REGIONAL FOCUS GROUP WORKSHOP

From Forestry Residues to Bioplastics

Andalusia

Funded by the European Union · Grant Agreement No 101135166

SYMBIO
MEET YOUR SUSTAINABILITY TARGET

alchemia nova research

Cardiff Metropolitan University

CTA
Corporación Tecnológica de Andalucía

Agenda

01 Introduction to SYMBIO Project

02 The Value Chain: Forestry residues to PHA

03 Material Flow Analysis

04 Economic, Ecological & Social Aspects

05 Ecosystem Map

06 Designing the Implementation Blueprint

07 Validating Slovenia’s Ecosystem Map

08 Networking and light Lunch

The SYMBIO Project

WP1

DATA-HUB BUILDING

Explored and analyzed regional resources that trigger symbiotic activities close to the market.

- Quantified biomass availability
- Mapped 12 promising bio-based products and transformation pathways
- Ecosystem mapping

WP2

VALUE-CHAIN DESIGN

Connecting companies in circular value chains based on their specific material flows and available technologies

- 47 prioritised value chains
- selected based on local feedstock supply, conversion technologies, and clear local market demand
- Use of AI-tool VCG.AI

Have a look at VCG-AI:

WP3

BUSINESS MODELLING

Development of a circularity index and reporting system to support companies in building a circular business model

- 11 regional value chains were prioritized via Multi-criteria decision-making analysis (MCDMA)
- Visualization through Material Flow Analysis
- Multi-criteria overview
- Followed by multi-stakeholder workshop
- Policy recommendations

WP4

BUSINESS DEPLOY

Accelerate business case development by measuring social, economic and environmental impact

- LCC, LCA, social and sociological benefits assessment
- Building Synergies with EU projects, networks, initiatives
- Exploitation routes

Pilot regions

Methodology designed, tested and validated in **12 EU pilot regions** selected based on their biological resources, infrastructure and potential for developing close-to-market CBE supply chains.



