



WG 4 – Valorisation of agrofood waste and a circular bio-economy

Start Month (M1) – October 2023

End Month (M48) – October 2027

FoodWaStop Conference

Zadar, Croatia, 5-6 February 2026

Jessica Girardi, WG4 leader

Victoria Krauter, WG4 co-leader





WG4 Memberships

Registered members*: 657 (913) in 53 countries (63)

Country	WG4 members
Albania	13
Algeria	1
Armenia	4
Austria	1
Azerbaijan	2
Belgium	4
Bosnia and Herzegovina	3
Bulgaria	10
Croatia	7
Cyprus	4
Czech Republic	5
Denmark	2
Egypt	1
Estonia	3
Finland	1
France	4
Germany	6
Greece	21
Hungary	6
Ireland	9
Israel	1
Italy	47
Jordan	2
Kenya	1
Kosovo	12
Latvia	4
Lithuania	18

Country	WG4 members
Luxembourg	2
Malta	1
Moldova	2
Montenegro	3
Morocco	5
Netherlands	2
Nigeria	1
North Macedonia	7
Norway	3
Pakistan	1
Poland	9
Portugal	45
Romania	11
Serbia	48
Slovakia	3
Slovenia	2
South Africa	3
Spain	47
Sri Lanka	1
Sweden	4
Switzerland	3
Tunisia	5
Turkiye	247
Uganda	1
Ukraine	1
United Kingdom	7



WG4 Tasks

❖ T4.1 Mapping food systems

- ✓ A4.1 n. 10 in-person and online meetings aimed at establishment of the effectiveness of bioconversion by insects
- ✓ *S. Milliken poster - Valorising Food Waste with Insects: A Protocol for Cross-Country Comparative Research*

❖ T4.2 Integrate systems with a search for innovation

- ✓ A4.2 n. 3 campaigns with consumers to raise awareness of the importance of enhancing the value of recycled products (e.g., packaging from the F&V waste stream)
- ✓ *Training School*

❖ **T4.3 Develop a more comprehensive understanding of valorisation strategies for their improvement, and to define new ones**

❖ **T4.4 Define the value-added final product**

❖ **T4.5 Study potential practical applications of these innovative products that are obtained from the waste of the F&V value chain**

❖ **T4.6 Run comparable analyses of techno-economic durability and environmental impacts of potential valorisation pathways of FW**



WG4 Deliverables

- ❖ D4.1. Preparation of a short guideline where the new valorisation strategies available/possible to develop per Country will be summarised **M36 (Oct2026)**
- ❖ D4.2. Creation of a list of bioactive compounds extracted or obtained from F&Vs by-products **M28 (Feb2026)**
- ❖ D4.3. Review papers on the valorisation of agrifood waste method **M36 (Oct2026)**
- ❖ D4.4. Develop at least 4 potential applications of the valorisation and use of the waste of the F&V value chain **M48 (Oct2027)**



WG4 Structure

Established 4 working groups and define coordinators

SG Vegetables → Sarah Milliken (University of Greenwich)

SG Fruits → Ozgur Tarhan (Usak University)

SG Cereals → Victoria Krauter (FH Campus Wien)

SG Animal production* → Kaltrina Berisha (University Of Prishtina "Hasan Prishtina")

*meat and meat products, milk and dairy products, seafood

→ incorporated in SG Cereals

Role of coordinators

- organize and lead subgroup internal meetings
- coordinate tasks in between the SG members to address the deliverables
- update WG4 leader

Aim

Gather active members contribution & preparation of first round deliverables

D4.1. Guidelines for the new valorisation strategies (coordinator: **László Abrankó**, supported by **Sarah Milliken**)

D4.2. List of bioactive compounds extracted or produced from F&V waste (coordinator: **Enrique Barrajon-Catalán**, supported by **Doinita Muntean** and **Sarah Milliken**)

D4.3. Review paper on valorisation of agrofood waste (several coordinators)



WG4 Activities done in 2025

From January 2025 – 10 cross SGs meetings & several regular independently organised SG meetings

May/June 2025 – organisation of the first session of FoodWaStop webinar series

October 2025 – open call for all the WG4 members. Request for contributions to D4.1 and D4.2, to strengthen and finalise the documents



WEBINAR SERIES



SUSTAINABLE NETWORK FOR AGROFOOD LOSS AND WASTE PREVENTION, MANAGEMENT, QUANTIFICATION AND VALORISATION (FoodWaStop CA22134)

