

SUCELLOG: IEE/13/638/SI2.675535

D3.2 Summary of the regional situation, biomass resources and priority areas of action for SUCELLOG

15th December 2014



About SUCELLOG project

The SUCELLOG project - Triggering the creation of biomass logistic centres by the agro-industry - aims to widespread the participation of the agrarian sector in the sustainable supply of solid biofuels in Europe. SUCELLOG action focuses in an almost unexploited logistic concept: the implementation of agro-industry logistic centres in the agro-industry as a complement to their usual activity evidencing the large synergy existing between the agro-economy and the bio-economy. Further information about the project and the Partners involved are available under www.sucellog.eu.

Project Coordinator



Project Partners



About this document

This report corresponds to D3.2 of the SUCELLOG project – Summary of the regional situation, biomass resources and priority areas of action for SUCELLOG. It has been prepared by:

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Table of contents

About SUCELLOG project	1
About this document.....	1
Table of contents.....	2
1. Introduction	3
2. Regional situation in SPAIN	5
3. Regional situation in FRANCE	6
4. Regional situation in ITALY.....	7
5. Regional situation in AUSTRIA	8
Annex I. Ratios of biomass production and availability percentage.....	10

List of tables

Table 1: Ratios of biomass production (t/ha) in SPAIN per region.....	10
Table 2: Percentage of availability of biomass (%) in SPAIN per region.	10
Table 3: Ratios of biomass production (t/ha) in FRANCE per region.....	11
Table 4: Percentage of availability of biomass (%) in FRANCE per region.	11
Table 5: Ratios of biomass production (t/ha) in ITALY per region.	12
Table 6: Percentage of availability of biomass (%) in ITALY per region.	12
Table 7: Ratios of biomass production (t/ha) in AUSTRIA per region.....	13
Table 8: Percentage of availability of biomass (%) in AUSTRIA per region.....	13

1. Introduction

SUCELLOG focuses on the implementation of biomass logistic centres into agro-industries as complement to their usual activity. Agro-industry facilities can be utilised in their idle periods to handle and pre-treat biomass feedstock (mainly from their own residues or agricultural residues nearby) to produce solid biomass with minor investment.

Within WP3-“Regional framework and stakeholders’ engagement”, SUCELLOG has carried out the following four actions in the project target regions of Spain, France, Italy and Austria:

- Assess available biomass resources.
- Evaluate with the stakeholders both the technical and the non-technical barriers of the implementation of SUCELLOG concept in the agro-industries.
- Determine the potential areas for the development of agro-industry logistic centres.
- Engage agro-industries to the project.

For the first action, an evaluation of the real potential of primary agrarian biomass has been carried out inside Task 3.1. The methodology selected corresponds to a “Resource focussed approach”, as described by BEE standardised classification (project Biomass Energy for Europe), which starts with statistical data from agrarian inventories. This data has been complemented with the real availability indices (the share of biomass that is not currently being used for other aims including soil sustainability issues, see Annex I) gathered in the regional workshops with the agrarian sector during Task 3.3. As a first result, primary biomass resources have been firstly catalogued according to existing competitive uses and relevance in terms of current unused quantities. This assessment has been performed by country level since no regional differences have been observed. Secondly, a map of the distribution of real available primary resources and a table of the available tons per year in dry base were built per target region. Even though the use of agro-industry residues is a target of SUCELLOG, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Therefore the maps and tables presented do not include this type of resources, which will be deeply assessed for particular cases of logistic centres monitored or audited during WP4-WP6.

As a second action, an assessment of the barriers and opportunities for the development of logistic centres was carried out through personal interviews with each target sector in Task 3.2. Existing agro-industries from the potential sectors (those owning compatible equipment for the conditioning and storage of raw material) were asked about: equipment, idle periods, residues produced in their facilities and upstream in the crop cultivation, the economic situation of the sector and possible upcoming changes due to the Common Agricultural Policy, practical and legal

incompatibilities in using their facilities for the production of solid biomass, social barriers for the development of this new activity and, finally, opportunities detected. After this analysis, target sectors were identified per region and specific agro-industry locations were included inside the biomass resource map.

To determine the potential areas inside each target region for the development of agro-industry logistic centres, it has been taken into account the diversity and quantity of available agrarian resources (both woody and herbaceous) and of agro-industries present in the region as well as the compatibility among them. Compatibility has been defined according to their seasonality (matching the months of biomass production with the idle period of the agro-industry) and their technical compatibility of use. Logistic issues such as good communication networks and proximity to consumption areas have also been taken into consideration. Potential areas have been identified per region. However, it is important to highlight that the selection of a potential area does not mean that an agro-industry non belonging to it could not start a new activity and the opposite. The size of the future logistic centre has not been a limiting factor for the selection of the potential area (even if SUCELLOG target is a production of 10 kt/yr per centre) since no data of the total amount of biomass is available (agro-industry residues missing as mentioned before).

Results obtained from the above mentioned work for each target region are shown in the corresponding reports that have been elaborated by country in their own language. In the following sections a summary per country is shown.

As a last activity belonging to this WP, workshops and personal contacts were carried out with agro-industries in Task 3.3, with the aim of engaging them to the services offered by the project (technical and decision-making support to become biomass logistic centres). The result of this action is shown in the document “D3.1-Report on engagement actions”.

2. Regional situation in SPAIN

SUCELLOG has evaluated the situation of the different target regions in Spain (Aragón, Castilla y León, Cataluña, Extremadura and Galicia) to host agro-industry logistic centres in terms of barriers/opportunities for their development and of available agrarian biomass resources.

Regarding biomass resources and according to the criteria of competitiveness and availability, the maize straw and the woody prunings appear to be the most interesting agrarian sources to be taken into account in general with the exception of Galicia. A large number of types of residues do still not have a real market and are left on the soil, burnt or just given for free to avoid the costs of disposal. On the contrary to what happens in other regions, whose logistic centre could be entirely based on agrarian resources, the creation of a logistic centre in Galicia should rely on the supply of the important forest resources of the region together with the woody prunings.

In what concerns the main potential sectors for the creation of biomass logistic centres, they are: forage dehydration facilities, cereal dryers, rice dryers, sugar industry, nut industry, tobacco dryers, distilleries and oil pomace industries. They have been selected due to the existence of compatible equipment for the pre-treatment of raw material (dryers and/or pelletisers) that has idle periods and where no technical barriers for the development of the new activity as biomass logistic centre have been detected. Those sectors owning horizontal dryers (forage dehydration, sugar industries, distilleries and oil pomace industries) present most versatile facilities able to process a greater variety of raw material formats while vertical dryers are more limited to olive and grape pits and crushed almond shell. Additional sectors like cellars and oil mills have also been taken into account, even if they do not present compatible equipment, because of their important capacity to gather agrarian biomass and their high interest in the project. In this sector, a new line for the production of biomass should be implemented. Finally, the animal feedstuff producer sector has also been considered in Galicia, even though their dryers and pelletisers work all the year, since a possible decrease in their production could generate the existence of a line free for the production of solid biomass.

All target regions present potential areas for the creation of logistic centres and the interest of the sectors is high in general since they see it as an opportunity to consume their own residues (reducing fuel acquisition) and to diversify their activity. However, even if the agro-industry sector is one of the largest consumer of solid biomass in Spain, being familiar with bioenergy issues, the most limiting barrier to be overcome in this country is the mistrust to changes in regulatory frameworks that could generate the stop of an industrial activity. Renewable energies arose as a good solution for the rural development and in some cases (like electricity production with solar systems) failed due to regulatory framework. The legal emission limits to start

being applied in the next years are one of the reasons that stop the sector from starting operating as solid biomass logistic centre.

For further details please see the document in Spanish “D3.2-Resumen de la situación regional, recursos disponibles y áreas potenciales en España” prepared by CIRCE in close collaboration with Spanish Cooperatives.

3. Regional situation in FRANCE

SUCELLOG project has evaluated the six target regions in France (Auvergne, Centre, Champagne-Ardenne, Ile-de-France, Picardie and Rhône-Alpes) with respect to agrarian resources and agro-industry sectors for the development of biomass logistic centres.

Regarding the quantity of available resources, the straw from herbaceous crops (cereal, rape and maize) is the most interesting resource to be taken into account in France. However, to be able to upgrade the quality of the resulting fuel, a woody source should be acquired, being in some regions possible to come from agrarian sources (prunings from vineyards) but in others only forest residues would be available. Residues from the agro-industry could be a complement for a mixed pellet although they do already have a market, which in some cases is even bioenergy (biogas production from sugar or distillery process residues for example).

Concerning the agro-industry sectors, the ones evaluated within the project in France have been: forage dehydration facilities, cereal dryers, sugar industry, distilleries, tobacco dryers, cellars, oil extraction industries and feedstuff producers. All of them have been considered target for the project except the last two, since the extraction industries and the feedstuff producers, even if they have compatible equipment for the production of solid biomass, do work during the whole year having no idle period for this new activity, unless a new line is installed or their current production decreases due to market issues. From the rest, forage dehydration facilities are already a very integrated industry, working in many cases as logistic centres to diversify their activity for the production of animal feed or even to produce woody pellets coming from forest sources. Cereal dryers, due to their vertical drying system, are not really compatible with the majority of available residues in France (with no granulated format) and therefore their strength as logistic centre would rely on their handling and storage equipment. In the case of the cellars, they have been included as target, even if they do not own compatible equipment but their easy access to an agrarian woody residue (vineyard prunings) and the interest shown by the sector, makes this particular case interesting for the project.

Potential areas for the development of logistic centres have been identified in all regions except in Ile-de-France, which does not imply that it could be not placed in that region. Association among nearby industries should be promoted in France in order to take advantage of the different idle periods and equipment and it won't be a barrier since the agrarian sector is used to taking advantage of synergies.

For further details please see the document in French “D3.2- Analyses régionales : ressources en biomasse et aires d’action prioritaires en France” prepared by CIRCE in close collaboration with Services Coop de France.

4. Regional situation in ITALY

The situation of the five target regions in Italy (Emilia-Romagna, Marche, Puglia, Sardegna and Toscana) have been analysed in order to evaluate their potentiality to set an agro-industry logistic centre. The evaluation has been carried out from the perspective not only of the available resources but also of the existing agro-industries compatible with this new activity according to SUCELLOG concept.

Regarding the resources, the potential feedstock are several: straw from cereal and maize mainly, prunings from olive tree and vineyards and agro-industry residues coming from the olive and wine sectors. A large number of types of resources do have not a market and are left on the soil or burnt to avoid the cost of harvesting/disposal.

The agro-industries evaluated by the project have been the following ones: forage dehydration facilities, cereal dryers, rice dryers, tobacco dryers, distilleries, oil pomace industries and sugar industries. They all own equipment that can be used for the production of solid biomass like dryers and/or pelletisers and idle period in their regular activity (not working the whole year). They all have been considered as target for the project since no important technical barriers for the development of a logistic centre in their facilities have been detected. More concretely, from all of them, cereal and rice dryers are the less versatile installations because of their existing drying system, which can be only compatible with a granulated product (like olive pits, grape pits and crushed almond shells). The rest of sectors could be able to pre-treat a large variety of resources format (straw, chips or granulated) since they have horizontal dryers. Cellars and oil mills have also been considered as target industries since, even if not owning compatible equipment, their easy access to biomass residues (from the agrarian practice or from the industrial process) make them interesting for the project. Therefore, in their case, investment in a new pre-treatment line should be made. The tobacco dryers have been also considered for the project even though they are not currently allowed to use their dryers with other resources due to commercial restrictions. Due to the fact that the sector is in decline and a restructuration will be needed, it can be a good possibility to include it as a possible new business line using existing equipment.

The situation of Italy is promising in terms of available resources and amount of agro-industries. However, it should be highlighted that there are still barriers to be faced when developing the project and which have come up during the interviews with the sector. The first can be the lack of trust that the society has in services that are provided for free (even if the project will not finance any investments or analysis, giving only technical support) which can lead to a lack of compromise. The second

barrier is that, in some cases, the law is different according to the region and often differently interpreted among provinces belonging to the same region. The best example is the definition of residue, whereas in Puglia the olive pomace is considered as by-product and it can be used as biomass, in other regions (i.e. Tuscany) it is considered as waste, and it cannot be used as biomass, because of the chemical treatment to extract oil using hexane. Different provinces can give their own more or less strict interpretation of the law, allowing or not to consider the raw material as a by-product. The third barrier can be the target consumers since the main market for SUCELLOG, which is the agro-industry sector, is not really familiar with biomass being highly dependent on natural gas whose network is really developed in Italy. However, the project considers that these barriers will be overcome with a good pilot example that can show that developing a biomass logistic centre can be a successful business line for the agro-industry to diversify their activity. Association among industries (even from different sectors) can be a convenient option to avoid high investment costs that could discourage possible entrepreneurship.

For further details please see the document in Italian “D3.2- Sintesi della situazione regionale, delle risorse di biomassa e aree di azione prioritaria in Italia” prepared by CIRCE in close collaboration with D.R.E.Am Italia.

5. Regional situation in AUSTRIA

The situation of the four target regions in Austria (Carinthia, Lower Austria, Styria and Upper Austria) was evaluated by SUCELLOG project in order to see the potential of the agro-industries to become solid biomass logistic centres.

From all the agro-industry sectors evaluated in Austria (cereal dryers, animal feedstuff producers, sugar industry, oil extraction industries, cellar and breweries), the project considers the cereal dryers and the animal feedstuff industry are the only two sectors able to implement SUCELLOG concept, although with minor modifications. Sugar industry has been discarded since there is only one present in the target Austrian territory and their interest in starting this new activity has been low, even if they present an appealing potential. The rest, either do not own compatible equipment or do not have idle period in the production.

In contrast to what happens in other countries, in Austria the main biomass feedstock available to be used in a future logistic centre is clear: the corn cobs. In the case of cereal straw, even if some part is sold in the feed market and some is left on the soil there is still a 33% of availability. Maize straw has no availability since it is mainly used to increase the amount of organic content in the soil, which is currently a problem in the country. Residues produced by the agro-industries are also used for animal feed having an important market. In the cereal dryers, a new drying line should be implemented in the facility to be able to process this kind of biomass, but handling equipment as well as storage and transport means (and in minor cases also

pelletisers) could be utilised in the idle period (9 months). The feedstuff producers own a drying system that works all the year but their pelletisers work according to demand, having the possibility to be adjusted for the production of agro-pellets. Even if both industries could work as logistic centres on their own, it is considered that an association among them, taking advantage on the synergies of available equipment and periods of work, could play an important role in the success of the new business activity.

Although most of the agro-industries think that the idea is a good opportunity to diversify their activity, their main concern is the market of the product (reduced to large consumers or broaden also to household), which will depend on the legal aspects of the combustion of agrarian biomass in Austria, currently under discussion. The situation in some regions, where corn cobs are already allowed to be used in households make the sector be optimistic about this new business line.

For further details please see the document in German “D3.2- Zusammenfassung der regionalen Situation, der Biomasse-Ressourcen und der vorrangigen Handlungsgebiete in Österreich” prepared by CIRCE in close collaboration with the Chamber of Agriculture and Forestry of Styria.

Annex I. Ratios of biomass production and availability percentage

SPAIN

Table 1: Ratios of biomass production (t/ha) in SPAIN per region.