Austria

Carinthia



Belgium

Brussels Capital, Wallonia, Flanders



Croatia



Italy

Lombardy, Piedmont, Veneto, Friuli-Venezia Giulia, Emilia-Romagna

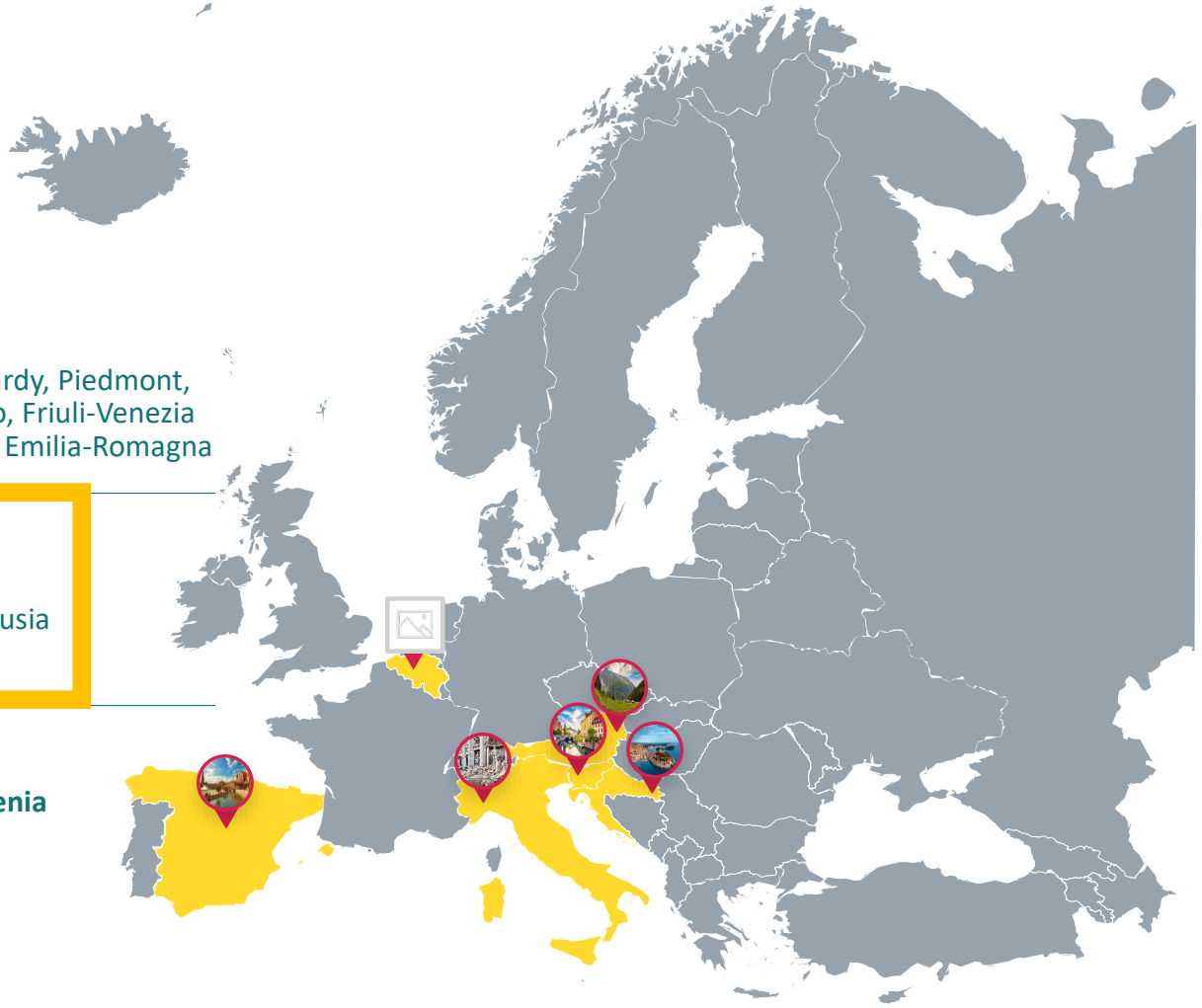


Spain

Andalusia



Slovenia



Strategic Decision-Making

Multi-Criteria Decision Analysis (MCDMA)

- Integrates **environmental, economic & social criteria**
- Enables **transparent comparison** of options
- **Ranks value chains** based on overall **performance**

Material Flow Analysis (MFA)

- Quantifies **material inputs and outputs**
- **Visualises resource flows** through the system
- Assesses **circularity and resource efficiency**
- Applicable for **ESRS E5 corporate reporting**

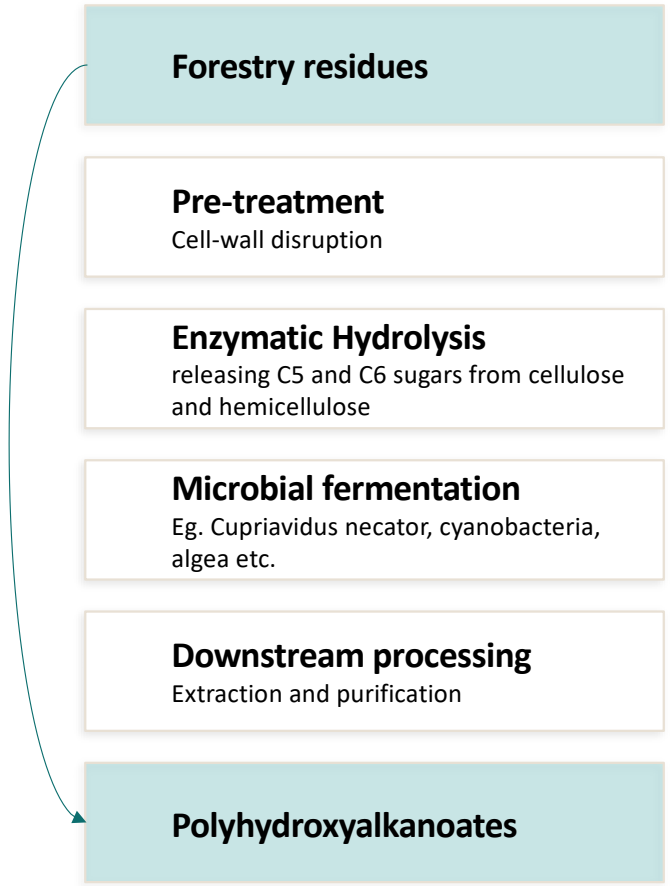
Multi-Stakeholder Focus Groups

- Brings together **all actors across the value chain**
- Identifies **barriers, enablers** and financing options
- Validates **implementation potential** in practice

Combining data, sustainability metrics, and stakeholder insight to guide strategic decisions.

