in terms of type and number of considerations per biomass type
  - Options to choose & combine

## Types of feedstocks

- **Primary production of biomass crops (lignocellulosic and woody crops)**
  - Miscanthus, giant reed, cardoon, sorghum, etc.
- **Agricultural residues**
  - From arable crops cereals, rape, sunflower, grain maize and sugarbeet (leaves).
  - Secondary from agro industries
- **Grassland**
- **Forestry**
  - Stemwood, thinnings, etc
  - Secondary- wood processing industries
- **Road verge grass**
- **Landscape care management biomass**
- **Waste/ tertiary residues**

# Display of results in the toolset/ atlas: Stem and Crown Biomass from Early Thinnings 2020



# Display of results in the toolset/ atlas: Cost-supply potential for residues from cereal crops

## Cost Supply: Residues from Cereal Crops

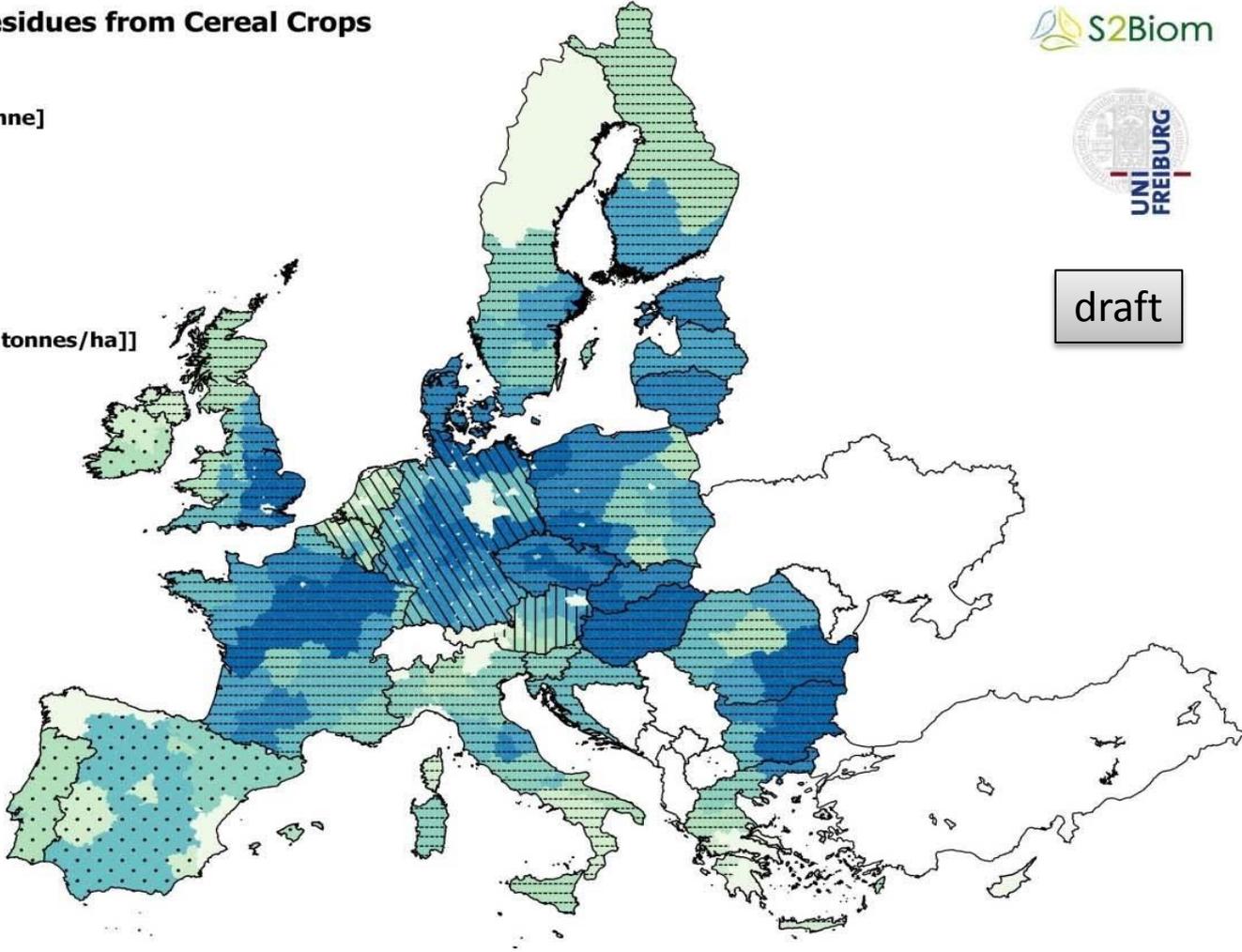
2012

### Cost Levels [EUR/tonne]

- 10 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- > 80

### Supply Levels [1000 tonnes/ha]

- 0
- 0.00 - 0.0004
- 0.004 - 0.0015
- 0.0015 - 0.0075
- 0.0075 - 0.0150
- 0.0150 - 0.0250
- 0.0250 - 0.0500
- > 0.0500



draft



### S2Biom

- **Key question S2Biom modelling focuses: To what extent the additional biomass demand for chemicals and materials could be sufficiently significant to:**
  - influence lignocellulosic biomass prices and
  - induce scarcity and competition issues with
  - energy applications?
- **Focus of specific product to market combinations (PMCs- see next slide): Uncertainties are substantial with respect to:**
  - technologies that are to be further developed
  - supporting policies required
  - the future of (petro)chemical industry in EU