Tuesday 20 May 2025 – 16.00 GMT+2



WELCOME TO PARTICIPANTS

Gianfranco Romanazzi, Action Chair

Jessica Girardi, WG4 leader

TALK

Enrique Barrajon Catalan and Francisco Javier Alvarez Martinez

AI REVIEWER: ARTIFICIAL INTELLIGENCE APPLIED TO THE MASSIVE ANALYSIS OF SCIENTIFIC INFORMATION



Tuesday 3 June 2025 – 16.00 GMT+2



WELCOME TO PARTICIPANTS

Gianfranco Romanazzi, Action Chair

Jessica Girardi, WG4 leader

TALK

Enrique Barrajon Catalan and Francisco Javier Alvarez Martinez

AI REVIEWER: ARTIFICIAL INTELLIGENCE APPLIED TO THE MASSIVE ANALYSIS OF SCIENTIFIC INFORMATION – II SESSION



To join the webinar and ask questions the [registration link](#). The webinar will be also delivered on the Facebook page [COSTFoodwastop](#)





WG4 Deliverable 4.1 - Guidelines for valorisation of fruit, vegetable, cereal and animal product processing side-streams (M36)



Guidelines for new valorisation strategy



Sustainable network for agri-food loss and waste prevention, management, quantification and valorisation

FoodWaStop COST Action CA22134

Guidelines for valorisation of fruit, vegetable, cereal and animal product processing side-streams

Deliverable D4.1

WG4 - Valorisation of agri-food waste and a circular bio-economy



Annex 1



Guidelines for new valorisation strategy – supplementary information on industrially implemented solutions

Prepared by: László Abrankó – Hungarian University of Agriculture and Life Science
Email: abranko.laszlo.peter@uni-mate.hu
Year: 2025

Case Study: Valorisation of apple pomace

1. Introduction

- Overview of apple pomace as a by-product of apple juice manufacturing.

2. Context and Baseline

- Description of the production process, including scale (large, medium, small dairies).

Apple pomace is generated during juice and cider production, where apples are washed, milled, pressed, and separated into liquid and solid fractions. Industrial processors typically work with mixed apple varieties rather than a single cultivar. To increase juice yield, pectinolytic enzymes are routinely applied, breaking down cell wall pectins and improving extraction efficiency. Production scales range from small artisanal cider houses to large industrial plants generating thousands of tons of pomace annually.

- Current management or disposal practices (e.g., land application, wastewater treatment, animal feed).

Pomace is commonly used as low-value animal feed, composted, applied to land as a soil improver, or sent to anaerobic digestion. It is also not uncommon that it is simply disposed of as organic waste, creating handling and storage challenges due to its high moisture content and rapid spoilage.

- Environmental, regulatory, and socio-economic context.

In the European Union, approximately 11.1 million tonnes of apples are harvested annually, of which around 4.1 million tonnes—equivalent to about 37%—are processed, primarily for juice and purée production as well as for cider manufacturing. During industrial processing, an average of 140–160 kg of apple-derived by-products (pomace) is generated per tonne of fruit. Based on this conversion, the EU produces an estimated ~570–660 thousand tonnes of such organic by-products each year.

When apple pomace is not used for energy generation or animal feed, and is instead applied to soil, its use must comply with the EU Nitrates Directive, which regulates the application of organic materials by setting limits on the maximum annual nitrogen load. Moreover, the intrinsically low pH of apple pomace can pose technological and soil-management challenges.

For food-industry applications, special attention is required because apple seeds contain amygdalin, a cyanogenic compound that can release hydrogen cyanide under certain conditions. Although the associated risk is not necessarily significant in all contexts, it nonetheless warrants technological control and careful handling.



Guidelines for new valorisation strategy – supplementary information on industrially implemented solutions

Prepared by: László Abrankó – Hungarian University of Agriculture and Life Sciences (MATE)
Email: abranko.laszlo.peter@uni-mate.hu
Year: 2025

Note: This document provides a scientific contribution for COST Action CA22134 Deliverable D4.1. It does not imply commercial involvement, operational commitments, or representation of any company

1. Company/Project Name:

Grapoila

2. Location:

Hungary, H-1224 Budapest, Szakiskola str. 33-43.

3. Website / Contact Info:

Link to the company/project website or contact for further info.