Lignocellulosic Biomass for Succinic Acid Production

PRODUCTION CASCADE



From Forestry Residues to PHA

Forestry Residues

Andalusia generates significant volumes of secondary biomass from its active timber industry. This includes sawdust, bark, wood chips, tree branches, and leaves.

2-4 %	60 – 80 %
PHA conversion yield	Carbohydrate content

Traditional uses

- Energy production
- Left on the field for soil improvement
- Paper & pulp industry

Polyhydroxyalkanoates (PHA)

Bacterially synthesised biopolyesters that are 100% bio-based, fully biodegradable, and biocompatible — sustainable alternatives to petroleum-based plastics.

USD 650M	11.8%
global market (2023)	CAGR growth rate (2025-2034)

Key applications

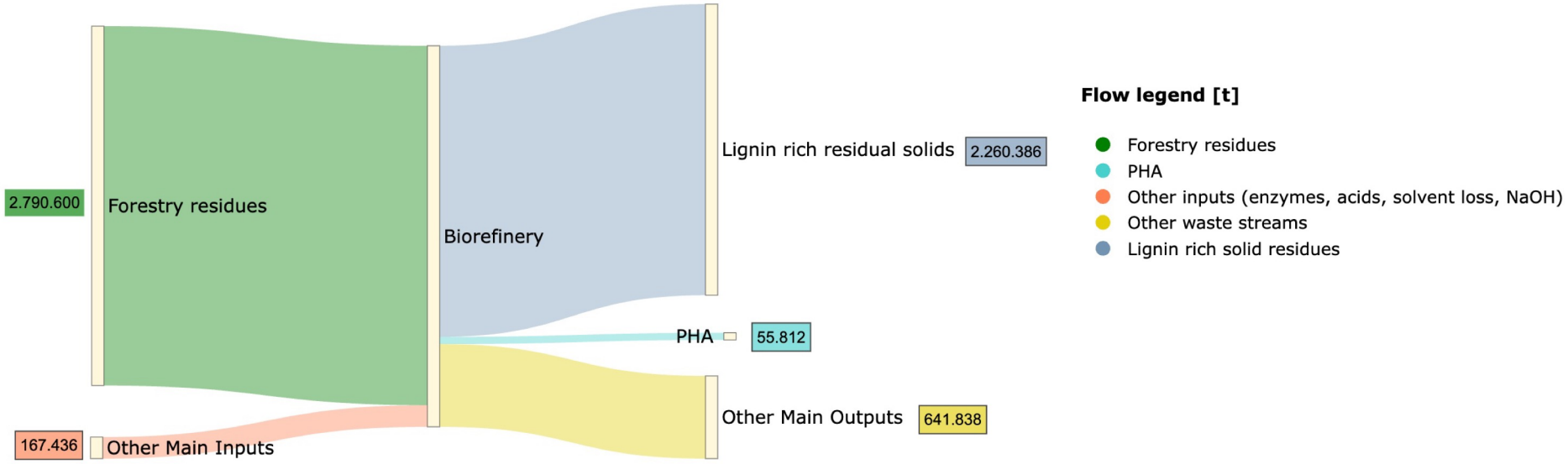
- Biodegradable packaging
- Pharmacy: Tissue engineering & drug delivery
- Agriculture

Material flow analysis

2.79 mt/y
Forestry residues Available

56 kt/y
PHA production potential

2.3 mt/y
Lignin residues



Economic Reality: Opportunities vs Challenges

Feedstock Cost Advantage
Utilizing lignocellulosic feedstocks reduces raw material costs compared to using refined sugars

Value-added by-products
Lignin residues can be used for renewable energy, or high-value chemicals. Residual biomass as animal feed or fertilizer.

High Feedstock Abundance
With 2.79 Mt of residues available, there is a massive scale for industrial operations

High Production Costs
PHA production remains 3 to 12 times more expensive than petroleum-based plastics. Pretreatment & Downstream Bottlenecks.

Logistics & Infrastructure
There is a critical lack of large-scale pilot or demonstration facilities to bridge the gap between lab-scale research and full industrial implementation.