  - the oil price, being a strong factor affecting the
  - prospects for biobased chemicals and
  - Materials

**Current state of biomass use for bioenergy, biofuels and bio-based materials & scenarios for modelling future demand in Europe**

**Tool demo for testing; two webinars so far- new update within May – initial tailoring to case studies; BeWhere tool, LocaGIStics tool, matching tool, benchmarking tool for resource efficient use of biomass (policy guidelines)**

**Strategic and advanced case study work ongoing**

**Vision of 1 Billion tonnes lignocellulosic biomass in Europe by 2030- open consultation & ongoing validation**

Database, method and atlas of sustainable non-food lignocellulosic biomass feedstocks at NUTS3 level for EU28, western Balkans, Turkey, Moldova and Ukraine.

Database, method and tool with indicators to assist decision makers in matching biomass types with the optimal conversion technologies.

Database, method and tool to evaluate promising logistics supply chains at local, regional level with sustainability and demand criteria

A computerised toolset integrating data and methodologies from biomass cost supply, conversion and logistics which will “facilitate the integrated design and evaluation of optimal biomass delivery chains at European, national, regional and local scale.

Harmonized sustainability requirements for bioeconomy value chains, including guidelines for methodologies to determine sustainability performance.

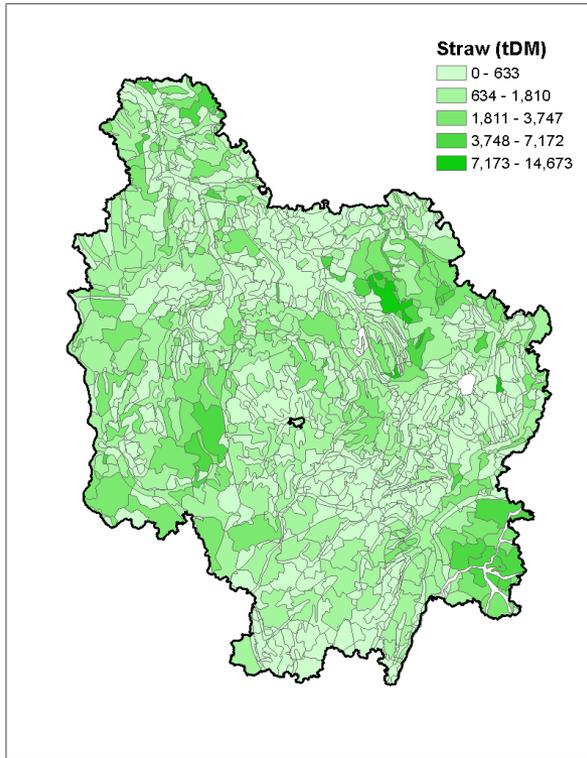
A database on EU and national level, for all 37 countries analysed in this call, and policy guidelines in relation to the mobilization of sustainable non-food biomass for the biobased economy.