<https://grapoila.hu>

info@grapoila.hu, info@virginoilpress.hu,

4. Description:

A brief overview of the company/project, its mission, and relevance to food waste valorisation.

Grapoila (Virgin Oil Press Ltd.) is a Hungarian producer of cold-pressed seed oils, seed flours, natural cosmetics, and gourmet products, operating fully under a zero-waste production model. The company sources raw materials mainly from Hungarian producers and processes everything in-house across its three facilities. Its mission is to create high-quality, natural products while ensuring that 100% of by-products are reused.

5. By-product Valorised:

Type of food by-product/loss being processed (e.g., fruit peels, whey, spent grain, etc.).

The company processes by-products such as grape pomace, grape seeds, rosehip seeds, mustard seed sludge and other seed residues from food and beverage production. These side streams are upcycled into oils, flours, seed butters, cosmetics ingredients, and innovative food products.

6. Technology Used:

Short description of the technology or process (e.g., fermentation, drying, extraction, bioconversion).





WG4 Deliverable 4.2 - List of bioactive compounds extracted or produced from F&V waste (M28)

Ready for CG final revision

- up-to-dated list of bioactives listed in public databases (FooDB, KEGG BRITE, KNApSack, Phenol-Explorer, FoodWasteEXplorer, PhInd, eBASIS, PhytoHub)
- selection of the most significant publications
- selection of the most relevant patent databases to facilitate specialized searches (Espacenet (EPO), PATENTSCOPE (WIPO), Google Patents, The Lens, USPTO, J-PlatPat (Japan))
- table including the data compiled for fruit and vegetables. 20 selected raw materials have been consolidated: Apple, Artichoke, Avocado, Blueberry, Broccoli, Cabbage, Fig, Garlic, Grape, Lemon, Mango, Mushroom, Mustard, Olive, Orange, Pomegranate, Tomato, Onion, Pepper, Quince



List of bioactive compounds extracted or produced from F&V waste

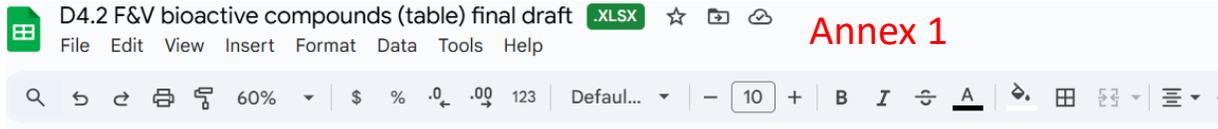


Funded by the European Union



Sustainable network for agrofood loss and waste prevention, management, quantification and valorisation

FoodWaStop COST Action CA22134



List of bioactive compounds extracted or produced from F&V waste

Deliverable (D4.2)

