Alps4GreenC Crowdsourcing campaign results report

Deliverable 1.1.1

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Contents

1 Introduction

Alps4GreenC aims at implementing transnational value-chains in the Alpine territories to facilitate the development and implementation of bio-economy focusing mainly on the sustainable production and utilization of green carbon (biochar).
Project tasks not only foreseen practical tests for biochar production, but also mapping activities, context and gap analysis and policy recommendations.
In order to collect the biomass residues to be converted into biochar, facilitate the mapping and raise awareness among citizens, companies, and other stakeholders on the benefits of green carbon utilization, a crowdsourcing campaign was launched in the three countries involved in the Project: Austria, Italy and Slovenia.
This report presents the methodology used for running the crowdsourcing campaign and the related results.

2 Methods

In order to perform the crowdsource campaign activities, a methodology was developed by the consortium. It consisted of five steps: 1) Rules and timeline definition, 2) On-line form preparation, 3) Meeting with stakeholders and promotion of the crowdsourcing campaign, 4) Participants list finalization, 5) Residues selection.

2.1 STEP 1 - Rules and timeline definition

As first step, the rules for participating to the crowdsourcing campaign were laid down by the project partners and a timeline was drafted.

Rules:
All the participants need to fill out a dedicated form prepared by the consortium and made available on-line. Once all contributions are collected, 10 residues are selected to be characterized and tested in lab- and pilot-scale plants to produce biochar. Five residues are tested in pyrolizers available at BEST's facilities and the other five in gasifiers available at UNIBZ's facilities. For doing so, the selected participants send the residues they would like to test to the national partner in charge of the collection (BEST; UNIBZ, SGZ). Then, the national partner sends the residues both to a pre-selected external laboratory for characterization and, when necessary, to BEST or UNIBZ for pyrolysis and gasification tests, respectively.

All participants are rewarded with:

- Dedicated profile in the Alps4GreenC interactive stakeholder map (available on-line),
- Display of company name and logo at final project event,
- Invitation to upcoming events and networking possibilities,
- Continuous exchange of information with the Alps4GreenC team of experts,

- Updates on the project results (newsletter).

In addition, selected participants benefit from both the technical analysis of their residues and an increased visibility.
The technical analysis foresees:

- Full characterization of the residues,
- Information on possible processes for biochar production from the residues,
- Information on possible uses of the produced biochar,
- Sample of biochar produced from the residues,

While increased visibility foresees:

- Dedicated page on the project website,
- Award and award ceremony at final event.

Timeline:
The timeline for the crowdsourcing campaign was defined by the partners and is reported in Table 1. Briefly, the campaign was launched in December 2022 and lasted until February 2023. Winners were contacted in March 2023 and residues collected until the end of April 2023.

Table 1: Crowdsourcing campaign timeline.

	12/22	01/23	02/23	03/23	04/23
Crowdsourcing campaign open					
Residues collection					

2.2 STEP 2 - On-line form preparation

As second step, a form for collecting the interest of possible participants and information on the residues was prepared by the consortium and made available on-line in four languages: English, German, Italian and Slovenian.

The form consists of 5 pages:

- Page 1 is dedicated to the presentation of the project and the rules of the crowdsourcing campaign;
- Page 2 collects participants data;
- Page 3 collects information on the residues the participants would like to valorize within the project;
- Page 4 is to confirm the availability to provide
  - 30 kg of residues for characterization and lab-scale tests (mandatory step)
  - 2 tons for pilot-scale tests (optional step).
- Page 5 reports the main contact details to use in case further information is needed.

Figure 1 reports a screenshot of the first page of the form available on-line (English version).