Strategies & implementation plans for lignocellulosic biomass supply tailored to a) different levels of governance (i.e. regional and specific local ones linked to case studies) and ii) industrial sectors

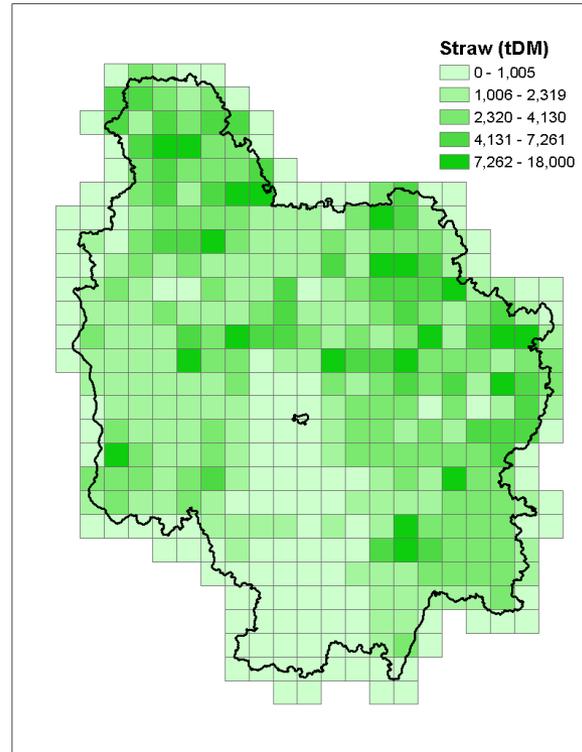
Case studies to validate the Strategies, Roadmaps and the Tool from the users' point of view (i.e. Member States, Associates and neighbouring countries, regional authorities, industries)

# Case study example: Burgundy

Straw availability



Aggregated straw availability



## Input: biomass (WP1)

### - Biomass

Location

Availability

Collecting cost

BeWhere model; IIASA

# Input: technology

<i>Key parameters</i>	<i>Unit</i>	<i>Methanol<sup>a, b</sup></i>	<i>Ethanol<sup>c</sup></i>	<i>FT diesel<sup>b</sup></i>	<i>CHP<sup>d</sup></i>
Feedstock		Wood chips	Wood chips	Wood chips	Straw
Base plant capacity	t <sub>biomass</sub> /hour	357	105	100	3.75
<b>Cost</b>					
Base investment	M€/a	505	143	67	0.63
O&M	M€/PJ <sub>biofuel</sub>	1.2	2.5	2.9	1.75
<b>Efficiencies</b>					
Total	GJ <sub>in</sub> /GJ <sub>out</sub>	<b>0.66</b>	<b>0.81</b>	<b>0.57</b>	<b>0.85</b>
Biofuel	GJ <sub>biofuel</sub> /GJ <sub>biomass</sub>	<b>0.55</b>	0.30	0.45	-
Electrical	GJ <sub>electricity</sub> /GJ <sub>biomass</sub>	0	0.11	0.06	<b>0.25</b>
District heating	GJ <sub>heat</sub> /GJ <sub>biomass</sub>	0.11	<b>0.40</b>	0.06	<b>0.60</b>

<sup>a</sup> Hamelinck, et al., 2002.