WG4 - Valorisation of agrofood waste and a circular bio-economy

Source	By-Product	Compound Name	Amount Found (mg/g or %)	Extraction Method	Extraction Yield (%)	Applications	Dosage Used	Stability & Storage	Toxicity/Safety Concerns	Market Trends & Commercial Use	Regulatory Status	References
Rosehip (<i>Rosa canina</i>)	seeds	α -Linolenic acid, Oleic acid, Phenolic compounds	Oil 20–25 % of seed; Fiber 31–44 %	Cold pressing / solvent extraction	≈10–15 % oil yield (literature-based)		Up to 15 % inclusion in concentrate diets for lambs	Stable under dry, cool conditions; oil sensitive to oxidation	Safe at feed additive levels; no adverse effects reported	Increasing interest in upcycled feed oils and natural antioxidants	Approved feed material (EU feed catalogue); also used in food supplements	https://doi.org/10.1007/111250-011-9857-6
Potato (<i>Solanum tuberosum</i>)	Potato by-products (potato peels, pellets, flesh, red waters)	Chlorogenic acids (3-CQA, 4-CQA, 5-CQA); Total phenolic compounds (TPC); phenolic acids	Total phenolic compounds: up to 57 mg/g FW (ethanol extract, red waters); Chlorogenic acids: up to 870 ± 39.7 µg/g FW (5-CQA, potato peels/pellets); ORAC values: 1500–1650 µM TE/g	Hydroalcoholic extraction (methanol–water or ethanol–water, 4:1) using maceration, heat-assisted extraction, and ultrasound-assisted extraction; compounds quantified by HPLC and Folin–Ciocalteu method	Not reported as percentage	Natural antioxidants; functional food ingredients; nutraceutical applications: valorisation of potato-processing waste within circular bioeconomy	Not applicable	Phenolic compounds stable under controlled extraction conditions; freeze-drying increased antioxidant capacity; excessive heat may cause isomerization or degradation	No toxicity reported	High potential for industrial valorisation of potato by-products as low-cost sources of natural antioxidants; growing demand for clean-label, plant-derived phenolics	Potato-derived phenolics and chlorogenic acids permitted for food and nutraceutical use under general food safety regulations	https://doi.org/10.3390/molecules28010177
Industrial apple & grape vinegar production	Vinegar fermentation lees (yeast sediment)	Total protein & peptides	Vinegar lees typically 35% protein (dry matter); higher target range expected for lees-derived yeast extract	Autolysis of <i>Saccharomyces cerevisiae</i> cells (pH ~5–6, 45–55 °C), enzymatic hydrolysis, and mechanical degradation techniques to form protein and amino acid-rich components. It is followed by separation, concentration and spray-drying or freeze drying	Induced autolysis can solubilise ~10% of yeast biomass as soluble nitrogenous compounds, depending on time, pH and temperature	Umami and fragrant flavor enhancer, clean-label flavor enhancer in soups, sauces, snacks, bouillons, plant-based products	In foods typically 0.1–1.0% (w/w) for flavour enhancement	Spray-dried and freeze dried powder, low water activity; stable 12–24 months at <25 °C, protected from humidity and light (standard yeast extract specs)	Yeast extract from <i>S. cerevisiae</i> is GRAS	Strong growth in clean-label, plant-based and natural umami ingredients; increasing demand for salt-reduction solutions, alternative protein sources and sustainable flavour enhancers produced via circular economy and food waste valorisation.	Yeast extract complies with Codex Alimentarius (CXG 2-1985/2021) principles for food safety and quality. It is not classified as a food additive under EU legislation and therefore has no E-number; however, it is subject to general EU food safety and flavouring regulations (Regulation (EC) No 1333/2008, CODEX STAN 192-1995/2024, CXG 36-1989/2023). In Türkiye, yeast extract is regulated under the Turkish Food Codex Food Additives Regulation (Category 12.8 – Yeast and yeast products), where only Group 1 additives are permitted.	



WG4 Deliverable 4.3 - Review paper on valorisation of agrofood waste (M36)

SG Vegetables: S. Milliken, F. J. Alvarez-Martinez

Title: **Valorisation pathways for vegetable by-products and waste...**

Progress: Cluster analysis almost completed. Delving deeper into the 6 most prevalent vegetables (focus on prioritisation hierarchy level and TRL)

SG Fruits: O. Tarhan, S. Kamiloglu, Z. Ayhan, S. Saponara

Title 1: **Innovative approaches for extracting bioactive compounds from citrus by-products: A state-of-the-art review**

Progress: Under review (BMC Chemistry - Springer)

Title 2: **Strategies for integration of fruit by-products bioactives in food supply chain: application, bioeconomy, challenges and safety assessment**

Progress: Some undelivered parts are still waited to further process.

Title 3: **Exploring agricultural and industrial fruit-based waste/by-products for eco-friendly multifunctional bio-based food packaging and coating materials**

Progress: Accepted. Journal Food and Bioprocess Technology-Springer

Title 4: **Harnessing Fruit by-products for Health: Bioactive Extraction, Cardiometabolic Benefits, and Sustainable Valorization**

Progress: All the parts compiled, revision comments of the CA were sent to the co-authors.

SG Cereals (& Animal Productions): V. Krauter, E. Barraji n-Catal n

Title: Not decided yet [maybe: **Cereals are not only food, a comprehensive review of cereal by-products applications.**

Aimed Journal: Industrial Crops and products (Q1)]

Progress: Work in progress



WG4 Deliverable 4.3 - Review paper on valorisation of agrofood waste (M36)

Title 3: Exploring agricultural and industrial fruit-based waste/by-products for eco-friendly multifunctional bio-based food packaging and coating materials

Progress: Accepted. Journal Food and Bioprocess Technology-Springer

Authors: Zehra Ayhan*, Dilhun Keriman Arserim-Uçar, Derya Alkan, Sevil Cikrikci Erunsal, Aylin Altan, Ayca Aydogdu Emir

Gönderen: Food and Bioprocess Technology <vincent.salvo@springernature.com>
Date: 5 Şub 2026 Per, 05:02
Subject: Food and Bioprocess Technology: Decision on your manuscript
To: <zehraayhan@sakarya.edu.tr>

Ref: Submission ID b7417345-1a6d-4a87-a581-2b5086f0cb93

Dear Dr Ayhan,

Re: "Exploring agricultural and industrial fruit based waste/by products for eco-friendly multifunctional bio-based food packaging an

We're delighted to let you know that your manuscript has been accepted for publication in Food and Bioprocess Technology.