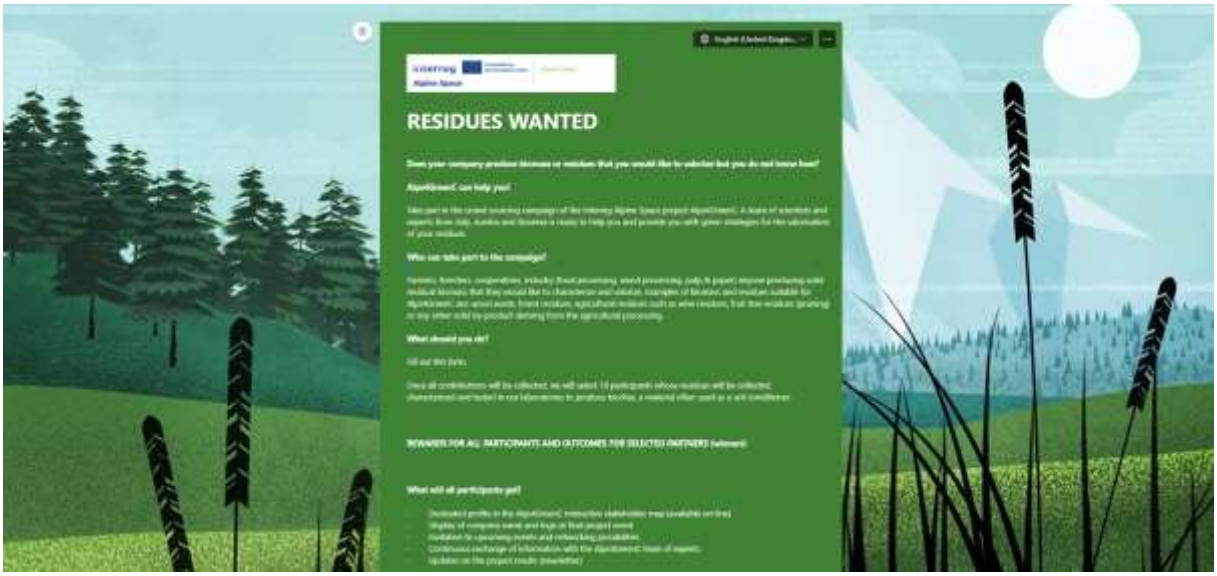

Figure 1: Screenshot of the first page of the form available on-line.

The form is available at the following link:
https://forms.office.com/pages/responsepage.aspx?id=q4RjeLESUUO-emSLfWx0ixTtPGpMyp9Jox93NATyDu9UMlJMWjU3WDFaSjRCVDE1TFJQMDc0T1JLQS4u

The whole text of the English version of the form is reported in the Attachment.

2.3 STEP 3 - Meeting with stakeholders and promotion of the campaign

In order to increase awareness on the project and foster the stakeholders' involvement in the crowdsourcing campaign, a stakeholder meeting was organized in each of the three country.
The details of the three meetings are reported in Table 2.

Table 2: Meetings with stakeholders.

	Austria	Italy	Slovenia
Date	24.01.2023 8:30 – 9:00	26.01.2023 16:00 - 18:00	16. 12. 2022 10:00- 11:10
Organizer	BIOBASE	AIEL	CCIS
Event name	Alps4GreenC Crowdsourcing Blitzworkshop	Valorizzazione dei combustibili legnosi	Crowdsourcing kampanja zbiranja ostankov za pridobivanje bio-oglja
Mode	On-line	On-line	On-line
Participants (nr.)	12	40 - 53	10

Notes	The workshop consisted of i) Short introduction to the Alps4GreenC project (BioBASE), ii) Information about the crowdsourcing campaign (BEST), iii) Time for questions	A presentation entitled "Una nuova vita per le biomasse residuali: come partecipare al progetto Alps4GreenC" was held by UNIBZ.	The workshop included i) overall presentation of the project, its activities and outcomes. ii) the biochar was presented with its properties and benefits. The partners from NIC were on call for technical questions about the delivery of biomass residuals to the laboratories. iii) presentation of the Questionnaire, created to collect the interested biomass producers.