<sup>b</sup> Wahlund, et al., 2004.

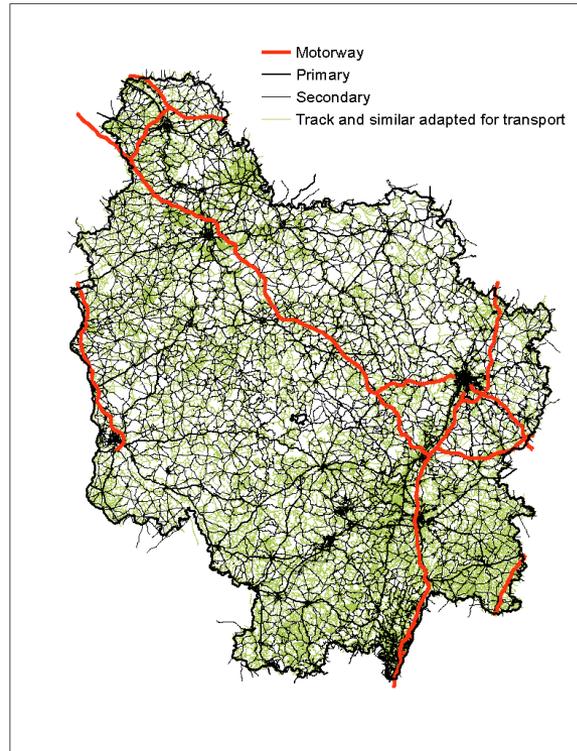
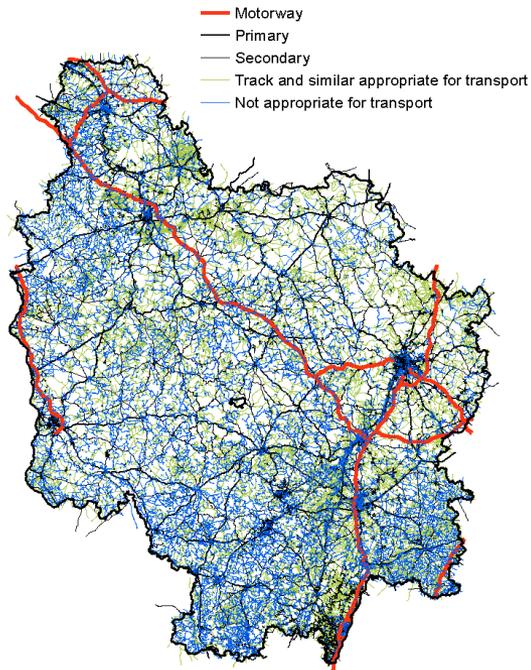
<sup>c</sup> Barta, et al., 2010.