Crop	Galicia	Aragón	Castilla y León	Extremadura	Cataluña
Wheat	1,84	1,7	1,95	0,68	1,84
Rye	1,96	0,64	1,03	1	0,88
Barley	1,66	1,95	1,32	0,85	1,29
Oat	1,48	0,65	0,99	0,95	0,79
Maize	20	20	20	20	20
Rice	3,8	3,8	3,8	3,8	3,8
Beans	1	1	1	1	1
Pulses_oth	1	1	1	1	1
Tobacco	1	1	1	1	1
Hemp	-	-	-	-	-
Rape	1	1	1	1	1
Sunflower	3	3	3	3	3
Soya	1	1	1	1	1
Linseed	-	-	-	-	-
Seed_other	1	1	1	1	1
Fruit_temp	3	3,5	2,5	3	2,5
Fruit_subtrop	3	3,5	2,5	3	2,5
Berry	1,5	1,5	1,5	1,5	1,5
Nuts	0,7	0,7	0,7	0,7	1,7
Citrus	-	6	6	6	6
Olive	-	3	3,75	3	3
Vineyard	3,75	4	3	0,5	3,75

Table 2: Percentage of availability of biomass (%) in SPAIN per region.

Crop	Galicia	Aragón	Castilla y León	Extremadura	Cataluña
Wheat	30	30	30	30	30
Rye	30	30	30	30	30
Barley	30	30	30	30	30
Oat	30	30	30	30	30
Maize	0	50	50	50	50
Rice	10	10	10	15	0
Beans	0	0	0	0	0
Pulses_oth	0	0	0	0	0
Tobacco	-	-	90	30	-
Hemp	-	-	-	-	-
Rape	50	50	50	50	50
Sunflower	10	10	0	10	10
Soya	-	-	-	70	-
Linseed	-	-	-	-	-
Seed_other	-	-	75	75	-
Fruit_temp	80	90	90	95	90
Fruit_subtrop	80	90	90	95	90
Berry	95	95	95	95	95
Nuts	99	99	99	99	50
Citrus	-	90	90	90	90
Olive	-	80	97	95	80
Vineyard	80	99	80	70	97

FRANCE

Table 3: Ratios of biomass production (t/ha) in FRANCE per region.

Crop	Île-de-France	Champagne-Ardenne	Picardie	Centre	Rhône-Alpes	Auvergne
Wheat	3,3	3,3	3,5	3	3,5	3,5
Rye	1	1	1	1	1	1
Barley	3,3	3,3	4	3,64	3	3
Oat	1	1	1	1	1	1
Maize	3,3	3,3	5	5,9	5	5
Rice	2	2	2	2	2	2
Beans	8	8	9,75	8	8	8
Pulses_oth	2,6	2,6	4,5	5	5	1
Tobacco	-	-	-	-	2,5	2,5
Hemp	-	-	-	-	-	-
Rape	2	2	2,5	1,2	2	2
Sunflower	2,5	2,5	2,5	2,5	1	1
Soya	2,7	2,7	2,7	2,7	2,7	2,7
Linseed	1	1	1	1	1	1
Seed_other	1	1	1	1	1	1
Fruit_temp	1,5	1,5	1,5	1,5	1,5	1,5
Fruit_subtrop	1,5	1,5	1,5	1,5	1,5	1,5
Berry	1,5	1,5	1,5	1,5	1,5	-
Nuts	-	-	-	1	1,1	-
Citrus	-	-	-	-	-	-
Olive	-	-	-	-	-	-
Vineyard		1,8	1,5	1,5	1,5	1,5

Table 4: Percentage of availability of biomass (%) in FRANCE per region.

Crop	Île-de-France	Champagne-Ardenne	Picardie	Centre	Rhône-Alpes	Auvergne
Wheat	14,4	14,4	30	30	5	5
Rye	14,4	14,4	30	30	30	30
Barley	14,4	14,4	30	50	30	30
Oat	14,4	14,4	30	50	30	30
Maize	17,4	17,4	5	5	50	50
Rice	-	-	-	-	-	-
Beans	100	100	100	100	100	100
Pulses_oth	0	0	0	0	-	-
Tobacco	-	-	-	-	90	90
Hemp	0	-	-	0	-	-
Rape	50	50	50	50	50	50
Sunflower	40	50	50	50	50	50
Soya				70	70	70
Linseed	80	75	75	75	-	-
Seed_other	75	75	75	75	75	75
Fruit_temp	90	90	90	90	90	90
Fruit_subtrop	-	--	-	-	-	-
Berry	90	90	90	90	90	-
Nuts	-	-	-	90	90	-
Citrus	-	-	-	-	-	-
Olive	-	-	-	-	-	-
Vineyard	90	90	90	90	20	20

ITALY

Table 5: Ratios of biomass production (t/ha) in ITALY per region.

Crop	Puglia	Sardegna	Emilia-Romagna	Toscana	Marche
Wheat	1,51	2,27	2,71	2,48	1,96
Rye	0,73	0	2,16	1,12	0
Barley	1,23	1,99	5,28	2,55	3,67
Oat	1,2	1,67	2,47	1,81	2,35
Maize	4,04	6,6	4,08	4,12	6,43
Rice	0	2,27	1,92	3,21	0
Beans	1,88	1,84	3,81	2,83	2,41
Pulses_oth	1,65	1,2	4,89	3,3	2,26
Tobacco	0	0	0	0,47	0
Hemp	0	0	0	5	0
Rape	0	0	0	0	0
Sunflower	1,52	1,54	2,75	1,57	1,15
Soya	0	0	3,75	0	0
Linseed	0	0	0	2,5	0
Seed_other	0	0	0	0	14,74
Fruit_temp	1,11	1,1	1,6	1	2,2
Fruit_subtrop	2	1,45	0	0,45	0
Berry	0,83	0,9	0,81	0,65	1,01
Nuts	1,45	1,38	1	0,96	1
Citrus	2,01	1,45	0	0,47	0
Olive	1,32	2,3	0,06	1,39	1,27
Vineyard	1,82	1,61	1,68	1,55	1,59

Table 6: Percentage of availability of biomass (%) in ITALY per region.

Crop	Puglia	Sardegna	Emilia-Romagna	Toscana	Marche
Wheat	35	25	10	25	35
Rye	40	40	40	40	0
Barley	35	30	10	30	30
Oat	40	40	40	40	40
Maize	45	50	50	45	45
Rice	0	40	40	40	0
Beans	0	0	0	0	0
Pulses_oth	0	0	0	0	0
Tobacco	0	0	0	85	0
Hemp	0	0	0	0	0
Rape	0	0	0	0	0
Sunflower	40	40	40	40	40
Soya	0	0	70	0	0
Linseed	0	0	0	0	0
Seed_other	0	0	0	0	0
Fruit_temp	25	20	20	20	20
Fruit_subtrop	0	0	0	0	0
Berry	40	40	40	40	40
Nuts	40	40	0	40	40
Citrus	40	35	0	40	0
Olive	55	45	47	45	47
Vineyard	50	50	50	40	50

AUSTRIA

Table 7: Ratios of biomass production (t/ha) in AUSTRIA per region.

Crop	Austrian target regions
Wheat	4
Rye	4
Barley	3,5
Oat	2,6
Maize	4
Rice	10,3
Pulses	-
Tobacco	-
Hemp	0
Rape	4
Sunflower	10
Soya	2
Linseed	-
Seed_other	7
Fruit_temp	2
Fruit_subtrop	-
Berry	1
Nuts	1
Citrus	-
Olive	-
Vineyard	3

Table 8: Percentage of availability of biomass (%) in AUSTRIA per region.

Crop	Austrian target regions
Wheat	33
Rye	33
Barley	33
Oat	33
Maize	0
Rice	-
Pulses	0
Tobacco	-
Hemp	0
Rape	50
Sunflower	0
Soya	50
Linseed	-
Seed_other	50
Fruit_temp	70
Fruit_subtrop	-
Berry	70
Nuts	70
Citrus	-
Olive	-
Vineyard	70

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D3.2a Summary of the regional situation, biomass resources and priority areas of action in Spain

1 November 2014



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Contents

About SUCELLOG project	1
About this document.....	1
Contents	2
List of Tables	3
List of Figures.....	3
1. Introduction	4
2. Agro-industries: profile, barriers and opportunities	5
3. Evaluation of available resources.....	10
3.1. Agricultural residues:.....	11
3.2. Other biomass resources	12
3.3. Methodology of work	13
3.4. Summary of results per region	14
4. Regional Framework of ARAGÓN.....	15
4.1. Identification of agro-industries in Aragón	15
4.2. Identification of biomass resources in Aragón.....	15
4.2.1. <i>Localization of resources and agro-industries in Aragón</i>	<i>17</i>
4.2.2. <i>Priority areas in Aragón.....</i>	<i>18</i>
4.3. Regional Framework of CASTILLA Y LEÓN	19
4.3.1. <i>Identification of agro-industries in Castilla y León.....</i>	<i>19</i>
4.3.2. <i>Identification of biomass resources in Castilla y León.....</i>	<i>19</i>
4.3.3. <i>Localization of resources and agro-industries in Castilla y León.....</i>	<i>21</i>
4.3.4. <i>Priority areas in Castilla y León.....</i>	<i>22</i>
4.4. Regional Framework of CATALUÑA	23
4.4.1. <i>Identification of agro-industries in Cataluña.....</i>	<i>23</i>
4.4.2. <i>Identification of biomass resources in Cataluña.....</i>	<i>23</i>
4.4.3. <i>Localization of resources and agro-industries in Cataluña.....</i>	<i>25</i>
4.4.4. <i>Priority areas in Cataluña</i>	<i>26</i>
4.5. Regional Framework of EXTREMADURA.....	27
4.5.1. <i>Identification of agro-industries in Extremadura.....</i>	<i>27</i>
4.5.1. <i>Identification of biomass resources in Extremadura</i>	<i>27</i>
4.5.2. <i>Localization of resources and agro-industries in Extremadura.....</i>	<i>29</i>
4.5.3. <i>Priority areas in Extremadura.....</i>	<i>30</i>
4.6. Regional Framework of GALICIA	31

4.6.1.	<i>Identification of agro-industries in Galicia</i>	31
4.6.2.	<i>Identification of biomass resources in Galicia</i>	31
4.6.3.	<i>Localization of resources and agro-industries in Galicia</i>	32
4.6.4.	<i>Priority areas in Galicia</i>	33
5.	Summary of the situation in Spain	34
	Annex I: Table of ratios y availability percentage per region	36

List of Tables

Table 1:	Classification of biomass resources in Spain.....	11
Table 2:	Most strategic resources by target region.....	14
Table 3:	Availability of equipment and biomass resources in Aragón.....	18
Table 4:	Availability of equipment and biomass resources in Castilla y León.....	22
Tabla 5:	Availability of equipment and biomass resources in Cataluña.....	26
Table 6:	Availability of equipment and biomass resources in Extremadura.....	30
Table 7:	Availability of equipment and biomass resources in Galicia.....	33
Table 8:	Ratios of biomass production (t/ha) in SPAIN per region.....	36
Table 9:	Percentage of availability of biomass in SPAIN per region.....	36

List of Figures

Figure 1:	Summary of available agricultural biomass residues in Aragón.....	16
Figure 2:	Localization and type of agro-industries and resources in Aragón.....	17
Figure 3:	Summary of available agricultural biomass residues in Castilla y León....	20
Figure 4:	Localization and type of agro-industries and resources in Castilla y León.	21
Figure 5:	Summary of available agricultural biomass residues in Cataluña.....	24
Figure 6:	Localization and type of agro-industries and resources in Cataluña.....	25
Figure 7:	Summary of available agricultural biomass residues in Extremadura.....	28
Figure 8:	Localization and type of agro-industries and resources in Extremadura. .	29
Figure 9:	Summary of available agricultural biomass residues in Galicia.....	31
Figure 10:	Localization and type of agro-industries and resources in Galicia.....	32

1. Introduction

SUCELLOG focuses on the implementation of biomass logistic centres into agro-industries as complement to their usual activity with minor investments. Agro-industry facilities can be utilised in their idle periods to handle and pre-treat biomass feedstock (mainly from their own residues or agricultural residues nearby) to produce solid biomass to be introduced into the market.

This document shows the results of the work carried out within SUCELLOG WP3-“Regional framework and stakeholders’ engagement” in Spain. During this WP, four main actions were carried out in the project target regions (Aragón, Castilla y León, Cataluña, Extremadura y Galicia):

- Allocate biomass resources.
- Evaluate with the stakeholders both the technical and the non-technical barriers of the implementation of SUCELLOG concept in the agro-industries.
- Determine the potential areas for the development of agro-industry logistic centres.
- Engage agro-industries to the project.

For the first action, an evaluation of the real potential of primary agrarian biomass has been carried out inside Task 3.1. The methodology selected corresponds to a “Resource focussed approach”, as described by BEE standardised classification (project Biomass Energy for Europe), which starts with statistical data from agrarian inventories. This data has been complemented with the real availability indices (the share of biomass that is not currently being used for other aims including soil sustainability issues) gathered in the regional workshops with the agrarian sector during Task 3.3. As a first result, primary biomass resources have been firstly catalogued according to existing competitive uses and relevance in terms of current unused quantities. This assessment has been performed in by country level since no regional differences has been observed. Secondly, a map of the distribution of real available primary resources and a table of the available tons per year in dry base were built per target region. Even though the use of agro-industry residues is a target of SUCELLOG, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Therefore the maps and tables presented do not include this type of resources, which will be deeply assessed for particular cases of logistic centres monitored or audited during in WP4-WP6.

As a second action, an assessment of the barriers and opportunities for the development of logistic centres was carried out through personal interviews with each target sector in Task 3.2. Existing agro-industries from the potential sectors (those owning compatible equipment for the conditioning and storage of raw material) were asked about: idle periods, residues produced in their facilities and upstream in the crop cultivation, the economic situation of the sector and possible upcoming changes

due to the Common Agricultural Policy, practical and legal incompatibilities in using their facilities for the production of solid biomass, social barriers for the development of this new activity and, finally, opportunities detected. Section 2 presents the situation of the country since no regional differences were appreciated. After this analysis, target sectors were identified per region and specific agro-industry locations were included inside the biomass resource map.

To determine the potential areas inside each target region for the development of agro-industry logistic centres, it has taken been into account the diversity and quantity of available agrarian resources (both woody and herbaceous) and of agro-industries present in the region as well as the compatibility among them. Compatibility has been defined according to their seasonality (matching the months of biomass production with the idle period of the agro-industry) and their technical compatibility of use. Logistic issues such as good communication networks and proximity to consumption areas has also been taken into consideration. Potential areas have been identified per region and are shown in this document. However, it is important to highlight that the selection of a potential area does not mean that an agro-industry non belonging to it could not start a new activity and the opposite. The size of the future logistic centre has not been a limiting factor for the selection of the potential area (even if SUCELLOG target is a production of 10 kt/yr per centre) since no data of the total amount of biomass is available (agro-industry residues missing as mentioned before).

The following sections show the results obtained about the above mentioned issues (passing from a country to a regional perspective). A summary of the situation in Spain is included in the last part.

As a last activity belonging to this WP, workshops and personal contacts were carried out with agro-industries in Task 3.3 with the aim of engaging them to the services offered by the project (technical and decision-making support to become biomass logistic centres). The result of this action is shown in the document “D3.1-Report on engagement actions”.

2. Agro-industries: profile, barriers and opportunities

The main potential agro-industry sectors to become a solid biomass logistic centre in Spain have been evaluated in the following lines, describing the equipment they usually own and their idle period, as well as the residues produced both in the agrarian practice and the production process. Finally the barriers and opportunities they would face when thinking to start this new activity have been identified. The information has been provided through interviews with representative industries of the sector and agrarian experts.