2.4 STEP 4 - Participants list finalization

After officially closing the crowdsourcing campaign in February 2023, the information regarding all the interested participants who filled in the on-line form was collected in an excel file and the final list of participants was drafted.

2.5 STEP 5 - Residues selection

Starting from the participants list drawn up in STEP 4, the 10 residues to be tested were selected. Five residues were selected for pyrolysis tests to be carried out at BEST's facilities, the other five instead were selected for gasification tests to be carried out at UNIBZ's facilities.
Selected and not selected participants were officially informed by e-mail.

3 Results

The crowdsourcing campaign was officially launched in December 2022 and closed in February 2023. A total of 22 participants filled in the on-line form showing their interest in the project.
The list of the participants along with their nationality and associated residues is reported in Table 3.

Table 3: List of participants to the crowdsourcing campaign along with their nationality and associated residues.

	Participant	Country	Residues
1	Az. Agr. Corte Arano di Giovannini Mattia	Italy	Vine shoots
2	Atlantic Droga Kolinska d.o.o.	Slovenia	Coffee chaffs
3	AVTARKIJA, zavod za obnovljive vire energije Murska Sobota so. p.	Slovenia	Miscanthus
4	Dravske elektrarne Maribor d.o.o.	Slovenia	River woody debris
5	JZ Notranjski park	Slovenia	Cane and common reed
6	Agraria Riva del Garda s.c.a	Italy	Pitted olive pomace
7	Agrana Research & Innovation Center GmbH	Austria	Sewage sludge, bran starch
8	Hanfwelt Riegler-Nurscher GmbH & Co KG	Austria	Hemp straw
9	BIOMASS GREEN ENERGY SRL	Italy	Wood chips from broadleaf forestry sites
10	Teuschler GmbH	Austria	Bark
11	Butzenlechner Marianne u. Herbert	Austria	Food residues (remaining of food not eaten by cows)
12	Brantner Österreich GmbH	Austria	Screen overflow from composting
13	NUSSLAND GmbH	Austria	Walnut shells
14	VERMIGRAND Naturprodukte GmbH	Austria	Starch and diatom mixture (filter aid)
15	Karl Brader	Austria	Spelt husks
16	Beton Eisack Gmbh	Italy	Wood scraps
17	X Timber AG	Italy	Bark, wood shavings
18	FAL di Brugnara e Chistè srl	Italy	Machine cutting waste from Glulam fir wood
19	Dapoz Roland	Italy	Wood affected by bark beetles
20	Ledoga srl	Italy	Chestnut wood after tannins removal
21	Associazione AMVA promozione sviluppo Macugnaga valle anzasca	Italy	Woody biomass
22	FRIUL PALLET SNC DI PETRIGH FRANCO E TIZIANO	Italy	Sawdust

Among the 22 participants, 8 came from Austria, 10 from Italy and 4 from Slovenia (see Figure 2). Regarding the production sector, 4 participants came from the forestry sector, 3 from the food processing sector, 3 from the agricultural sector, 2 from the pulp and paper

sector and 7 from other sectors (i.e., hydropower generation, Mischantus production, fertilizers and agricultural substrates production, wood packaging production, wood industry, recycling) (see Figure 3). Three participants (nr. 8, 11. 13) declared to belong to more than one sector: Agriculture and Food processing (nr. 8 and 13) and Agriculture and Forestry (nr. 11).

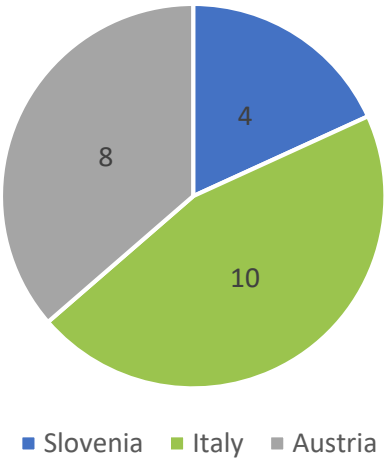

Figure 2: Distribution of participants by country.