Environmental Profile

100 %
Biobased, biodegradable and biocompatible

Net Carbon Cycle

Preserves resources

STRENGTHS

- **Mitigates microplastic pollution** due to biodegradability in soil and marine environments
- **CO2 is absorbed** during wood growth
- **Reduces GHG emissions** compared to fossil-based plastics
- Valorization of secondary resources **reduces pressure on natural ecosystems**

RISKS

- Excessive removal of forestry residues can lead to soil organic matter depletion
- Chemical- and energy-intensive processes needed
- Net greenhouse gas reduction potential depends on regional energy mix
- Large water inputs needed

Social & Regulatory Landscape

Policy Framework

- Increasingly **strict EU packaging and sustainability regulations** (PPWR, REACH etc.)
- Upcoming **Circular Economy Act** will push use of secondary resources
- **Andalusian Circular Bioeconomy Strategy** provides a regional push and funding opportunities
- **Integrated Waste Plan for Andalusia 2030** further reinforce sustainable resource use and recovery

Social Landscape

- growing consumer **concern regarding microplastic pollution**
- Offers **new job potential**
- **Stakeholder density:** A total of 57 companies in the bioeconomy sector were identified
- **Skills Gaps:** Lack of human capital specialized in advanced fermentation engineering
- **Coordination Challenges:** fragmented nature of forestry-sector actors makes large-scale mobilization and consolidation of bulky residues difficult

Social Impact

- **Rural development and employment** by establishing local supply chains
- **Food security and ethics** by using second-generation foodstick, having no competition with the human food supply chain
- **Adresses public health concerns** by using fully biodegradable and non toxic plastics
- **Reduces microplastic pollution**
- **Soil health concerns** if retention thresholds are not strictly managed

Why Ecosystems Matter for Bio-based Value Chains

1 Bio-based value chains depend on strong regional innovation ecosystems.

2 Industrial symbiosis requires coordination between businesses, research, policy and funding actors.

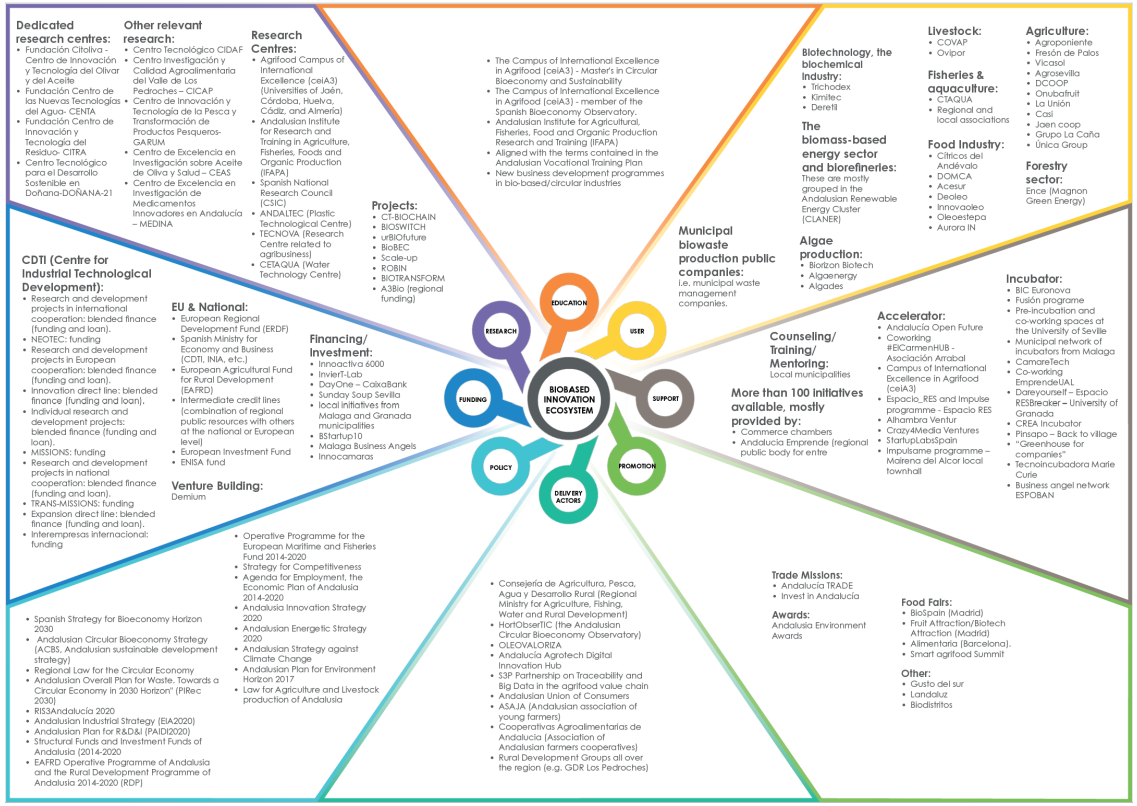
3 Ecosystems enable collaboration, knowledge transfer, investment and scale-up of circular bio-based solutions.