Forage dehydration:

Forage dehydration sector presents an important opportunity to become a logistic sector due to two synergies: it has an important idle period of 5 months (from November to April approximately) and owns compatible equipment (horizontal dryers, pelletisers and silos) for the production of solid biomass. Additionally, in some cases the agro-industries are consumers of biomass to supply their energy demands.

The forage dehydration facilities do not produce any important biomass residue, either in the agrarian or processing phase, meaning that the raw material for the production of solid biomass should be acquired. However, since this activity is in many cases integrated with cereal dryers, they have easy access to the residues produced during the agrarian and processing phases (like maize, wheat and barley straw or grain dust).

The sector do think that there is no social or technical barriers to start this new activity within their installations, presents a high degree of professionalization and is used to ask for funding schemes.

Cereal dryers (winter cereals and maize):

This sector shows an interesting potential to become a solid biomass logistic centre from a technical point of view, offering a long idle period of around 8 months (from February to October approximately) as well as proper equipments such as vertical dryers, screening equipment and silos for storage.

Regarding the raw material available for a possible logistic centre, cereal dryers are located in areas where there are important cereal extensions. Farmers supplying the grain to be dried in the facilities produce important quantities of straw which main market is the livestock feeding, bedding and champignon substrate. Depending on the year, a considerable amount of straw is not able to enter the market, being left on the soil (even if it is not considered as a proper agrarian practice) or burnt. The agro-industry itself does not produce important amounts of residues, just the broken grains and grain dust, which is normally given to the stockbreeder as animal feeding material without costs.

These industries are familiarised in using biomass as fuel during their process and no legal or practical incompatibility to become a biomass logistic centre has been observed. Economically, is a sector used to ask for financing and even some of them may have own funds to perform the investment.

As mentioned previously, cereal dryers are in many occasions integrated with the forage dehydration facilities in the same agro-industry, increasing their potential to initiate this new activity as a logistic centre of agrarian biomass due to the variety of idle periods and equipment available.

Sugar industry

The sugar industry presents, on the one side, an important idle period which goes from January to October (9 months) approximately and, on the other side, compatible equipment for the production of solid biomass such as horizontal dryers and pelletizers.

These equipments are used in the production of beet pulp, a by-product from the sugar production, which is highly appreciated by the livestock sector and commercialized in a pellet format. They do not produce residues during their process neither during the agrarian practice.

In Spain, all the installations have become very efficient energetically co-generating with natural gas their own electricity during their process, while the biomass is no used for supplying heat demands.

Sugar industry is a highly entrepreneurial sector, used to diversify to be able to adapt to changes and invest in research. No practical or legal incompatibility has been detected to become a logistic centre.

Nowadays, the industry face an important uncertainty since on the 2016/2017 campaign the quotes system in Europe will finish, becoming then a free commerce product worldwide. A prediction on how the sugar market will be in the future is not possible. For these reasons it can be a good sector to implement the logistic centre as an opportunity for diversification. However, more effort should be paid in order to engage them since they are not familiar with bioenergy issues.

Rice dryers:

The rice dryer industry has an idle period of around 8 months (from December to August approximately) and counts with vertical dryers presenting an interesting synergy to become a logistic centre.

In what concerns the residues associated to this type of agro-industry, the straw is not harvested due to the technical difficulty of working in waterlogged areas in which rice is produced generating. In Cataluña, for example, rice straw is not available since the crop is inside a Natural protected Area. However, in some cases anaerobic and pests problems are a consequence of the lack of harvesting. Husks and broken grain obtained during the rice processing is sold as poultry bedding and as feedstock for animals. In some regions like Extremadura, rice dryers and maize dryers share the same facility.

New regulations will make the situation even more delicate than it is now, reducing the production. Therefore the sector could see in the development of a logistic centre an opportunity to diversify the activity and maintain the employees.

As it has been mentioned already, vertical dryer does not seem so versatile as horizontal ones and are only compatible with granulated materials.

Nut industry:

The sector of the nut industry performs their activity during the whole year but their dryers are not working from December to August approximately (9 months idle period). Dryers are the main equipment compatible with the production of solid biomass they usually own, apart from silos and handling systems.

Nut industry produces nut shell during the months of September to June, a valuable residue that can be used as solid biomass and nowadays is really appreciated for that purpose. Therefore they are not only target industries from SUCELLOG but also producers of residues to be considered in a resource assessment. Apart from that, fruit tree prunings are an important wood source to be taken into consideration.

The sector has not perceived any technical or legal incompatibility if cleaning processes are correctly applied. In the case of the almond sector, their situation is highly unstable and subject of variation according to the international market (more concretely depend on the prices fixed by the Almond Board of California). The creation of a logistic centre can be seen as a good opportunity although the sector is not in the best conditions to make high investments.

Tobacco dryers

The agro-industry of the tobacco remain open the whole year but their dryers have an idle period of 8 months per year (from December to August approximately) presenting a good opportunity to become a biomass logistic centre.

The sector is highly familiar with biomass issues since most of the tobacco facilities use biomass during their drying process from 2010, when specific regional aids (83/2010) for the sector fostered the investments for the use renewable energy sources.

The sector has not identified any incompatibility (technical or legal) on producing solid biomass together with their current activity and they have shown interest on studying the possibility of becoming a solid biomass logistic centre although economic incentives for the sector currently do not exist.

Wine sector:

The wine sector includes the cellars and the distilleries, the latter processing the residues obtained from the cellars. From both, it is only the distilleries the ones owning equipment (horizontal dryers) compatible with the production of solid biomass. The idle period of these dryers is short compared to other agro-industries, from June to October (4 months) approximately.

Nevertheless, it has been selected as a potential sector to become a logistic centre because of their easy access to the agrarian residues such as the pruning or to the agro-industry residues obtained during the wine and distillate elaboration. During the wine production there is the production of grape stem in the cellar. During the

distillate process the grape pits/pomace, the vinasse and the fermentation sludge are produced, being the last two valorised as fertilisers. Vineyard prunings are also incorporated into the soil, although the sector shows a high interest in providing them a value as solid biomass once overcome the harvesting barrier. Therefore, the grape pits, the grape marc and the grape stem could be used as solid biomass. At the same time, also the prunings could be commercialised once chipped and dried in the same distillery or in a new production line implemented in the cellar.

Technically and socially they do not see any trouble for initiating a new activity as a logistic centre. Moreover, they find it as an interesting opportunity since it might help to create employment in the area.

Olive oil sector:

The olive oil sector includes oil mills and oil pomace extraction industries. Similarly to the wine sector, the latter is processing the residue obtained in the oil mills owning horizontal dryers and pelletisers for this purpose. Even though the idle period is reduced (4 month approximately, from June to October), it is considered an interesting sector to develop a biomass logistic centre due to the capacity of using its own residues.

In what concerns the residues produced, the most interesting ones from the bioenergy point of view are the olive pits and pomace. The last one is produced in the olive pomace industries. The olive pit can be produced in the oil mil (if the mil own as system to extract it, which is common in Cataluña region) or in the olive pomace industry (common in Extremadura since most of the mills do not have the possibility to extract the pit from the pomace).

Olive pits are widely used as biomass source for households or in the oil mills for heating purposes. The extracted olive cake has also good properties to be used as biomass source but sometimes is commercialised as an animal feed product. During the agrarian phase, the olive orchards produce important amounts of prunings to be transformed in high quality biomass in a new production line, enforcing this sector as a potential solid biomass logistic centre.

Both the olive mill and the olive pomace industry do not see technical or social incompatibilities to become biomass logistic centres. In the case of the olive mill, a drying system should be implemented since the facility does not normally present this type of equipment.

Feedstuff producers

This sector has been identified as a potential one to become a solid biomass logistic centre. Even though it does not have idle periods, it counts with many proper equipment types that might be used for the new activity such as: pelletizes, silos for storage, screening and chipping equipments.

Additionally, the sector produces interesting amounts of residues, around the 2 – 10% of their production, although some are already formulated feedstuffs which might content antibiotics. Therefore their use as possible solid biomass source needs to be study in order to produce no dangerous emissions for the environment.

The sector presents a high degree of professionalization and is used to ask for financing. However, the logistic centre should be implemented whether in a line not used at the moment or in a lines specifically installed for this purpose. This sector has only be considered as potential in Galicia region where production is significant.

3. Evaluation of available resources

SUCELLOG has considered that the development of agro-industry logistic centre should rely on agrarian biomass coming both from the agrarian practices (like straw or prunings) and from the agro-industry process (for example distilleries residues). The fact is that, for the first case, agro-industries have already a network with farmers providing the raw feedstock to be processed. For the second case, the use of their own residues is the opportunity to reduce their fuel consumption or avoid the cost of disposal if there is no market for it. Quantifying the biomass resources up-stream and down-stream the agro-industry is the object of this section since it is strategic for establishing new commercial relations with usual providers and clients.

A study about the available biomass resources has been performed, focusing in the agrarian biomass since it was not possible to have data about the production of agro-industries residues per region/country. When talking about availability of the residue, it is meant the amount of resources that do not have a market or that is not left on the soil to improve organic content, therefore having the opportunity to be used for energy purposes. Three examples to explain what availability is (see more detail about the methodology of work in section 3.3 and availability percentage in Annex I):

- If a farmer, after taking the wheat grain, leaves the straw on the soil due to agrarian recommendations then availability should be considered 0%.
- On the contrary, if the farmer leaves the straw on the soil just because the cost for harvesting does not cover the value in the animal feed market then availability is 100%.
- It can also happen that in one region the 40% of the straw is commercialized for animal feed (so it has a market), a 20% is left on the soil as a recommended agrarian practice. Therefore, 40% of the straw is available for other uses like the production of solid biomass.

3.1. Agricultural residues:

Biomass resources can be catalogued in three groups in the Spanish target regions, according to next two criteria:

- Competitiveness: existing competitive uses
- Amount of available biomass: relevance in terms of current unused quantities

From this scope, agricultural biomass resources in Spanish target regions can be catalogued in average as next:

Table 1: Classification of biomass resources in Spain.

Criteria		Biomass resources
Competitiveness	Available unused biomass	
Competitive uses make biomass unavailable for energy	None	Beans and pulses stalks
Many competitive uses	Some source still available	Cereal straw
Some competitive uses	Important source still available	Maize and sunflower stalks
Few or non-competitive uses	Relevant resource available	Woody prunings
Some or few competitive uses	Marginal local amounts (may play a role in a singular facility)	Tobacco stalks, rape straw.
None due to technical barrier to be collected	None	Rice straw

As observed, in general, the resources with lowest risk derived from competitive uses are maize and sunflower straw, as well as prunings from permanent crops. The state of these resources being practically unused also implies a risk in terms of implementation of new supply chains due to social or technical barriers. In case of maize, it has been stated in Spanish target regions that farmers usually leave it on the field as organic amendment. The reason does not usually respond to a need of balancing nutrients, but to the application of the most economical way to dispose the crop leftovers due to the absence of an alternative market. In these cases, the availability must be checked locally with farmers and cooperatives, which may take the decision to change their current agricultural practices to start a new supply chain to the local agro-industry biomass logistic centre.

With respect to woody agricultural prunings, they are an appealing source due to its relevant high availability in several provinces of the Spanish target regions. In fact is its woody structure, which is an advantage for the preparation of solid biofuels, usually with better quality in terms of quality composition and suitability for existing energy conversion systems compared to herbaceous residues. Its high availability

(more than 80% of the existing resources without any use), makes pruning a more secure fuel in terms of price stability. However, it also involves the challenge to local farmers to start a new logistic chain although most of them have already shown interest in using them as a fuel and several initiatives have been carried out.

Other feedstocks like tobacco or rape straw can be locally interesting for future logistic centres, but not an issue when doing a regional analysis since they are really located.

Resources as rice straw, or bean and pulses stalks shall not be considered as a resource when setting the regional strategy. That does not mean that it may be found locally from neighbour farmers. The reason for rice straw is its difficulty to be harvested in waterlogged, being usually integrated into the field as amendment. In the case of beans and pulses, the straw is either integrated to improve soils or sold for animal feeding due to its nutritive properties.

3.2. Other biomass resources

Even though in SUCELLOG a comprehensive list of agro-industries has been compiled by region, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Agro-industry residues are interesting in the case of the oil, wine and nut fruit sector because of their amount, while in the case of the cereal, rice and feedstuff sector, for example, these residues could be a complement in the production of the solid biomass since their production is not of significance in amount. The use of agro-industry residues is a target of SUCELLOG, but its actual use will be decided for the particular cases of logistic centres monitored or audited during WPs 4, 5 and 7. There, the local reality and capacity of neighbour facilities to become reliable biomass suppliers will be assessed.

With respect to forestry biomass, SUCELLOG has not carried out any specific assessment since the project is focused on fostering agricultural residues as a source of solid biomass. However, the feedback obtained from the target regions shows that forestry residues may be at the reach of future logistic centres, and can be an option in few provinces for upgrading the properties of biomass mixtures to be commercialised. Biomass directly from forestry exploitation for energy purposes can be done under the framework of regulated forestry management plans but it has been considered that it is not a source for the short-time term in SUCELLOG.

An analysis performed by regions instead of by resources is carried out in section 4. Biomass assessment in the present work involves the study of 5 autonomous regions of Spain, adding a total area of 244.900 km², about 48% of the total area of Spain. For this scale of work the use of existing data from inventories was needed as an input data source. The aim of the approach is to provide a framework of the available

sources in the region. It is not aimed to be the specific biomass assessment for a facility, which will be object of task 4.2, and which requires other type of approaches.

3.3. Methodology of work

The methodology selected corresponds to a “Resource focused approach”, as described by BEE standardised classification (see project BEE in www.eu-bee.info). It starts with statistical data from agrarian inventories, and complemented with the availability indices and utilization for soil preservation leads to a technical potential, including soil sustainability issues. The work done also represents biomass explicit in the territory, and so the type of assessment can be named technical spatially explicit technical potential, including sustainability of soils.

The method followed is based on ratios of residual biomass production per hectare of cultivated area (tons of residue per hectare). The use of ratios is a widespread methodology for biomass assessments, appropriate for both large and small scale. The main issue is to account with reliable inventories and ratios. By multiplying the cultivated area (ha) by the ratios (t/ha) the theoretical potential is obtained:

$$\text{Biomass Potential [t]} = \text{Ratio [t/ha]} * \text{Area [ha]}$$

The methodology used here brings a step forward in the country analysis by including the competitiveness for biomass resources. For that purpose it is necessary to know the share of biomass that is currently being used for other aims, and that will be considered as not available for the present study. The availability index (I_{AV}) expressed as percentage is defined as next:

$$I_{AV} = 100 - I_{COMPET} - I_{SOILS}$$

Where :

I_{COMPET} : is the percentage of the total biomass in a region that other uses (power plants, cattle, industry) already are using.

I_{SOILS} : is the percentage of total produced biomass that remains in the soil. E.g.: if farmers prefer to leave part of the straw as soil organic amendment.

By using these indices it is possible to obtain the final biomass available by doing next operation:

$$\text{Available Biomass [t]} = \text{Potential Biomass [t]} * I_{AV} = \text{Ratio [t/ha]} * \text{Area [ha]} * I_{AV}$$

The data sources have been obtained as next:

- **Agricultural areas:** the biomass has been calculated on the base S2Biom project land areas (www.s2biom.eu) given by NUTs3 (Spanish provinces), in order to have same base units than ongoing referential projects like S2Biom is. Since NUTs3 is a too large scale for the purposes of the SUCELLOG work,

the biomass obtained by NUTs3 has been downscaled at LAU2 (former NUTs5) geographical resolution (Spanish municipalities), by assigning each LAU2 unit a biomass share proportional to the area occupied by crop type.