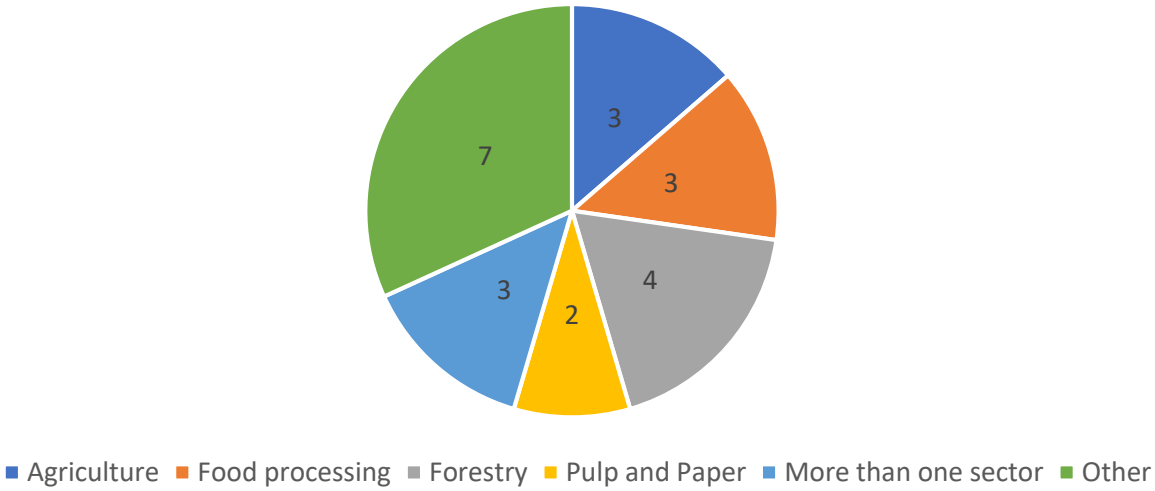

Figure 3: Distribution of participants by sector.

Moreover, 15 participants were available to provide both the 30 kg of residues needed for characterization and lab-scale tests and the 2 ton needed for the pilot tests.
It is worth mentioning that among the residues, 10 could be considered woody biomass.

The Excel file with all the information collected is attached.

4 Residues selected

All the pieces of information regarding the residues were carefully revised. When relevant information was missing, the consortium contacted directly the company.
Due to technical reasons and process feasibility, some residues were immediately excluded from the selection process:

- Sewage sludge shows a low carbon content (14% carbon content, rest mineral) that makes it unsuitable for further green-carbon production.
- Hemp straw needs cutting before testing. However, the strong fibers make the cutting step rather difficult.
- Food not eaten by cows is gathered from stables. Therefore they may be a heterogeneous residues, including different types of animal feed as well as cow excrements, which would create problems for storage and transportation (smell, high water content and biological activity leading to deterioration of the residue).
- Concerning the starch and diatom mixture (filter aid), the filter aid material included in the residue would not be suitable for treatment in pyrolyser or gasifier.

Some residues are suitable for testing, but they would require an intensive pre-treatment step:

- Pitted olive pomace shows a high moisture content (up to 65%) that makes it unsuitable for further processing through pyrolysis and gasification unless a pre-drying step is foreseen.
- Also the screen overflow from composting, with a high moisture content (approximately 40%), would require a drying step. Moreover, cutting/crushing is needed to reduce the particle size (which is currently up to 250mm).
- Several residues may require cutting/crushing to reduce their particle size before the thermal treatment. Such residues include cane and common reed and some woody biomass.

Starting from this preliminary evaluation, 10 residues were selected, 5 for pyrolysis tests and 5 for gasification tests (as foreseen by the Project).
The list of the selected residues and the relative application are reported in Table 4 starting from the Slovenian residues, followed by the Austrian and Italian ones. According to this list, a number code has been associated to each residue.

Table 4: List of selected residues for the production of biochar through pyrolysis and gasification tests.