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WG4 Deliverable 4.4 - Develop at least 4 potential applications of the valorisation and use of the waste of the F&V value chain (M48)

How to interpret it

Develop something new by adapting what is already known

→ elaborate Case Study from the D4.1

→ open discussion during WG4 meeting session

Call for interest in contributing

When: as soon as D4.2 is submitted (pre-call in Zadar)

How: Microsoft form (as for the first call in October 2024)

With/without SG division: to be decided



WG4 Training School - Valorisation of food processing side-streams in a circular economy

Soon the call open - invitation through the Newsletter!



The main topics covered are:

- agrifood waste definitions and overview of current valorisation strategies
- waste-to-resource approach
- holistic biorefinery approach
- workflow for resources' valorisation
- challenges in effective valorisation

TRAINING SCHOOL COST CA22134 FOODWASTOP

Valorisation of food processing side-streams in a circular economy

26-28 May 2026

Cēsis, LATVIA

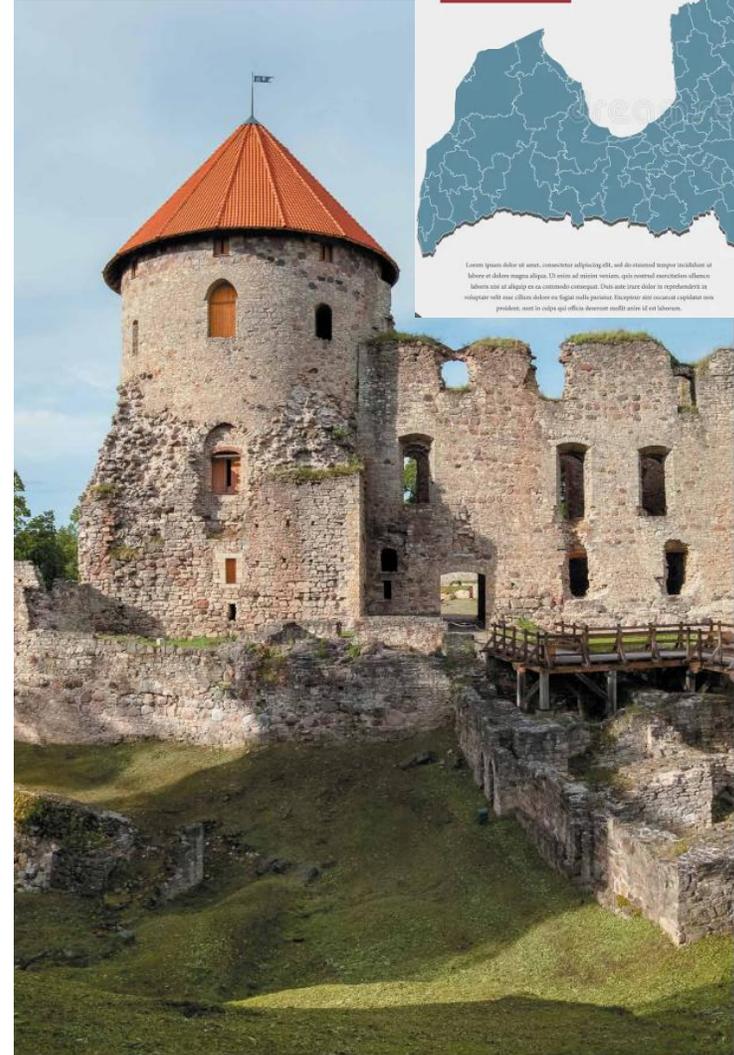
Local organizer Jessica Girardi (WG4 leader)

Chair Gianfranco Romanazzi, Vice Chair Fernando Pérez Rodriguez

Sustainable network for agrofood loss and waste prevention, management, quantification and valorisation
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WG4 Training School - Agenda draft