- **Land distribution:** Corine Land Cover version 2010. Biomass per municipality has been allocated to land parcels actually used for agriculture
- **Ratios and availability indices:** a specific work has been carried out by region. For each region ratios have been obtained from direct contact with specialists and cooperatives, and in few cases, complemented with literature. The purpose of this effort has been to use ratios and availability indices representing the reality of the region, and not just ratios found in literature. The workshops done in task 3.3 have served to include the feedback from the sector to improve the final datasets. Ratio and availability percentage are shown in Annex I.

3.4. Summary of results per region

Next table classifies provinces according to the most strategic resources for SUCELLOG.

Table 2: Most strategic resources by target region.

Region	Cereral straw	Maize + Sunflower straw	Olive + Fruit + Vineyard prunings	Others
Aragón	ALL	ALL	Mainly Zaragoza	----
Castilla y León	ALL	León, Palencia, Salamanca, Valladolid, Zamora	Burgos, León, Valladolid, Zamora	----
Cataluña	Lérida	Gerona, Lérida	Barcelona, Lérida, Tarragona	----
Extremadura	Badajoz	ALL	ALL	Tobacco (Cáceres)
Galicia	Orense	ALL	Orense, Pontevedra	----

4. Regional Framework of ARAGÓN

4.1. Identification of agro-industries in Aragón

The interesting agro-industries to become a logistic centre in Aragón are:

- **Cereal dryers:** Aragón is one of the most important grain producers in Spain and therefore the facilities drying this resource are very important. More concretely, Aragón is the second region in surface cultivated with maize in Spain (being the area of Monegros of importance) and it is the third and the fourth region of surface cultivated with barley (the area of Ejea de los Caballeros) and wheat (the area of Zaragoza) respectively. Cereal dryers are very often sharing installations with the forage dehydration facilities.
- **Forage dehydration facilities:** Aragón is the first Spanish region in surface cultivated with Lucerne, being Zaragoza, La Litera, La Hoya de Huesca and Monegros the most important areas. The facilities drying this resource are numerous.
- **Rice dryers:** mainly located in the area of Ejea de los Caballeros but also in La Hoya de Huesca, Monegros and La Litera.
- **Distilleries:** in the agrarian area of Almunia de Doña Godina and, more concretely in Cariñena area, most of the wine sector and one of the distillery of the region are sited. The other distillery is located in la zona de producción de vino de Somontano.

Other agro-industries identified as biomass resources suppliers are: wine sector (grape stem; grape pits y grape pomace), olive mills (olive pits).

4.2. Identification of biomass resources in Aragón

From a general perspective, Aragón has an annual amount of available agricultural residues of more than 1 Mt, permitting still a progress in the use of biomass, and therefore room for further mobilization of herbaceous and woody agrarian feedstock. Next graph summarizes the main figures on agrarian residues.

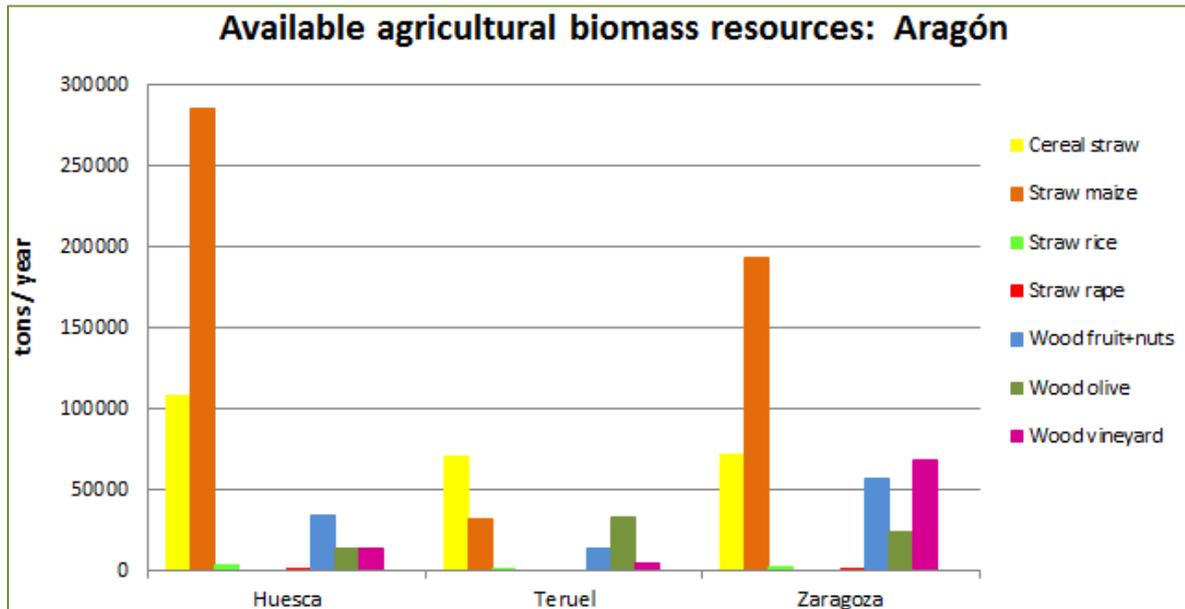


Figure 1: Summary of available agricultural biomass residues in Aragón.

Main conclusions in ARAGÓN:

- As in most of the Spanish regions, the most extended crops are annual cereals (wheat and barley mainly) and maize.
- Maize becomes there an important feedstock, available in large quantities and still with minor competitive uses. In fact, maize stalks are the main source for energy still available in Zaragoza and Huesca provinces.
- Woody residues from prunings are however also a relevant source in Zaragoza province. Locally may be an important source of biomass to take into consideration.
- Agricultural by-products such as broken grain and dust (from cereal dryers), husks (from the rice sector), wine and olive production residues as well as residues from feedstuff producers should be also taken into account.

4.2.1. Localization of resources and agro-industries in Aragón

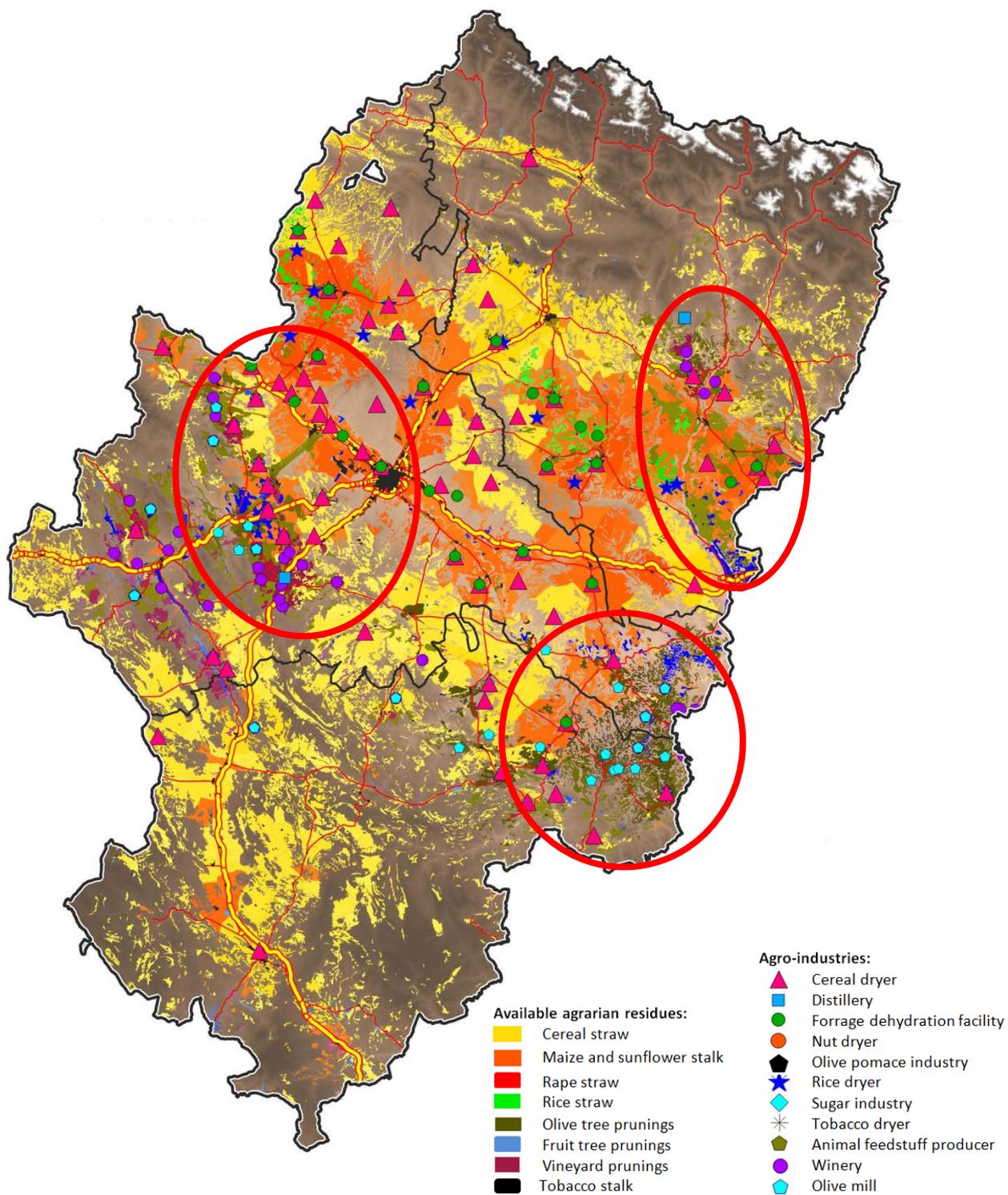


Figure 2: Localization and type of agro-industries and resources in Aragón.

4.2.2. Priority areas in Aragón

Potential areas detected in Aragón region for the implementation of SUCELLOG project are shown in Figure 2. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 3, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 3: Availability of equipment and biomass resources in Aragón.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal dryer												
Forage dehydration ind.												
Rice dryer												
Distilleries												
Cereal straw												
Maize stalks and cobs												
Permanent crop prunings												
Rice husks												
Grape stem												
Grape pits and pomace												
Olive pits												
Nut shell												

As it can be observed, the 3 potential areas are very similar. Here below are shown the main remarks:

- Cereal, maize, rice and nut could be compatible with the drying of olive pits, grape pits and almond shells.
- Forage dehydration facilities could process all type of residues existing in the area, especially maize stalks and permanent crop prunings (vineyard, olive tree or almond tree). The residues coming from the nut industry, the wineries, the olive oil industry, the cereal and rice dryers could also be of interest.
- Distilleries could process cereal straw and permanent crop prunings in their facilities, apart from their own residues (grape pits and pomace) and use the rice dryer residues as a complement.

In both cases (forage dehydration and distilleries) the conditioning could be drying only or both drying+ pelletising, depending on the type of residue and format demanded by the market. The production of pellets could be done from solely one residue or from a mixture of several residues. In the last case, it is highly recommended to consider a woody resource (permanent crop prunings for example) as a way to improve the chemical characteristics of the product.

4.3. Regional Framework of CASTILLA Y LEÓN

4.3.1. Identification of agro-industries in Castilla y León

The interesting agro-industries to become a logistic centre in Castilla y León are:

- **Cereal dryers:** Castilla y León is the first region in surface cultivated with maize mostly located in León and in cereals (wheat and barley), being the industries associated very important.
- **Forage dehydration facilities:** most of them sited in Palencia, Zamora and Valladolid.
- **Sugar industry:** Castilla y León is the most important sugar beet producer in Spain. This crop is cultivated under irrigated conditions mainly in Valladolid and León provinces. There are 6 facilities for extracting the sugar from the sugar beet crop, located in La Bañeza (León) in Toro and Benavente (Zamora), in Miranda de Ebro (Burgos), in Olmedo and in Peñafiel (Valladolid).
- **Distilleries:** la región de Castilla y León es importante por su producción vitivinícola en la zona del Duero y, por tanto, son de interés los residuos procedentes del sector. La destilería de la región sin embargo está situada en una de las zona de producción de vino de la provincia de León.

Other agro-industries identified as biomass resources suppliers are: wine sector (grape stem; grape pits y grape pomace), olive mills (olive pits).

4.3.2. Identification of biomass resources in Castilla y León

In the region of Castilla y León the quantity of resources that, from the evaluation performed by SUCELLOG Project, are considered as available agrarian biomass and without competitive uses rises to more than 1.5 Mt/yr. Even though all regions present important resources, it is León, Valladolid, Zamora and Salamanca the ones presenting higher availability, being the predominant residues the maize/sunflower stalks and the cereal straw.

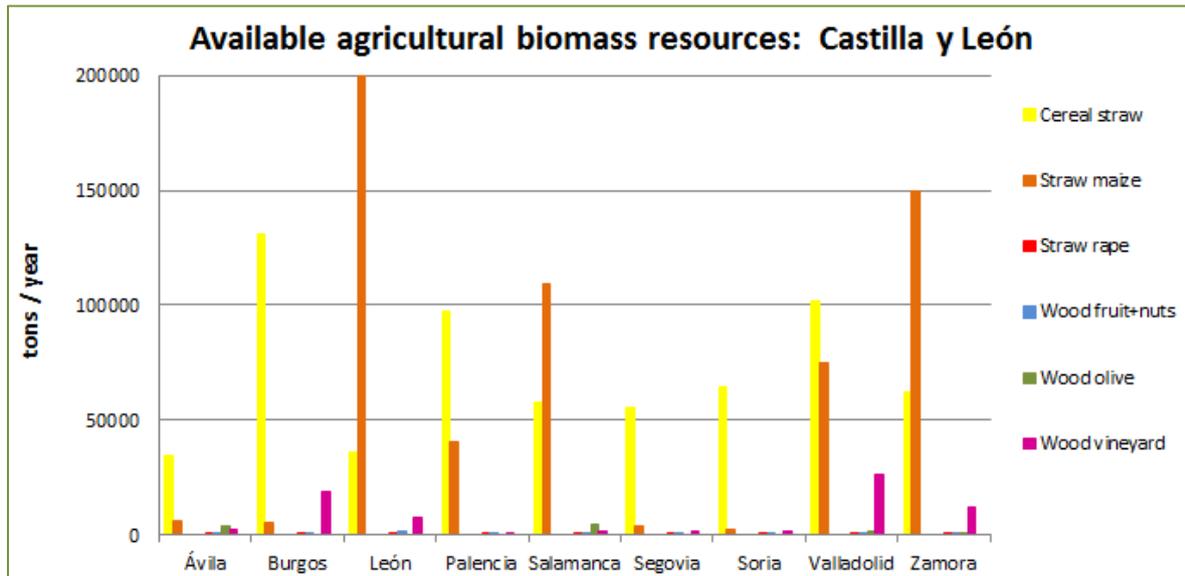


Figure 3: Summary of available agricultural biomass residues in Castilla y León.

Main conclusions in Castilla y León:

- In line with the rest of Spanish regions, maize stalks seem to be one of the main resources available in all provinces except in Ávila, Burgos, Segovia and Soria.
- Cereal straw is the other biomass resource to be considered, available in significant amounts in all regions.
- Prunings (more concretely vineyard prunings) are interesting sources in Burgos, Valladolid and Zamora. Special interest should be placed in the areas where the Designation of Origin of Ribera del Duero wine is produced.
- Regarding the residues from agro-industries, the main to be considered are coming from the wine and cereal industry.