Code	Participant	Country	Residues	Application
1	Atlantic Droga Kolinska d.o.o.	Slovenia	Coffee chaffs	Pyrolysis
2	Dravske elektrarne Maribor d.o.o.	Slovenia	River woody debris	Gasification
3	NUSSLAND GmbH	Austria	Walnut shells	Pyrolysis

4	Agrana Research & Innovation Center GmbH	Austria	Bran (starch)	Pyrolysis
5	Brantner Österreich GmbH	Austria	Composting surplus screenings	Pyrolysis
6	Karl Brader	Austria	Spelt husks	Gasification
7	Dapoz Roland	Italy	Wood affected by bark beetles	Gasification
8	Ledoga srl	Italy	Chestnut wood after tannins removal	Gasification
9	Az. Agr. Corte Arano di Giovannini Mattia	Italy	Vine shoots	Gasification
10	BIOMASS GREEN ENERGY SRL	Italy	Wood chips from broadleaf forestry sites	Pyrolysis

To reflect the participation to the crowdsourcing campaign by country, the consortium decided to select 2 residues from Slovenia, 4 from Austria and 4 from Italy.
The following sections describe the residues selected and the motivation behind their selection.

4.1 Slovenia

1 - Coffee Chaffs

The residuals come from the roasting process in the coffee company Barcaffe in Izola, a city on the Slovenian coastline. As a part of Atlantic Grupa concern, the company is the strongest coffee brand in Slovenia. The company receives 46 tons of coffee from the Koper's port daily, from which the 250 kg of coffee chaffs are separated during roasting; since the chaff does not taste pleasant and brewed, it must be thoroughly removed from the coffee beans – the residuals are available through all year consistently (year amount is approx. 120.00 kg). Chaff is the epidermis of coffee beans that falls off during roasting due to heat application. Each part is 2-5 mm big, but particles are often joined together in bigger parts - pellets – formed during the removal from the pipes within the roasting process, where also some water is added for easier removal because parts are light and fluffy in texture (Figure 4).

Source: https://www.barcaffe.si/

Figure 4: The coffee chaffs, photo credits: CCIS, Slovenia

2 - River wood debris

The residuals come from the company Dravske elektrarne Maribor, d. o. o., which produces almost a quarter of the total electricity produced in Slovenia. The average annual production of the company amounts to 2,800 GWh. The selected hydropower plant is located in Zlatoličje, near Maribor. Woody debris is the logs, sticks, branches, and other wood that falls into streams and rivers. This debris can influence the flow and the shape of the stream channel, and it can clog the system of hydroelectric plants and cause different problems and has to be removed from the river. The residuals are available all year, especially during rainy periods and high waters, with a yearly amount of around 8.000 tons. The wood from the Drava River is mechanically removed using machines and then processed through a wood shredder to be cut into smaller pieces, approximately 3cm (Figure 5).

Source: https://www.dem.si/en/

Figure 5: Wood debris at the hydroelectric plant at Zlatoličje, Slovenia

4.2 Austria

3 - Walnut shells

This residue comes from the walnut processing company NUSSLAND GmbH, located in Bergland, Lower Austria. At NUSSLAND, walnuts bought from local producers are cracked, sorted, grated and packaged or processed into walnut-based food products, such as purees, pesto etc.
Shells resulting from the cracking of walnuts are collected as residue (see Figure 6). Approximately two thirds of the nutshells are fed into a drying plant, which is part of the Nussland facility, while one third remains available for other uses. The company is willing to explore higher value applications, such as biochar production.
The overall annual shells production is 100 tons / year. Shells are very dry and have sizes in the range 1 mm to 1 cm.

Source: www.nussland.at

Figure 6: Sample of the walnut shells, Photo credits: BEST GmbH.