Tuesday 26/5/26 Space Education Center https://kosmosacentrs.lv/en/		Wednesday 27/5/26 Field Trip ZAAO education center "URDA" https://www.urda.lv/en		Thursday 28/5/26 University of Latvia in Rose square https://www.lu.lv/par-mums/struktura/filiales/cesu-filiale/	
08.30-09.00	Registration of participants	09.00	Departure for the Nature and Technology Park "URDA". Registration of participants in the bus	08.30-9.00	Joint reflections from the field trips (Jessica Girardi)
09.00-09.30	Welcome by the local organizer (Jessica Girardi) and FoodWaStop Chair (Gianfranco Romanazzi). State of the art of COST Action CA22134 FoodWaStop	09.00-10.00	Arrival and networking	09.00-9.30	Strategies for integration of fruit by-product bioactives in the food supply chain: challenges and safety assessment (Ozgur Tarhan)
09.30-10.00	Welcome by Cēsis Municipality vice major (Inese Suija Markova), overview of the regional plan for food waste valorisation and insight from the LIFE project "Waste to Resource" (Lāsma Ozola)	10.00-11.00	Presentation of ZAAO Company and its educational section URDA. Emphasizing a bioeconomy-based approach to waste management services (Mārtiņš Niklass)	9.30-9.10.00	Method to detect microplastic in farmed insects (TBD)
10.00-10.15	Guidelines for valorisation of food processing by-products (László Abrankó)	11.00-12.00	Excursion to Daibe Circular Economy Center and BNA bioFactory (Mārtiņš Niklass)	10.00-10.30	Food Safety Risk Assessment - contribution to the research (Fernando Pérez Rodríguez)
10.15-10.45	Industrial Symbiosis – an end or a means? State of the art in the Baltic Sea Region (Maja Kāle)	12.00-13.00	Lunch	10.30-11.00	Customer/consumer acceptance if constituents are upcycled to food / Upcycling vs feeding (social equity implications) (TBD)
10.45-11.15	Estimating the amount of food industry by-products in the European Union: a comprehensive assessment to promote the circular bioeconomy (Elīna Dāce)	13.00-14.00	Smart biowaste and compost management (TBD)	11.00-11.30	Coffee break
11.15-11.45	Coffee break	14.00-15.00	Visit to the scaled-up on-site compost case in a blackcurrant farm in Limbaži (Krogizeme) (lead Dace Zariņa)	11.30-12.00	Good practice and practical example of a circular bioeconomy approach: how to put it into action - Mushroom cultivation and use of spent compost for straw valorisation (Slaven Zjalic)

11.45-12.00	Valorising food waste using insect bioconversion : Challenges and opportunities (Sarah Milliken)	15.00-16.00	Plant in biocompost soil ("URDA" team)	12.00-12.30	BIOMUND (Kārlis Sams)
12.00-12.30	Organic waste as substrates for insect production for animal feed (TBD)	16.00	Departure from the Nature and Technology Park. Arrival in Cēsis at approx. 16.30	12.30-13.00	CLEANTECH LATVIA - Synergia Platform & Accelerator program (Vanda Rogovska)
12.30-13.00	By-product use in circular bioeconomy: different business models (Tālis Tisenkopfs)	16.30-17.30	Free time	13.00-14.00	Lunch
13.00-14.00	Lunch	17.30	Departure for the beer tasting and tour at the Valmiermuiža brewery	14.00-14.45	Industrial symbiosis case study from the bioregion - RoRo organic/Smiltene dairy products/ BioVilla (TBD)
14.00-14.15	Ensuring 'high level' valorisation (TBD)	18.00-19.30	Beer tasting and tour at the Valmiermuiža brewery	14.45-16.00	Practical exercise to wrap up - Labas saknes fermentation workshop
14.15-14.45	Active packaging (TBD)	19.30-22.00	Group Dinner at Valmiermuiža	17.00	Guided walk in the city and free evening
14.45-15.15	EIT Food Hub - Lack of comparable quantitative data on potential resources & Connecting stakeholders of the value chain (TBD)	22.30	Return in Cēsis		
15.15-15.45	Coffee break				
15.45-16.00	Environmental and economic assessment of food-packaging systems with a focus on food waste (Victoria Krauter)				
16.00-17.30	Group exercise: Value Stream Mapping. The goal is to create a diagram of the material flow for a given case study (led by Victoria Krauter)				
17.30 - 18.00	Networking Aperitivo and free evening				



Thank You for Your contribution!

Contacts

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<https://www.foodwastop.eu/>