4.3.3. Localization of resources and agro-industries in Castilla y León

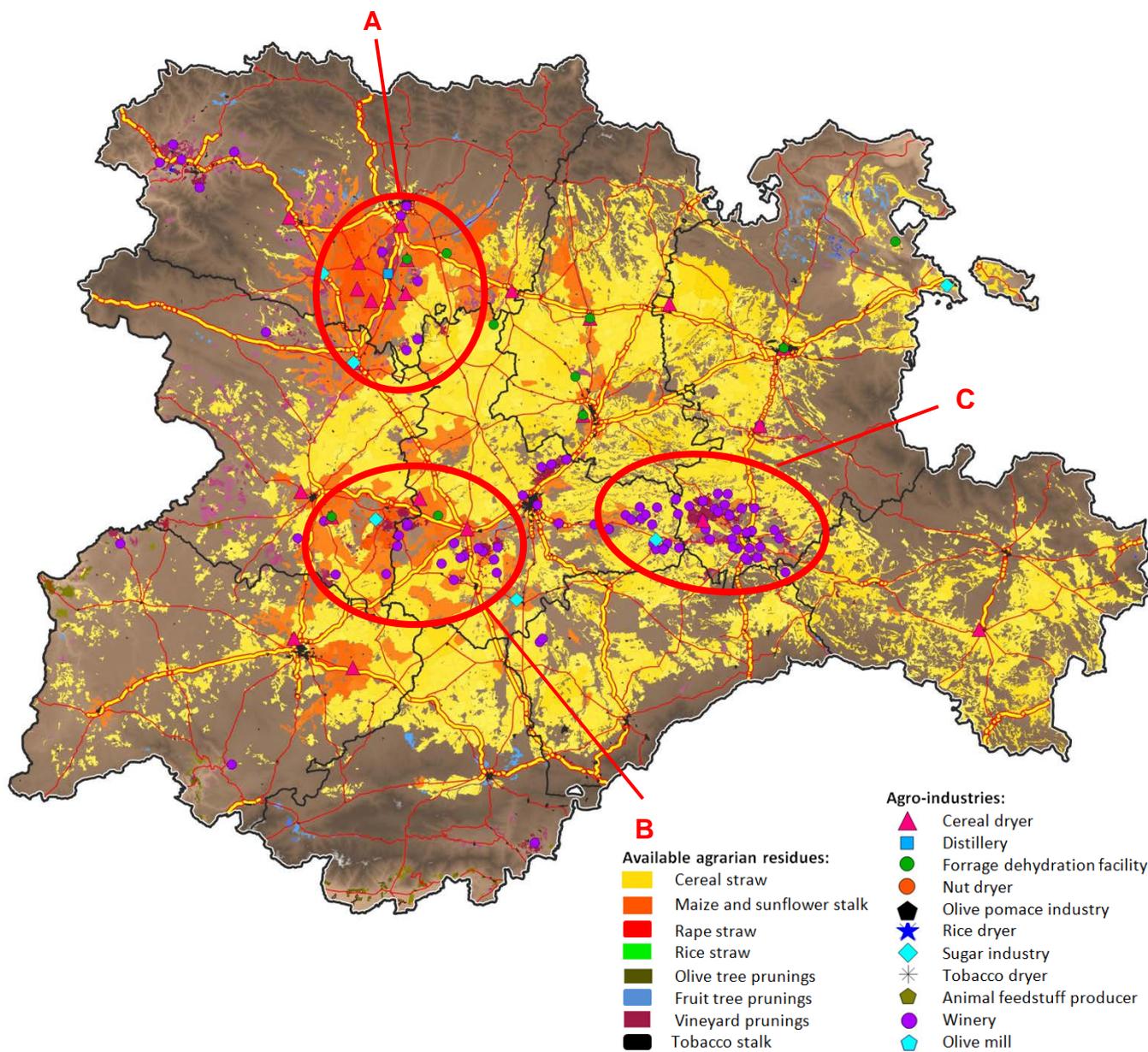


Figure 4: Localization and type of agro-industries and resources in Castilla y León.

4.3.4. Priority areas in Castilla y León

Potential areas detected in Castilla y León region for the implementation of SUCELLOG project are shown in Figure 4. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 4, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 4: Availability of equipment and biomass resources in Castilla y León.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal and maize dryer												
Forage dehydration												
Distilleries												
Sugar industry												
Cereal straw												
Maize stalks and cobs												
Permanent crop prunings												
Grape stem												
Grape pits and pomace												
Sugar beet pulp												

The potentiality of the selected zones is explained below:

- **Zones A y B:** both areas gather a large maize production being the stalks a priority residue available for biomass. Due to the season in which is generated, it could be dried in a forage dehydration facility or in a sugar industry, both owning horizontal dryers. These two facilities could be also compatible with cereal straw and vineyard prunings. Maize dryers, mainly present in zone A could provide the residue from their process (husk and flour at reduced moisture content) as a complementary raw material.
- **Zone C:** the main area of production of wine in the region presents also some sugar industry facilities in which a biomass logistic centre could be implemented working with vineyard prunings as feedstock.

4.4. Regional Framework of CATALUÑA

4.4.1. Identification of agro-industries in Cataluña

The interesting agro-industries to become a logistic centre in Cataluña are:

- **Cereal dryers:** Lérida province is the one in Cataluña which counts with more cereal presenting a large amount of facilities for the drying. The area of Urgel and Segria for maize and Segarra for wheat and barley are of importance.
- **Forage dehydration facilities:** Lérida is also the province of Cataluña with more Lucerne surface and where the agro-industries for their dehydration are located.
- **Rice driers:** are mostly located in the Delta del Ebro area.
- **Distilleries:** vine crop is important in all the territory, especially in the Penedés area where the only distillery of the region is placed.
- **Nut industry:** this sector is of special interest in this region due to the vast territory dedicated to the crop and the large number of facilities processing (drying) the nuts.
- **Olive pomace industries:** the only facility of this type is placed in the agrarian area of Les Borges Blanques.

Other agro-industries identified as biomass resources suppliers are: wine sector (grape stem; grape pits y grape pomace), olive mills (olive pits).

4.4.2. Identification of biomass resources in Cataluña

In Figure 5 it can be observed that Cataluña presents a higher diversification of agricultural activities with respect to other regions. Due to the climatology and conditions for the cultivation of fruit trees and vineyard, is the Spanish region (from the five regions assessed in SUCELLOG project) in which prunings can represent the most strategic resource when promoting the use of agricultural resources as biomass feedstock. The total potential is 0.7 Mt/yr, being half of it corresponding to prunings. Due to the diversity of the region, it is worth it to evaluate the provinces instead of the region as a whole.

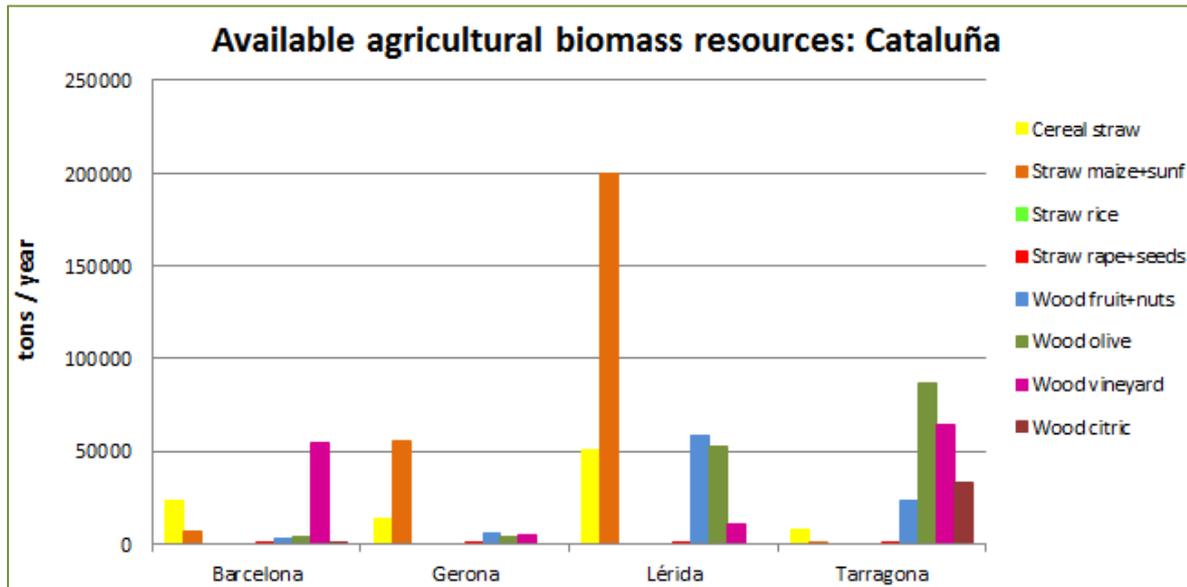


Figure 5: Summary of available agricultural biomass residues in Cataluña.

Main conclusions in Cataluña:

- Lérida province gathers the majority of resources available. Although wood prunings represent more than 120 kt/yr, it is the maize and cereal straw the main feedstock to take into account (250 kt/yr).
- Tarragona presents a unique situation in terms of type of available resources within SUCELLOG framework. Prunings is the by far the most interesting feedstock for a possible logistic centre.
- Barcelona presents a similar situation tan Tarragona does, being pruning the main resource to be considered.
- Gerona province is, however, more similar to what can be found in other Spanish regions, being the maize and cereal straw the predominant residues available.

Residues from the industries of olive oil, wine and nuts should also be considered together with the ones generated in the cereal and rice dryer industries.

4.4.3. Localization of resources and agro-industries in Cataluña

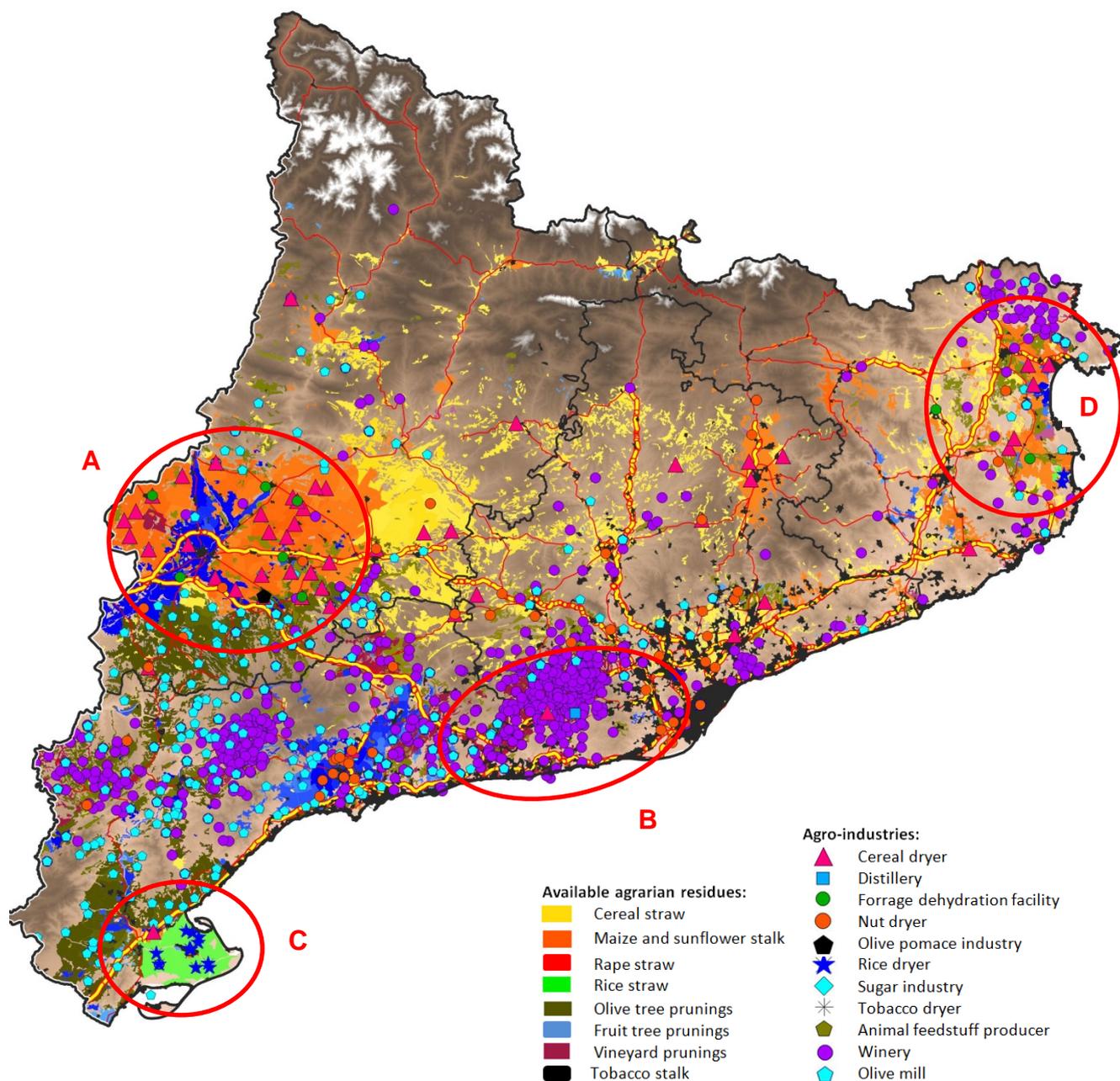


Figure 6: Localization and type of agro-industries and resources in Cataluña.

4.4.4. Priority areas in Cataluña

Potential areas detected in Cataluña region for the implementation of SUCELLOG project are shown in Figure 6. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see **Tabla 5**, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Tabla 5: Availability of equipment and biomass resources in Cataluña.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal and maize dryer												
Forage dehydration												
Rice dryer												
Distilleries												
Olive pomace industry												
Nut dryer												
Cereal straw												
Maize stalks and cobs												
Permanent crop prunings												
Rice husks												
Grape stem												
Grape pits and pomace												
Olive pits												
Olive pomace												
Nut shell												

The situation in the region could be summarised as next:

- Zone A:** it should be highlighted the presence of herbaceous residues (wheat straw and maize stalks) and the woody residues coming from permanent crop prunings (from almond and olive tree mainly) that could be processed in the forage dehydration facilities.

Additionally, the olive pits and the almond shell should also be considered as a potential biomass source to be marketed. Both the nut and the cereal dryers could be the place where to condition the raw material to achieve market properties.

The residue from cereal dryers (husks and flour) could also be considered as a possible complement for a mixed pellet based on prunings for example.
- Zone B:** the area closest to Mediterranean sea presents the most important quantity of residues coming from the industries producing wine, olive oil and nuts as well as wood prunings, which could be conditioned in the nut and distilleries dryers present in the nearby area.
- Zone C:** the area of the Ebro Delta presents the possibility to make compatible the rice dryers and the cereal dryers with the processing of olive pits coming from the olive mills.

- **Zone D:** this zone gathers an interesting mixture of herbaceous crops (maize mainly) and permanent crops. Residues of both crops could be treated in the existing forage dehydration facilities. Olive pits could also be conditioned in rice dryers or in the dehydration industries.

4.5. Regional Framework of EXTREMADURA

4.5.1. Identification of agro-industries in Extremadura

The interesting agro-industries to become a logistic centre in Extremadura are:

- **Cereal and rice dryers:** in Extremadura the cereal and rice dryers are normally at the same installations. Extremadura is the second rice producer in Spain after Andalucía, being cultivated mostly in the agrarian area of Don Benito (Badajoz). This area is also the one presenting the largest maize surface in the region, together with the areas of Mérida and Badajoz and therefore dryer facilities are mainly located in them.
- **Oil pomace processing industry:** the agrarian areas of Almendralejo, Castuera and Llerena are the ones where the most important olive surface are located.
- **Distilleries:** there are two distilleries present in the región, one in the wine production área of Almendralejo and the other one in the north of Cáceres.
- **Tobacco dryer:** this type of industries are placed in the province of Cáceres and, more specifically in the areas of Navalmoral de la Mata and Jaraíz de la Vera, in which the 80% of the surface is used to produce tobacco (the main area in the region).