4 - Bran (starch)

The bran to be tested in Alps4GreenC comes from the AGRANA Group, a large company (~9,000 employees) operating in the food processing sector. The company's main products are fruit preparations, fruit juice concentrates, sugar and cereals. Since 2008, AGRANA also runs a biofuel plant in Pischelsdorf (Lower Austria), where bioethanol is produced from the fermentation of carbohydrate-rich biomass such as sugar and starch.
The biofuel plant produces approximately 100 tons/day of bran from starch are as residue (see Figure 7). This material is currently used as feed-additive for animal nutrition, but AGRANA is willing to experiment other possible uses.
The bran has 13 % water content and a very small particle size, which makes it similar to a powder.

Sources:
https://www.agrana-research.com/en/start
https://www.agrana.com/en/about-us/overview
https://www.agrana.com/en/products/all-productportfolios/bioethanol/production-sites

Figure 7: Sample of the bran, Photo credits: BEST GmbH.

5 - Composting surplus screenings

The Brantner Group is large-size family-owned company operating in the sector of waste management. The company owns landfills, waste sorting and processing facilities, as well as composting plants.
The residue selected in Alps4GreenC is produced in a composting plant, in which tree shavings are treated. Shavings are cut to the desired size by a shredder and then composted. After composting the material is graded to a particle size >12 mm by a sieve. The fraction remaining in the upper part of the sieve (screen overflow) is the residue proposed in the crowdsourcing campaign and selected for testing (see Figure 8).
The screen overflow is produced over the whole year (10.000 tons/year). The particle size ranges from 12 mm to 250 mm and the water content is approximately 40%. The highly variable particle size and high water content were considered very challenging for the pyrolysis tests planned in the project. For these reasons, the residue was crushed and dried at the premises of Branter before delivery.

Source: https://www.brantner.com/en/group/about-us/history.html

Figure 8: Sample of the composting surplus screenings, Photo credits: BEST GmbH.

6 - Spelt husks

The organic farm "Brader", located in St. Leonhard am Forst (Lower Austria), is a part of a community of ecologic farms. The farm's main products are cereals, pumpkin seeds and pumpkin-seed oil. The farm also comprises a spelt dehulling facility. Other farmers from the region can take their spelt to the Brader farm to have it dehulled.
During the dehulling of spelt, husks are produced, in an amount equal to approximately 25 to 30% of the initial input material (see Figure 9). Currently, husks from the Brader farm are used as bedding material for animals, but higher value applications are desired.
Husks are produced over the whole year, with highest amounts after the harvesting of spelt. The water content is estimated to be at maximum 14% and the particle size is below 20 mm. Part of the residue is composed of very fine, almost dusty particles.

Figure 9: Sample of spelt husks, Photo credits: BEST GmbH.

4.3 Italy

7 - Wood affected by bark beetles

Bark beetles are insects that feed and breed between the bark and the wood of various tree species. While some species, do attack living trees, many bark beetle species feed on weakened, dying, or dead spruce, fir, and hemlock. In undisturbed forests, bark beetles serve the purpose of hastening the recycling and decomposition of dead and dying wood and renewing the forest. However, a few species are aggressive and can develop large populations that invade and kill healthy trees and are therefore known as pests.
Wood that has been severely affected by bark beetles cannot be used by the furniture, construction, or other industries as their structural integrity is damaged (see Figure 10). However, it could still be used for energy production via pyrolysis, gasification, or combustion especially when converted into woodchips (see Figure 11).
Considering the Italian Region of South Tyrol alone, 6,100 hectares of woods have been affected by bark beetles corresponding to 2.4 million m^3 of damaged wood. Thus, the amount of wood available is massive and this increases the valorisation potential of this material in the perspective of biochar and energy production.

Sources:
https://en.wikipedia.org/wiki/Bark_beetle
Newspaper Neüs 01/2023

Figure 10: Wood (on the right) affected by bark beetle (on the left). Source: https://www.rwhendricksenco.com/bark-beetles-identification-and-prevention/.

Figure 11: Woodchips provided by Dapoz Roland. Photo credits: UNIBZ.