4

- Businesses and value-chain actors form the core of the ecosystem.
- Supporting actors include research institutions, education providers and innovation support organisations.
- Policy, funding bodies, networks and promotion agencies create enabling conditions for innovation.

Andalusia's Bioeconomy Innovation Ecosystem – Snapshot

- **Research &Innovation:** IFAPA, ceiA3 Agrifood Campus, CSIC, ANDALTEC, TECNOVA, specialised centres focused on agriculture, food, water and waste valorisation
- **Support & Delivery:** Agrotech Digital Innovation Hub, Bioeconomy Observatory, OLEOVALORIZA, Andalucía Emprende
- **Policy & Funding:** Andalusian Circular Economy and Waste Plans, strong mix of EU, national and regional funding mechanisms
- **Users & Industry:** Strong agriculture, biomass and bioenergy sectors; Large cooperatives and agri-food companies; Emerging biotechnology and circular economy businesses



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Key Drivers and Challenges in Andalusia

Drivers	Challenges
•Strong policy commitment to circular bioeconomy •Abundant biomass resources and processing expertise •Extensive research, innovation and support infrastructure •Active clusters, networks and industry platforms	•Administrative and institutional bottlenecks •Fragmented support landscape and coordination challenges •Limited alignment between research and commercial deployment •Market uncertainty for bio-based products and scale-up

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Co-creation session

You are now invited to share insights and co-develop solutions to help forming industrial symbiosis in the bioeconomy

Generating an Implementation Blueprint

1

Step 1: Actors and Flows

DRAW on the poster:

- Draw the main **material flow**
  - You can add additional stages if needed.
- Identify the **lead and side actors (roles)** for each stage of the value chain (Feedstock / Biorefinery / Market)

2

Step 2: Bottlenecks & Enablers

STICK on the poster:

- Write critical **bottlenecks** on **RED sticky notes** (e.g. technology gaps, policies, logistics, market demand)
- Add **GREEN sticky notes** for enablers, opportunities and supporting conditions
- Add any existing **financing instruments** or funding opportunities you are aware of

Generating an Implementation Blueprint

3

Step 3: Key Leverage Point(s) (10 min)

- Ask yourselves: What are the most important next steps to move this value chain from concept to implementation?
- As a group, **agree on concrete actions** that would have the **biggest impact** on making this value chain happen.
- Write these key actions clearly on the poster.

Group Pitches & Discussion

Now each group has **5 minutes** to present their implementation blueprint

1. **Biggest Bottlenecks:**

   What are the most critical obstacles in your models? What would help to solve it?

2. **Leverage points:**

   Which actions would make the biggest difference?

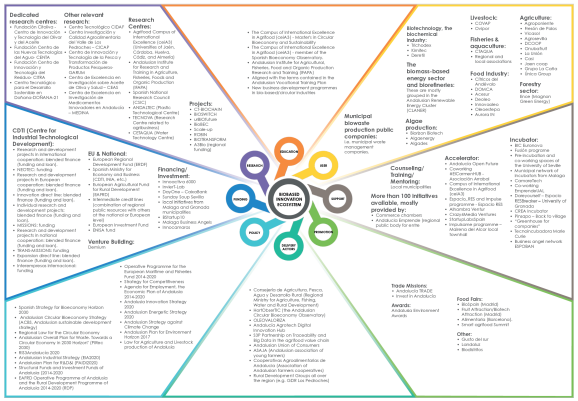
Andalusia's Bioeconomy Innovation Ecosystem – Snapshot

This session explores whether the **regional innovation ecosystem is ready to support the bio-based value chains discussed earlier.**

Rather than perfecting the map, we **focus on what enables implementation, what blocks it, and where coordination gaps exist.**

Activity

- Review the ecosystem map and consider the BioLink/value chain discussed earlier.
- Use sticky dots to mark:
  - 🟢 **Enablers** – elements already supporting implementation
  - 🔴 **Bottlenecks** – gaps, barriers, or missing capacities
- Write a short note explaining why it helps or blocks implementation.



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Feedback Survey

Before we move to networking, we would love to take a moment to hear your feedback.