Other agro-industries identified as biomass resources suppliers are: wine sector (grape stem; grape pits y grape pomace), olive mills and olive pomace industries (olive pits and pomace).

4.5.1. Identification of biomass resources in Extremadura

Extremadura region presents a particular case in which the cereal crop production (mainly maize) and olive tree crop are the predominant agricultural activity. Both provinces (Cáceres and Badajoz) present a similar situation in this aspect. The residues from both crops (stalks and prunings) should be considered as the potential sources of biomass in the region together with the ones coming from the agro-industries. The assessment of SUCELLOG points out a total of 0,8 Mt/yr of residues available.

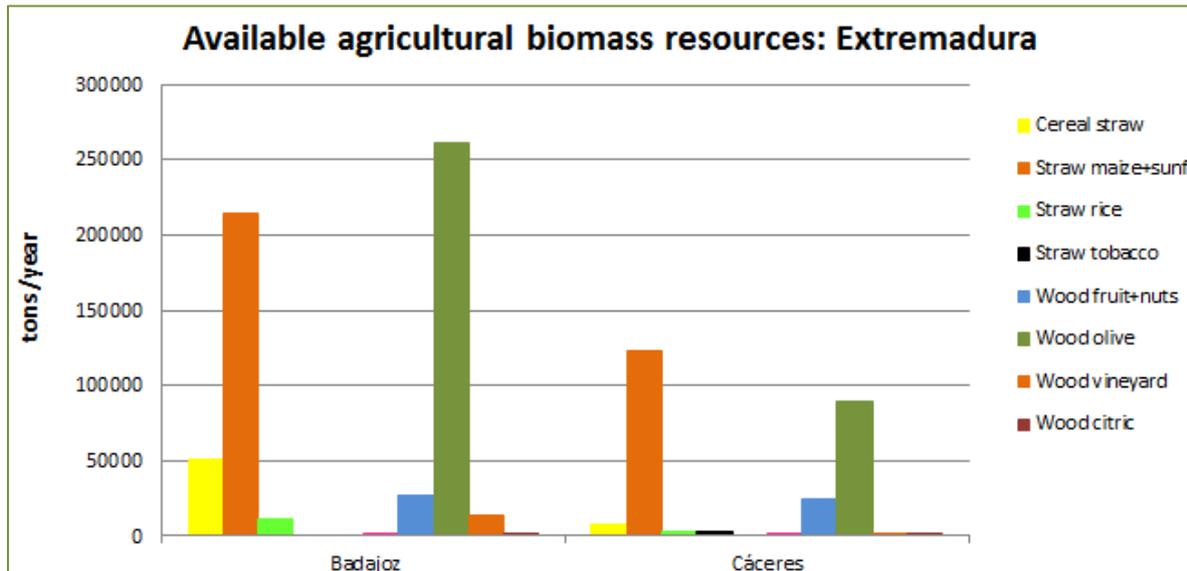


Figure 7: Summary of available agricultural biomass residues in Extremadura.

Main conclusions in Extremadura:

- Maize stalks are a very important source of biomass in the region.
- The vast extension of olive tree crop makes the prunings and sub-products of the olive oil industry (pits and pomace) a strategic resource to be considered in future logistic chains and solid biomass distribution centres.
- In comparison to other regions, Extremadura presents the possibility to consider the rice and soya straw as well as the tobacco stalks as a source of local interest.
- Residues from rice and maize dryers should also be taken into account as a possible complement in mixed pellets, as well as the ones coming from wine and olive oil sector.

4.5.2. Localization of resources and agro-industries in Extremadura

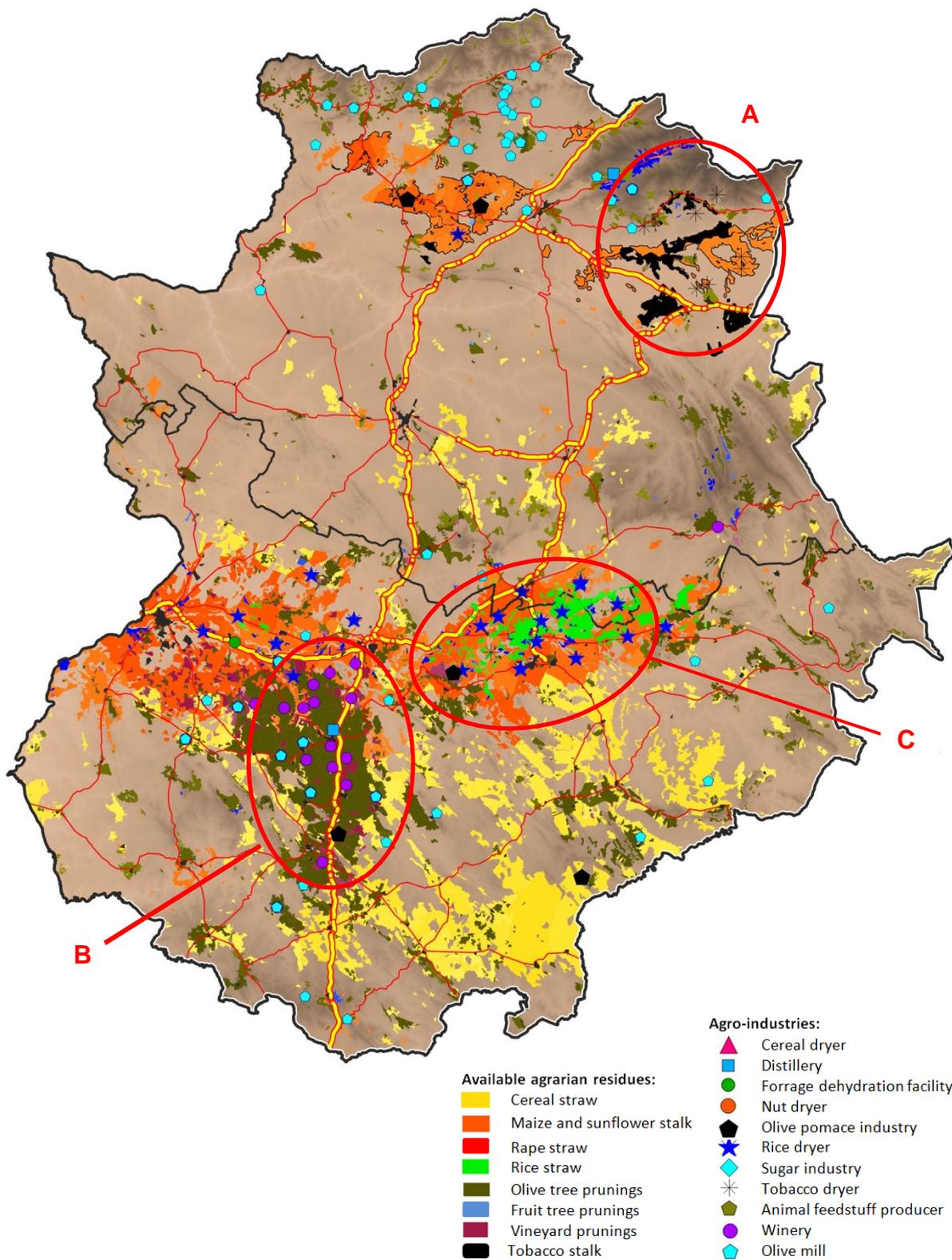


Figure 8: Localization and type of agro-industries and resources in Extremadura.

4.5.3. Priority areas in Extremadura

Potential areas detected in Extremadura region for the implementation of SUCELLOG project are shown in Figure 8. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see **Tabla 5**, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 6: Availability of equipment and biomass resources in Extremadura.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize and rice dryer	■	■	■	■	■	■	■	■	■		■	■
Distillery						■	■	■	■			
Olive pomace industry						■	■	■	■			
Tobacco dryer	■	■	■	■	■	■	■					■
Cereal straw						■	■	■				
Maize stalks and cobs										■	■	
Permanent crop prunings	■	■	■								■	■
Rice husks	■	■	■	■	■	■	■	■	■			
Grape stem										■		
Grape pits and pomace	■	■	■	■	■						■	■
Olive pits	■	■	■	■	■					■	■	■
Olive pomace	■	■	■	■	■					■	■	■
Tobacco stalks								■	■	■		

The potential areas of Extremadura region are:

- **Zone A:** The large amount of tobacco dryers present in the North of Cáceres province could be considered to condition the woody prunings from olive and almond trees to produce a good quality chip. A new line of pelletization could also be implemented as an alternative in order to produce solid biomass in pellet format.
- **Zone B:** the distillery and olive pomace industry could process their own sub-products and the pruning residues during their idle period.
- **Zone C:** both the rice and cereal dryers as well as the tobacco dryers could condition the olive pits. The olive pomace industry, apart from their own sub-products, could process the pruning residues to be sold in the biomass market as wood chips or pellets.

Even though the large amount of maize stalks available, their use seem to be unfeasible due to the incompatibility of the season when it is produced and the idle period of the existing agro-industries which could process an herbaceous residue.

4.6. Regional Framework of GALICIA

4.6.1. Identification of agro-industries in Galicia

The interesting agro-industries to become a logistic centre in Galicia are:

- **Distilleries:** In Galicia the wine cultivation is mainly located in Pontevedra (Litoral and Miño area) and Orense provinces, being the distilleries nearby these areas.

Other agro-industries identified as biomass resources suppliers are: wine sector (grape stem; grape pits y grape pomace), and the feedstuff industry (wrong formulated products).

4.6.2. Identification of biomass resources in Galicia

Galicia region presents large areas of forest and therefore some regions, like Lugo or La Coruña, do have reduced agricultural residues to be considered. Orense gathers more than half of the biomass resources available in the region (straw and vineyard residues).

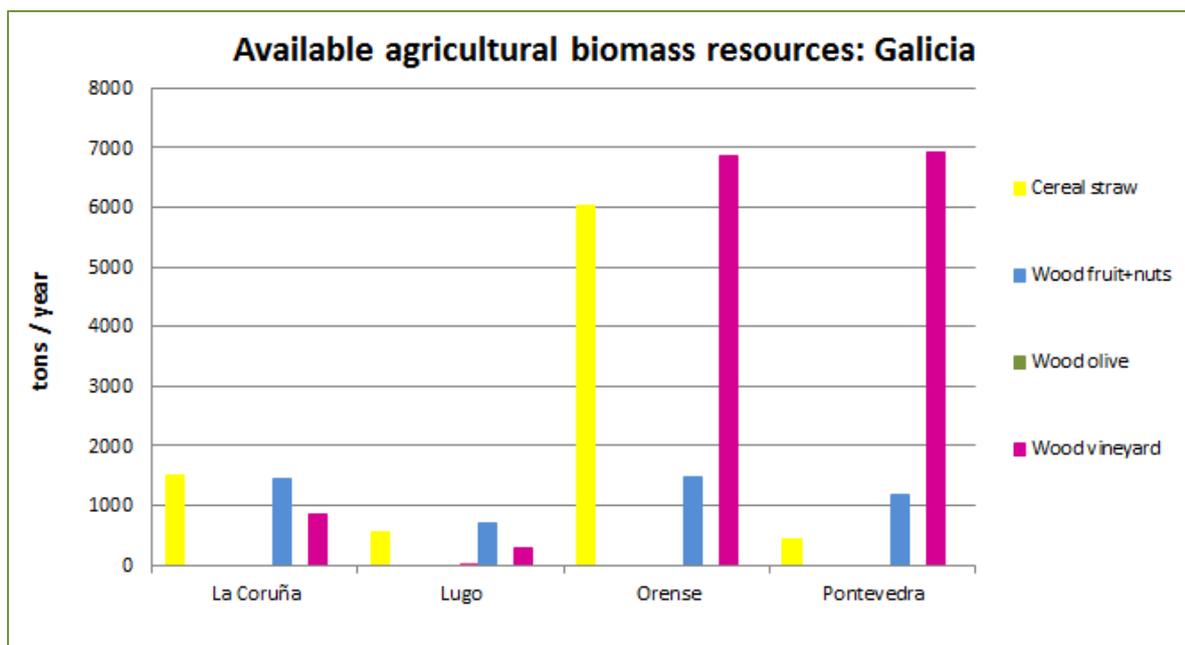


Figure 9: Summary of available agricultural biomass residues in Galicia.

Main conclusions in Galicia:

- The only herbaceous resource is cereal straw and of importance in Orense province.
- Vineyard prunings can be a relevant source of biomass in the vineyard areas of Pontevedra and Orense.

- The rest of resources can be considered as a minority and only of importance from the local point of view.
- Regarding residues produced in the agro-industries, it should be highlighted the ones coming from the production of wine and from the animal feedstuff industries (products with no commercial use, which represent around 2-10% of the total production).

4.6.3. Localization of resources and agro-industries in Galicia

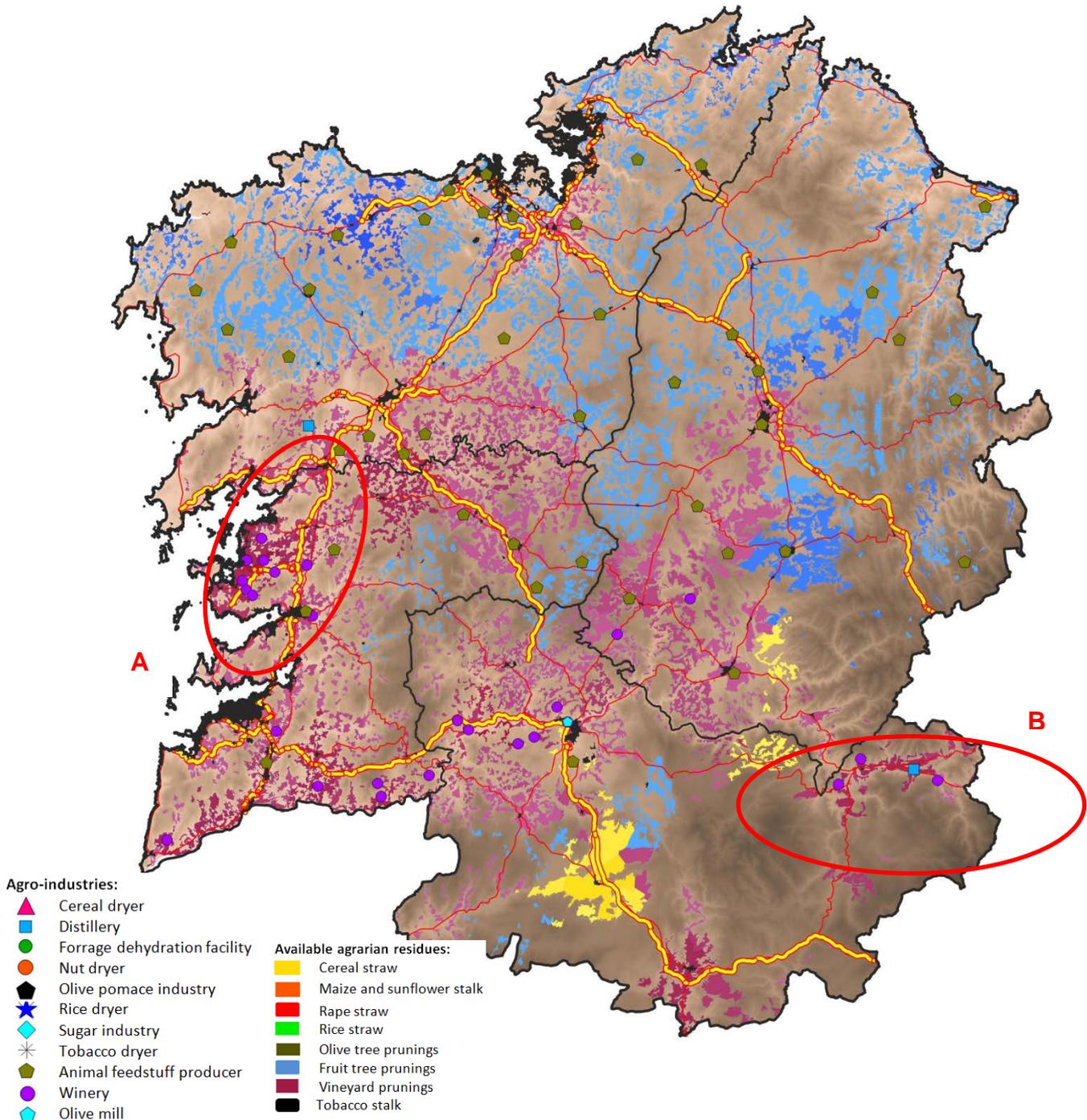


Figure 10: Localization and type of agro-industries and resources in Galicia.