<sup>d</sup> S2Biom

## Road Network

## Used road network

## Input

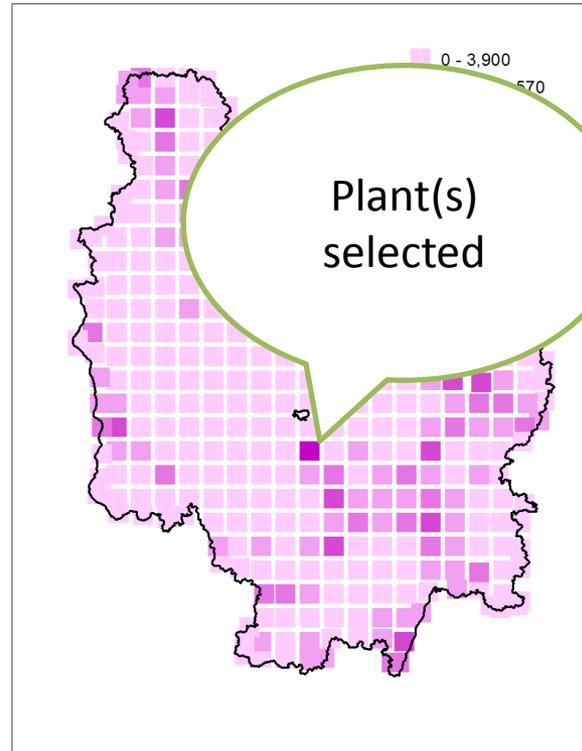
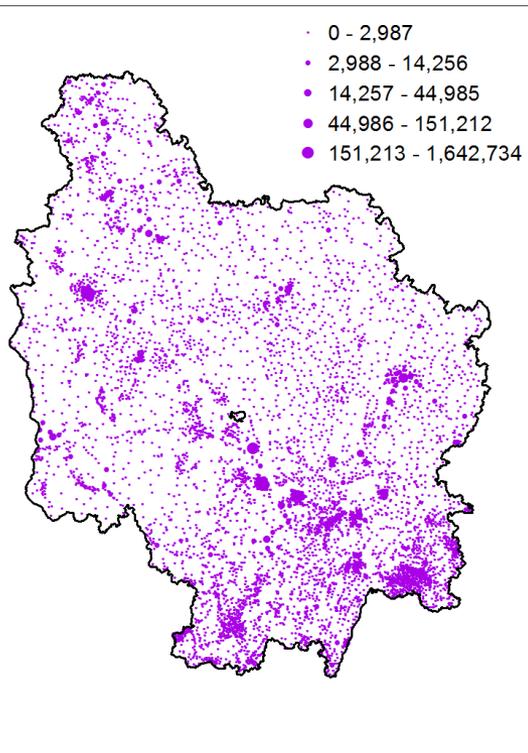


- Transport cost
- Emissions
- Terminals / pretreatment
- Distances from all points to all points based on  $\text{Min}(t)$  or  $\text{Min}(d)$

Source: OpenStreetMap.org

Population

Aggregated population



Source: OpenStreetMap.org

## - Existing industries

Location

Feedstock demand

Power/heat output

## - Production plants

Type of biomass

Biomass need

Economic parameters

Conversion efficiency

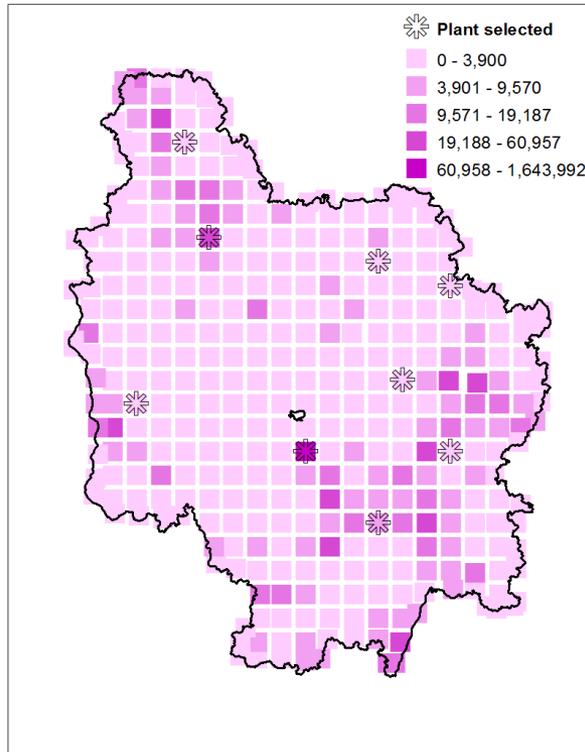
- **Heat** consumption
- **Power** consumption
- **Transport fuel** consumption

Based on statistics and weighted by number of inhabitants.