8 - Chestnut wood after tannins removal

Chestnut tree wood contains high levels of tannins, particularly in the bark and inner layers of the tree. These tannins are extracted as they have a wide range of applications in industries such as tanning, textile, and food.
Wood with high tannin content will have different properties from that void of any tannin. Particularly, tannin due to its flame-retardant nature negatively affects the thermochemical processes. For instance, during combustion the presence of tannins lead to high instability, smoke and CO formation (as claimed by Ledoga srl). Moreover, tannins being organic compounds, contribute to the formation of char during gasification.
Therefore, residues obtained after tannins removal (see Figure 12) could be further valorised for the production of biochar and energy.

Figure 12: Chestnut wood after tannins removal. Photo credits: UNIBZ.

9 - Wood chips from broadleaf forestry site

Wood chips are a standard feedstock for biomass gasification and are currently gasified by BIOMASS GREEN ENERGY srl to produce energy (see Figure 13). However, the resulting biochar do not meet compliance norms for agricultural applications. Hence, the aim is to explore the possibility of producing biochar from broadleaf wood via pyrolysis and evaluate the differences between the gasification and pyrolysis biochars.

Figure 13: Wood chips from broadleaf forestry site.

10 - Vine shoots

Italy is a country known for its production of wine. It has about 718,000 hectares of its total land area covered by vineyards. In the South Tyrol Region alone, there are 1,681 farms in the sector operating on a surface area of 5,525 hectares, which are associated with the highest total revenue per hectare in Italy (21,463 €/ha).
The large volumes of end products involved, however, are in turn associated with large volumes of waste material especially waste derived from the maintenance of the vineyards. In particular, Azienda Agricola Corte Arano proposes the valorization of vine shoots (see Figure 14 and 15) collected from their vineyards that are currently left on field or composted. The new valorization solution proposed by Alps4GreenC for these residues could be a valid alternative not only for the company itself, but also for all the stakeholders working in the field especially considering that the Italian Government will issue incentives for the removal of residues from the fields and their further valorisation.

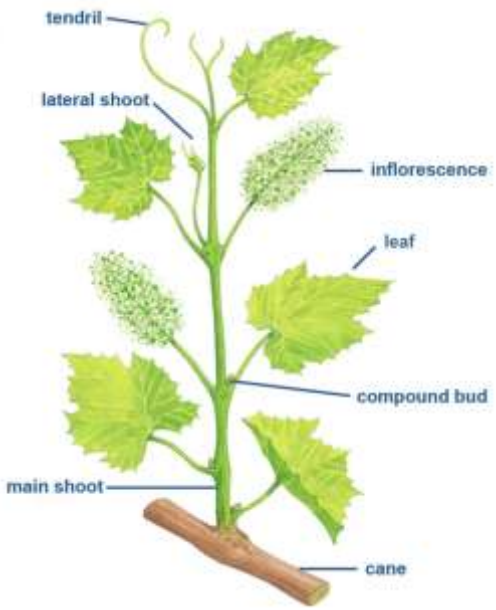

Figure 14: Main shoots component. Source : https://blissfulwineblog.com/main-shoots.

Figure 15: Chipped vine shoots. Photo credits: UNIBZ.

5 Summary and conclusion

A crowdsourcing campaign in the framework of the Alps4GreenC project was carried out from December 2022 to February 2023. The campaign attracted the interest of several stakeholders leading to the participation of 22 companies, exceeding the minimum number required for the Project implementation.
Different sectors were involved in the crowdsourcing, even though the majority of requests came for the valorization of different types of woody residues (10 over 22).
Some residues were not suitable for dry thermochemical processes such as pyrolysis and gasification and some of them needed pre-treatments before being converted into biochar.
Thanks to the Alps4GreenC activities all the participants and other stakeholders interested could deepen the aspects related to thermochemical processes, such as pyrolysis and gasification, and eventually, according to the nature of their residues, select them as possible valorisation strategies.