4.6.4. Priority areas in Galicia

Potential areas detected in Galicia region for the implementation of SUCELLOG project are shown in Figure 9. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 7, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 7: Availability of equipment and biomass resources in Galicia.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Distillery												
Cereal straw												
Permanent crop prunings												
Grape stem												
Grape pits												
Feedstuff residues												

As it can be observed, the only sector available in the region which could make compatible their own processes with the generation of solid biomass from the technical point of view is the distillery. This sector could work with cereal straw since it is the only resource available in time.

The East of Ourense province (zone A) would be therefore, the area is higher potential to develop SUCELLOG concept in the region. Vineyard prunings and cereal straw could be the feedstock for the production of a mixed pellet in the distillery of the area. The other distillery of the region, present in A Coruña (zone B), could process the prunings from the large vineyard area of Pontevedra. The forest residue generated in the large amount of industries of wood could be a complement for a mixed pellet.

On the other hand, the animal feedstuff industries, although not compatible due to their operation along the whole year, should also be taken into consideration if the market situation makes them reduce the production (making one line free) or if they want to diversify implementing a new line for biomass production.

5. Summary of the situation in Spain

SUCELLOG has evaluated the situation of the different target regions in Spain (Aragón, Castilla y León, Cataluña, Extremadura and Galicia) to host agro-industry logistic centres in terms of barriers/opportunities for their development and available agrarian biomass resources.

Regarding biomass resources and according to the criteria of competitiveness and availability, the maize straw and the woody prunings appear to be the most interesting agrarian sources to be taken into account in general with the exception of Galicia. A large number of types of residues do still not have a real market and are left on the soil or just given for free to avoid the costs of disposal. On the contrary to what happens in other regions, whose logistic centre could be entirely based on agrarian resources, the creation of a logistic centre in Galicia should rely on the supply of the important forest resources of the region together with the woody prunings.

In what concerns the main potential sectors for the creation of biomass logistic centres, they are: forage dehydration facilities, cereal dryers, rice dryers, sugar industry, nut industry, tobacco dryers, distilleries and oil pomace industries. They have been selected due to the existence of compatible equipment for the pre-treatment of raw material (dryers and/or pelletisers) that has idle periods and where no technical barriers for the development of the new activity as biomass logistic centre have been detected. Those sectors owning horizontal dryers (forage dehydration, sugar industries, distilleries and oil pomace industries) present most versatile facilities able to process a greater variety of raw material formats while vertical dryers are more limited to olive and grape pits and crushed almond shell. Additional sectors like cellars and oil mills have also been taken into account, even if they do not present compatible equipment, because of their important capacity to gather agrarian biomass and their high interest in the project. In this sector, a new line for the production of biomass should be implemented. Finally, the animal feedstuff producer sector has also been considered in Galicia, even though their dryers and pelletisers work all the year, since a possible decrease in their production could generate the existence of a line free for the production of solid biomass.

All target regions present potential areas for the creation of logistic centres and the interest of the sectors is high in general since they see it as an opportunity to consume their own residues (reducing fuel acquisition) and to diversify their activity. However, even if the agro-industry sector is the one of the largest consumer of solid biomass in Spain, being familiar with bioenergy issues, the most limiting barrier to be overcome in this country is the mistrust to changes in regulatory frameworks that could generate the stop of an industrial activity. Renewable energies arose as a good solution for the rural development and in some cases (like electricity production with solar systems) failed due to regulatory framework. The emission legal limits to start

being applied in the next years are one of the reasons that stop the sector from starting operating as solid biomass logistic centre. .

Annex I: Table of ratios y availability percentage per region

Table 8: Ratios of biomass production (t/ha) in SPAIN per region

Crop	Galicia	Aragón	Castilla y León	Extremadura	Cataluña
WHEat	1,84	1,7	1,95	0,68	1,84
Rye	1,96	0,64	1,03	1	0,88
Barley	1,66	1,95	1,32	0,85	1,29
Oat	1,48	0,65	0,99	0,95	0,79
Maize	20	20	20	20	20
Rice	3,8	3,8	3,8	3,8	3,8
Beans	1	1	1	1	1
Pulses_oth	1	1	1	1	1
Tobacco	1	1	1	1	1
Hemp	-	-	-	-	-
Rape	1	1	1	1	1
Sunflower	3	3	3	3	3
Soya	1	1	1	1	1
Linseed	-	-	-	-	-
Seed_other	1	1	1	1	1
Fruit_temp	3	3,5	2,5	3	2,5
Fruit_subtrop	3	3,5	2,5	3	2,5
Berry	1,5	1,5	1,5	1,5	1,5
Nuts	0,7	0,7	0,7	0,7	1,7
Citrus	-	6	6	6	6
Olive	-	3	3,75	3	3
Vineyard	3,75	4	3	0,5	3,75

Table 9: Percentage of availability of biomass in SPAIN per region

Crop	Galicia	Aragón	Castilla y León	Extremadura	Cataluña
WHEat	30	30	30	30	30
Rye	30	30	30	30	30
Barley	30	30	30	30	30
Oat	30	30	30	30	30
Maize	50	50	50	50	50
Rice	10	10	10	15	0
Beans	0	0	0	0	0
Pulses_oth	0	0	0	0	0
Tobacco	-	-	90	30	-
Hemp	-	-	-	-	-
Rape	50	50	50	50	50
Sunflower	10	10	0	10	10
Soya	-	-	-	70	-
Linseed	-	-	-	-	-
Seed_other	-	-	75	75	-
Fruit_temp	80	90	90	95	90
Fruit_subtrop	80	90	90	95	90
Berry	95	95	95	95	95
Nuts	99	99	99	99	50
Citrus	-	90	90	90	90
Olive	-	80	97	95	80
Vineyard	80	99	80	70	97

SUCELLOG: IEE/13/638/SI2.675535

D3.2b Summary of the regional situation, biomass resources and priority areas of action in France

1st November 2014



About SUCELLOG project

The SUCELLOG project - Triggering the creation of biomass logistic centres by the agro-industry - aims to widespread the participation of the agrarian sector in the sustainable supply of solid biofuels in Europe. SUCELLOG action focuses in an almost unexploited logistic concept: the implementation of agro-industry logistic centres in the agro-industry as a complement to their usual activity evidencing the large synergy existing between the agro-economy and the bio-economy. Further information about the project and the Partners involved are available under www.sucellog.eu.

Project Coordinator



Project Partners



About this document

This report corresponds to D3.2 of the SUCELLOG project - Summary of the regional situation, biomass resources and priority areas of action in France. It has been prepared by:

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Table of contents

About SUCELLOG project	1
About this document.....	1
Table of contents.....	2
List of Tables	4
List of Figures.....	4
1. Introduction	5
2. Agro-industries: profile, barriers and opportunities	6
3. Evaluation of available resources.....	10
3.1. Agricultural residues:.....	10
3.2. Other biomass resources	12
3.3. Methodology of work	13
3.4. Results	14
4. Regional Framework of AUVERGNE.....	15
4.1. Identification of agro-industries in Auvergne	15
4.2. Identification of biomass resources in Auvergne	16
4.3. Localization of resources and agro-industries in Auvergne	17
4.4. Priority areas in Auvergne	18
5. Regional Framework of CENTRE	19
5.1. Identification of agro-industries in Centre	19
5.2. Identification of biomass resources in Centre.....	19
5.3. Localization of resources and agro-industries in Centre.....	21
5.4. Priority areas in Centre.....	22
6. Regional Framework of CHAMPAGNE-ARDENNE.....	23
6.1. Identification of agro-industries in Champagne-Ardenne.....	23
6.2. Identification of biomass resources in Champagne-Ardenne	23
6.3. Localization of resources and agro-industries in Champagne-Ardenne ...	25
6.4. Priority areas in Champagne-Ardenne	26
7. Regional Framework of ILE-DE-FRANCE	27
7.1. Identification of agro-industries in Ile-de-France	27
7.2. Identification of biomass resources in Ile-de-France	27
7.3. Localization of resources and agro-industries in Ile-de-France	29
7.4. Priority areas in Ile-de-France	30

8. Regional Framework of PICARDIE.....	30
8.1. Identification of agro-industries in Picardie.....	30
8.2. Identification of biomass resources in Picardie	31
8.3. Localization of resources and agro-industries in Picardie	32
8.4. Priority areas in Picardie	33
9. Regional Framework of RHÔNE-ALPES.....	34
9.1. Identification of agro-industries in Rhône-Alpes.....	34
9.2. Identification of biomass resources in Rhône-Alpes.....	34
9.3. Localization of resources and agro-industries in Rhône-Alpes.....	36
9.4. Priority areas in Rhône-Alpes.....	37
10. Summary of the situation in France.....	38
 Annex I: Table of ratios y availability percentage per region	 39

List of Tables

Table 1: Classification of biomass resources in France.....	11
Table 2: Most strategic resources by target region.....	14
Table 3: Availability of equipment and biomass resources in Auvergne.....	18
Table 4: Availability of equipment and biomass resources in Centre.....	22
Table 5: Availability of equipment and biomass resources in Champagne-Ardenne.	26
Table 6: Availability of equipment and biomass resources in Ile-de-France.....	30
Table 7: Availability of equipment and biomass resources in Picardie.....	33
Table 8: Availability of equipment and biomass resources in Picardie.....	37
Table 9: Ratios of biomass production (t/ha) in FRANCE per region.....	39
Table 10: Percentage of availability of biomass in FRANCE per region.....	39

List of Figures

Figure 1: Summary of available agricultural biomass residues in Auvergne.....	16
Figure 2: Localization and type of agro-industries and resources in Auvergne.....	17
Figure 3: Summary of available agricultural biomass residues in Centre.....	20
Figure 4: Localization and type of agro-industries and resources in Centre.....	21
Figure 5: Summary of available agricultural biomass residues in Champagne- Ardenne.....	24
Figure 6: Localization and type of agro-industries and resources in Champagne- Ardenne.....	25
Figure 7: Summary of available agricultural biomass residues in Ile-de-France.....	27
Figure 8: Localization and type of agro-industries and resources in Ile-de-France..	29
Figure 9: Summary of available agricultural biomass residues in Picardie.....	31
Figure 10: Localization and type of agro-industries and resources in Picardie.....	32
Figure 11: Summary of available agricultural biomass residues in Rhône-Alpes.....	35
Figure 12: Localization and type of agro-industries and resources in Rhône-Alpes.	36

1. Introduction

SUCELLOG focuses on the implementation of biomass logistic centres into agro-industries as complement to their usual activity with minor investments. Agro-industry facilities can be utilised in their idle periods to handle and pre-treat biomass feedstock (mainly from their own residues or agricultural residues nearby) to produce solid biomass to be introduced into the market.

This document shows the results of the work carried out within SUCELLOG WP3-Regional framework and stakeholders' engagement in France. During this WP, four main actions were carried out in the project target regions (Auvergne, Centre, Champagne-Ardenne, Ile-de-France, Picardie and Rhone-Alpes):

- Allocate biomass resources.
- Evaluate with the stakeholders both the technical and the non-technical barriers of the implementation of SUCELLOG concept in the agro-industries.
- Determine the potential areas for the development of agro-industry logistic centres.
- Engage agro-industries to the project.

For the first action, an evaluation of the real potential of primary agrarian biomass has been carried out inside Task 3.1. The methodology selected corresponds to a "Resource focussed approach", as described by BEE standardised classification (project Biomass Energy for Europe), which starts with statistical data from agrarian inventories. This data has been complemented with the real availability indices (the share of biomass that is not currently being used for other aims including soil sustainability issues) gathered in the regional workshops with the agrarian sector during Task 3.3. As a first result, primary biomass resources have been firstly catalogued according to existing competitive uses and relevance in terms of current unused quantities. This assessment has been performed in by country level since no regional differences has been observed. Secondly, a map of real available primary resources and a table of the available tons per year in dry base were built per target region. Even though the use of agro-industry residues is a target of SUCELLOG, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Therefore the maps and tables presented do not include this type of resources, which will be deeply assessed for particular cases of logistic centres monitored or audited during in WP4-WP6.

As a second action, an assessment of the barriers and opportunities for the development of logistic centres was carried out through personal interviews with each target sector in Task 3.2. Existing agro-industries from the potential sectors (those owning compatible equipment for the conditioning and storage of raw material) were asked about: idle periods, residues produced in their facilities and upstream in the crop cultivation, the economic situation of the sector and possible upcoming changes due to the Common Agricultural Policy, practical and legal incompatibilities in using

their facilities for the production of solid biomass, social barriers for the development of this new activity and, finally, opportunities detected. Section 2 presents the situation of the country since no regional differences were appreciated. After this analysis, target sectors were identified per region and specific agro-industry locations were included inside the biomass resource map.

To determine the potential areas inside each target region for the development of agro-industry logistic centres, it has been taken into account the diversity and quantity of available agrarian resources (both woody and herbaceous) and of agro-industries present in the region as well as the compatibility among them. Compatibility has been defined according to their seasonality (matching the months of biomass production with the idle period of the agro-industry) and their technical compatibility of use. Logistic issues such as good communication networks and proximity to consumption areas has also been taken into consideration. Potential areas have been identified per region and are shown in this document. However, it is important to highlight that the selection of a potential area does not mean that an agro-industry non belonging to it could not start a new activity and the opposite. The size of the future logistic centre has not been a limiting factor for the selection of the potential area (even if SUCELLOG target is a production of 10 kt/yr per centre) since no data of the total amount of biomass is available (agro-industry residues missing as mentioned before).

The following sections show the results obtained about the above mentioned issues (passing from a country to a regional perspective). A summary of the situation in France is included in the last part

As a last activity belonging to this WP, workshops and personal contacts were carried out with agro-industries in Task 3.3 with the aim of engaging them to the services offered by the project (technical and decision-making support to become biomass logistic centres). The result of this action is shown in “D3.1-Report on engagement actions”.

2. Agro-industries: profile, barriers and opportunities

The main potential agro-industry sectors to become a solid biomass logistic centre in France have been evaluated in the following lines, describing the equipment they usually own and their idle period, as well as the residues generated both in the agrarian practice and in the production process. Finally, the barriers and opportunities they would face when thinking to start this new activity have been identified. The information has been provided through interviews with representative industries of the sector and agrarian experts.