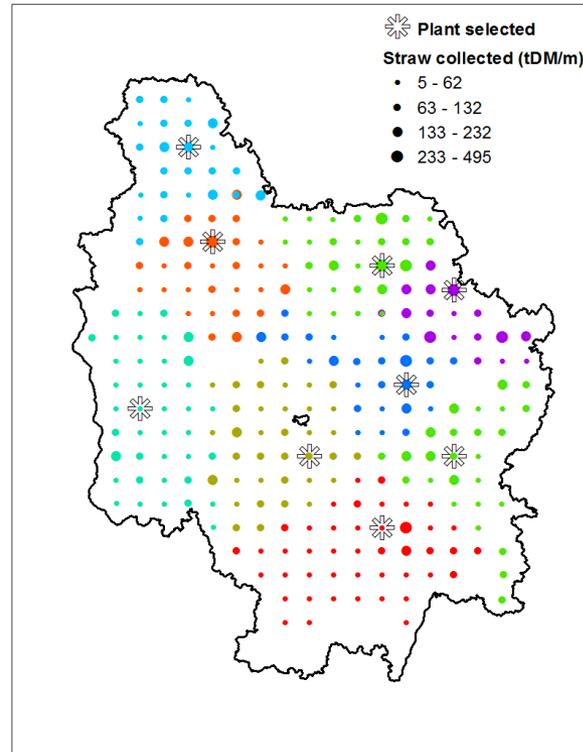
- **Price** of competing fossil fuel based heat / power / transport fuel

# Result Example

## Plant selected



## Biomass allocated



## Output

- Biomass used
- Technology allocated
- Heat, power produced
- Costs
- Emissions avoided

→ **LOCAgistics tool**

## - Biomass

Site used

To which plant

## - Production plants

Number

Technologies

Capacities

## - Demand

Demand met

Import and fossil fuel used

## - Additional information

Quantities

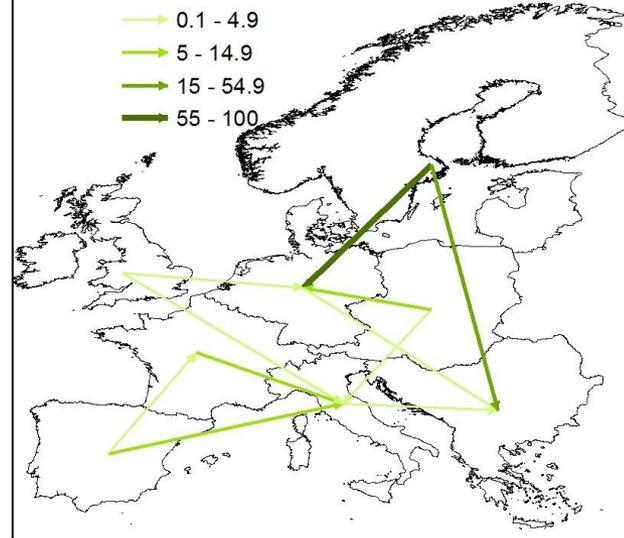
Costs

Emission

# European Model

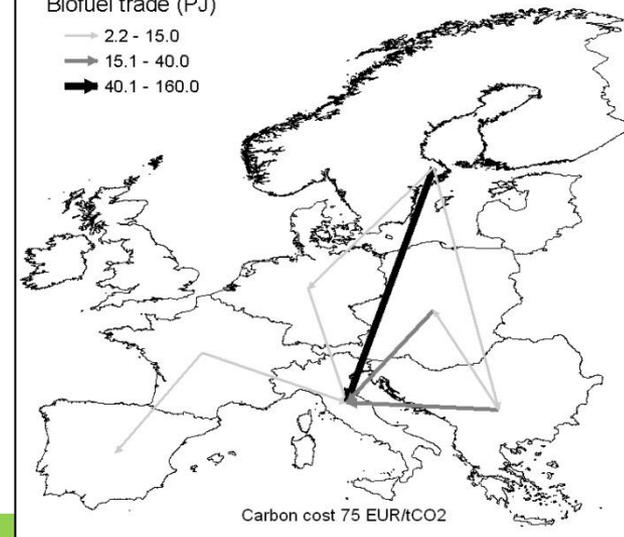
**Biomass trade in Europe (PJ)**  
Carbon cost 150 EUR/tCO<sub>2</sub>

- 0.1 - 4.9
- 5 - 14.9
- 15 - 54.9
- 55 - 100



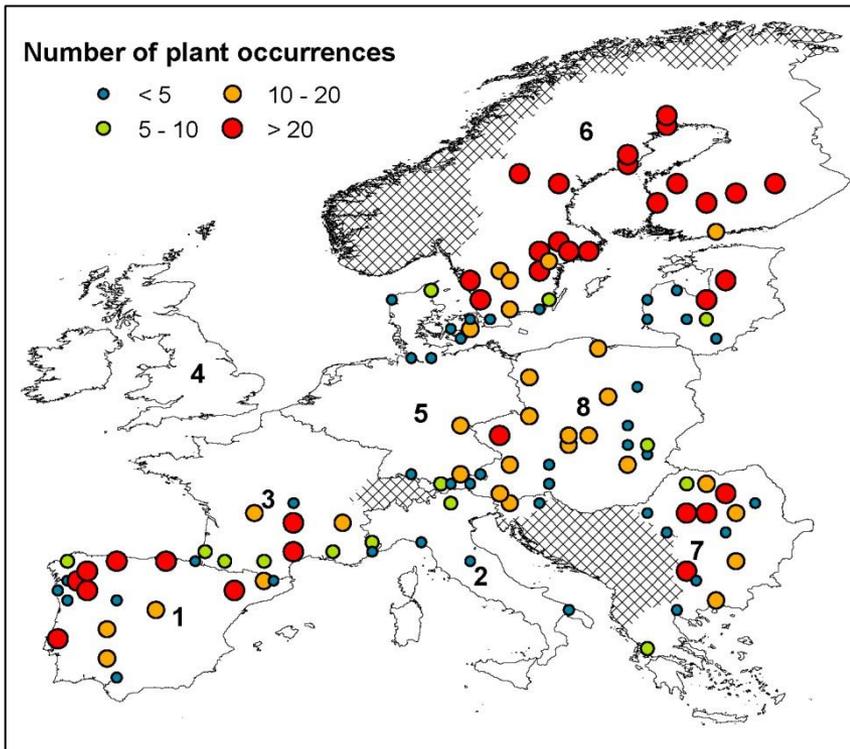
**Biofuel trade (PJ)**

- 2.2 - 15.0
- 15.1 - 40.0
- 40.1 - 160.0



**Number of plant occurrences**

- < 5
- 5 - 10
- 10 - 20
- > 20



- **BeWhere**
  - National level
  - Geographic location of plant
  - Based on techno-economic approach
- **LOCAgistics**
  - Regional level
  - Input from BeWHere
  - Detailed allocation of biomass to selected plants

# What will S2Biom deliver at the end of the project



- **Large datasets in databases:**
  - Facilitate the formation and comparability of comprehensive databases populated with consistent and accurate datasets on:
    - Lignocellulosic biomass cost supply, conversion technologies, logistic technologies, matching tool for biomass to conversion technologies, policies/ support mechanisms
- **Harmonised methodologies to assess biobased economy (cross sector)**
  - Transparency in data collection - harmonised protocols
  - Cross sector integrated frameworks addressing all bioeconomy sectors for: Life Cycle Analysis, Sustainability Criteria & Indicators Economic & energy modelling and Policy
- **S2Biom toolset- improve (feedstocks - geography) IT capacity for biomass cost supply & logistics for a wide range of feedstocks in a large geographic area with high resolution**
- **Bridging policy/ regulatory framework with local capacity and investment opportunities to develop action and investment plans in selected cases (special focus in Southeast Europe)**
- **Developing a Vision, Strategies, regional implementation plans (EU28 & EnC) & an R&D roadmap**



# Thank you for your attention!



## Project Coordinator

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