Forage dehydration:

Forage dehydration sector in France has an important idle period of 5 months (from November to April approximately) and owns compatible equipment for the production

of solid biomass (horizontal dryers, pelletisers and silos). From the 6 regions evaluated in SUCELLOG in France, it is mainly sited in the region of Champagne-Ardenne.

Usually installations are used all the year because they dry other material different from forage in order to diversify their activity (sugar beet, wine residues) or even are utilized to produce wood pellets. So the implementation of SUCELLOG concept is something that is already done in this sector. Since not all facilities work like this, the project will still consider this sector as a target for the development of biomass logistic centres.

The forage dehydration facilities do not produce any important biomass residue, either in the agrarian or processing phase, meaning that the raw material for the production of solid biomass should be acquired.

Dehydration sector passed by a difficult situation years ago so that diversification was the natural way to be still working. The evolution of European subsidies (PAC) could play an important role for this sector. The sector do think that there is no technical barriers to start this new activity within their installations, presents a high degree of professionalization and is able to invest.

Cereal dryers:

This sector shows an interesting potential to become a solid biomass logistic centre from a technical point of view, offering a long idle period of around 6 months (from January to July approximately and depending on the crop) as well as proper equipment such as vertical dryers, screening equipment and silos for storage.

Regarding the raw material available for a possible logistic centre, farmers supplying the grain to be dried in the facilities produce important quantities of straw which main market is the livestock feeding and biogas production. Depending on the year, a considerable amount of straw is not able to enter the market for animal feeding. Some studies consider that, one year out of three, the straw (of cereals, maize or rape) can be used for energy purposes, and that one third of the total amount of straw should be leaved on the soil.

The agro-industry itself produce residues such as the grain that for some reasons do not satisfy the quality/aesthetics requirements to be sold in the market or the silo dust, the spathes and the kernels (although normally are sold for animal feeding, biogas production or for combustion).

These industries see a good opportunity in making compatible their activity with the production of solid biomass although they think that a new line for drying may be required since not so many biomass formats are compatible with the dryers (only granulate material but no straw or chip). Otherwise their storage facilities and handling equipment could be used without any barrier. Economically, the sector has

in general a favorable economic situation and investments in new activities can be studied.

Sugar industry:

The sugar industry presents, on the one side, an important idle period of 7 months which goes from January to August approximately and, on the other side, compatible equipment for the production of solid biomass such as horizontal dryers and generally also pelletizers.

This equipment is used in the production of beet pulp cake, a by-product from the sugar production, which is highly appreciated by the livestock sector and commercialized in a pellet format. However in the last years, the use for biogas production has increased in such a way that, depending on market needs, some years is profitable to produce pellets and some others biogas. When biogas production is the predominant, pelletisers are not used.

The sector does not produce residues during the agrarian practice.

Nowadays, the industry has an important uncertainty due to the end of the quota in 2017 involving changes. For these reasons, it can be a good sector to implement the logistic centre as an opportunity for diversification.

Tobacco dryers:

The agro-industry of the tobacco remain open the whole year but their dryers have an idle period of 9 months per year (from October to July approximately) presenting a good opportunity to become a biomass logistic centre from the technical point of view.

The agrarian practice of the tobacco generates residues talks that currently are left on the soil because they have not found other use. They could be studied as a possible biomass source.

The sector is in a strong decline and restructuration. Therefore the production of solid biomass with reduced investments can become a good opportunity for them.

Wine sector:

The wine sector includes the cellars and the distilleries, the latter processing the residues obtained from the cellars. From both, it is only the distilleries the ones owning equipment (horizontal dryers) compatible with the production of solid biomass. The idle period of these dryers in the distilleries is from May to September/October.

It has been selected as a potential sector to become a logistic centre because of their easy access to the agrarian residues such as the pruning or to the agro-industry residues obtained during the wine and distillate elaboration.

Nowadays many of the by-products produced during the wine elaboration (grape marcs and grape stems) are already used as animal feeding or for methanization. Regarding the residues from the distillation process, they are sold for animal feedstock and biogas production. Vineyard prunings could be commercialised once chipped and dried in the same drier of the distillery or in a new production line implemented in the cellar.

Technically they do not see any trouble of initiating a new activity as logistic centre and investments could be studied.

Oil extraction industries:

The oil extraction industries are dedicated to rape and sunflower seeds mainly working all the year. The facilities count with pressers and driers.

Concerning the residues produced in the field, harvesting methods are not as efficient as for cereal straw. For this reason, the harvesting is only carried out when there is a lack of hay in the market for animal feed, being otherwise left in the soil as soil amendment. In the agro-industry production process, the cake from the seed pressing is really appreciated for animal feed although husks have not such a stable market.

They can be considered as a target industry for SUCELLOG if the production decreases and there is some line that it is not used.

Feedstuff producers

This sector has been identified as a potential one to become a solid biomass logistic centre. Even though it does not have idle periods, it counts with many proper equipment types that might be used for the new activity such as: pelletizes, silos for storage, screening and chipping machinery.

Additionally, the sector produces interesting amounts of residues not able to enter the market although some are already formulated feedstuffs which might contain antibiotics. Therefore their use as possible solid biomass source needs to be studied in order to produce no dangerous emissions for the environment.

The sector is facing a decrease in the market, making facilities oversized in some cases. The restructuration can be an opportunity to diversify with an activity to produce agro-pellets.

3. Evaluation of available resources

SUCELLOG has considered that the development of agro-industry logistic centre should rely on agrarian biomass coming both from the agrarian practices (like straw or prunings) and from the agro-industry process (for example distilleries residues). The fact is that, for the first case, agro-industries have already a network with farmers providing the raw feedstock to be processed. For the second case, the use of their own residues is the opportunity to reduce their fuel consumption or avoid the cost of disposal if there is no market for it. Quantifying the biomass resources up-stream and down-stream the agro-industry is the object of this section since it is strategic for establishing new commercial relations with usual providers and clients.

A study about the available biomass resources has been performed, focusing in the agrarian biomass since it was not possible to have data about the production of agro-industries residues per region/country. When talking about availability of the residue, it is meant the amount of resources that do not have a market or that is not left on the soil to improve organic content, therefore having the opportunity to be used for energy purposes. Three examples to explain what availability is (see more detail about the methodology of work in section XX and availability percentage in Annex I):

- If a farmer, after taking the wheat grain, leaves the straw on the soil due to agrarian recommendations then availability should be considered 0%.
- On the contrary, if the farmer leaves the straw on the soil just because the cost for harvesting does not cover the value in the animal feed market then availability is 100%.
- It can also happen that in one region the 40% of the straw is commercialized for animal feed (so it has a market), a 20% is left on the soil as a recommended agrarian practice. Therefore, 40% of the straw is available for other uses like the production of solid biomass.

3.1. Agricultural residues:

Agricultural biomass resources can be catalogued in different groups according to next two criteria:

- Competitiveness: existing competitive uses.
- Amount of available biomass: relevance in terms of current unused quantities.

From this scope, agricultural biomass resources in French target regions can be catalogued in average as next:

Table 1: Classification of biomass resources in France.

Criteria		Biomass resources
Competitiveness	Available unused biomass	
Competitive uses make biomass unavailable for energy	None	Pulses and hemp stalks
Moderate to high competitive uses	Important part of the source still available	Cereal straw, maize stalks (depends upon region).
Some competitive uses	Important source still available	Rape straw and sunflower stalks (depends upon region).
Some or few competitive uses	Marginal local amounts (may play a role in a singular facility)	Tobacco stalks, other oilseed straw, permanent crop prunings.
Uncertain due to technical barrier to be collected	If logistics is solved, biomass is ready available	Linseed

As observed, in general, the resources with lowest risk derived from competitive uses are oilseed straw (other than rape), permanent crop prunings and tobacco stalks, practically unused. However, these biomass types are only relatively important in regional scale for the target regions selected. It is at more local scale in general when they become more interesting, that is, once the location for a potential distribution of biomass is selected.

There is a group of crops which residues are still available in a relevant share, and that in most regions can play an important role as source of biomass. They are rape straw and sunflower stalks, which are still not much used, and since France accounts with important areas for these crops, the available potential is in general quite high in most regions.

In general, maize stalks and cereal straw have more competitive uses than straw from rape and sunflower. Maize straw has still not much competitive uses in Auvergne and Rhône-Alpes, whereas in the rest availability is small or even very small (Centre and Picardie). In the case of cereal straw, all regions show medium to high competitiveness for this resources, used to be left on the soil or as cattle feedstock mainly. Wheat straw is a very particular case in Auvergne and Rhône-Alpes, where it is practically unavailable, whereas the rest of cereal straw is still available to certain extent.

According to this description, biomass mostly available in the French target regions are cereal straw, rape straw, and maize and sunflower stalks. This biomass can be collected and does not imply any risk in terms of accessing it in terms of logistics.

With respect to woody agricultural prunings, they can complement the production of solid biomass commodities, since practically the amounts available are insufficient for dedicated logistic centres. Therefore, this resource can be considered as a good complement when planning the supply, but not as the main biomass source. This is a general rule in France except for the province of Marne where the potential of vineyard prunings is very interesting. In fact is its woody structure usually with better quality in terms of quality composition and suitability for existing energy conversion systems compared to herbaceous residues. However, in the cases that the availability of woody biomass from prunings is high, it also involves the challenge to local farmers to start a new logistic chain.

Other feedstock types have not being quantified in the study, but may be a source of biomass relevant at local scale. A specific case is linseed, which is only partly utilised and the rest of stalks is left on the soil due to the harvesting costs, even though the natural degradation on the soil is not good, and there are areas where farmers are looking for a possible market to provide an outlet for it. Tobacco stalks have been reported to be unused feedstock, and so, they may be locally of interest.

Resources like pulses straw shall not be considered as a resource when setting the regional strategy as they are either integrated to improve soils or sold for animal feeding due to its nutritive properties. Hemp is totally used for the fiber market.

3.2. Other biomass resources

Even though in SUCELLOG a comprehensive list of agro-industries has been compiled by region, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Agro-industry residues are interesting in the case of the oil and wine sector because of their amount, while in the case of the cereal and feedstuff sector, for example, these residues could be a complement in the production of the solid biomass since their production is not of significance in amount. The use of agro-industry residues is a target of SUCELLOG, but its actual use will be decided for the particular cases of logistic centres monitored or audited during WPs 4, 5 and 6. There, the local reality and capacity of neighbour facilities to become reliable biomass suppliers will be assessed.

With respect to forestry biomass, SUCELLOG has not carried out any specific assessment since the project is focused on fostering agricultural residues as a source of solid biomass. However, the feedback obtained from the target regions shows that forestry residues may be at the reach of future logistic centres, and can be an option in few provinces for upgrading the properties of biomass mixtures to be commercialised. Biomass directly from forestry exploitation for energy purposes has been considered as not a source for the short-time term in SUCELLOG.

An analysis performed by regions instead of by resources is carried out in section 1. Biomass assessment in the present work involves the study of 5 autonomous regions of Spain, adding a total area of 244.900 km², about 48% of the total area of Spain. For this scale of work the use of existing data from inventories was needed as an input data source. The aim of the approach is to provide a framework of the available sources in the region. It is not aimed to be the specific biomass assessment for a facility, which will be object of task 4.2, and which requires other type of approaches.

3.3. Methodology of work

The methodology selected corresponds to a “Resource focused approach”, as described by BEE standardised classification (see project BEE). It starts with statistical data from agrarian inventories, and complemented with the availability indices and utilization for soil preservation leads to a technical potential, including soil sustainability issues.

The method followed is based on ratios of residual biomass production per hectare of cultivated area (tons of residue per hectare). The use of ratios is a widespread methodology for biomass assessments, appropriate for both large and small scale. The main issue is to account with reliable inventories and ratios. By multiplying the cultivated area (ha) by the ratios (t/ha) the theoretical potential is obtained:

$$\text{Biomass Potential [t]} = \text{Ratio [t/ha]} * \text{Area [ha]}$$

The methodology used here brings a step forward in the country analysis by including the competitiveness for biomass resources. For that purpose it is necessary to know the share of biomass that is currently being used for other aims, and that will be considered as not available for the present study. The availability index (I_{AV}) expressed as percentage is defined as next:

$$I_{AV} = 100 - I_{COMPET} - I_{SOILS}$$

Where :

I_{COMPET} : is the percentage of the total biomass in a region that other uses (power plants, cattle, industry) already are using.

I_{SOILS} : is the percentage of total produced biomass that remains in the soil. E.g.: if farmers prefer to leave part of the straw as soil organic amendment.

By using these indices it is possible to obtain the final biomass available by doing next operation:

$$\text{Available Biomass [t]} = \text{Potential Biomass [t]} * I_{AV} = \text{Ratio [t/ha]} * \text{Area [ha]} * I_{AV}$$

The data sources have been obtained as next:

- **Agricultural areas:** the biomass has been calculated on the base S2Biom project land areas (www.s2biom.eu) given by NUTs3 (Spanish provinces), in order to have same base units than ongoing referential projects like S2Biom is. Since NUTs3 is a too large scale for the purposes of the SUCELLOG work, the biomass obtained by NUTs3 has been downscaled at LAU2 (former NUTs5) geographical resolution (Spanish municipalities), by assigning each LAU2 unit a biomass share proportional to the area occupied by crop type.
- **Land distribution:** Corine Land Cover version 2010. Biomass previously downscaled to municipality level has been allocated to the corresponding Corine Land Cover spots, intersecting the municipality.
- **Ratios and availability indices:** a specific work has been carried out by region. For each region ratios have been obtained from direct contact with specialists and cooperatives, and in few cases, complemented with literature. The purpose of this effort has been to use ratios and availability indices representing the reality of the region, and not just ratios found in literature. The workshops done in task 3.3 have served to include the feedback from the sector to improve the final datasets. Ratio and availability percentage are shown in Annex I.

3.4. Results

Table 2: Most strategic resources by target region.

Region	Cereal straw	Maize + Sunflower straw	Rape and oil seed plant straw	Olive + Fruit + Vineyard prunings	Others
Auvergne	Partly Allier, Puy-de-Dôme	Allier and Puy-de-Dôme	Allier	---	---
Centre	ALL	ALL (Eure-et-Loire to a lesser extent)	ALL	Indre-et-Loire, Loire-et Cher (also Cher to a lesser extent)	---
Champagne-Ardenne	ALL	ALL (but in general 1 magnitude order less than straw)	ALL	Marme and (to a lesser extent) Aube	---

Region	Cereal straw	Maize + Sunflower straw	Rape and oil seed plant straw	Olive + Fruit + Vineyard prunings	Others
Île-de-France	ALL (specially Seine-et-marne)	Seine et Marne mainly	ALL (specially Seine-et-marne)	---	---
	Metropolitan departments of Hauts-de-Seine, Seine-Saint-Denis and Val-de-Marne no biomass production.				
Picardie	ALL	---	ALL	Aisne (very locally)	---
Rhone-Alpes	ALL (as complement to maize/sunflower)	ALL	All (locally)	Drôme	---
	Ardeche, Haute-Savoie, Loire et Savoie are departments with insufficient available biomass to be considered, in principle, for distribution of agrarian solid biomass commodities				

4. Regional Framework of AUVERGNE

4.1. Identification of agro-industries in Auvergne

The interesting agro-industries to become a logistic centre in Auvergne are:

- **Cereal dryers:** the sector is very concentrated in the Limagne, the agro-industrial complex near Clermont-Ferrand but also in the North-Est and in the South. In these areas, more than 80% of the cooperatives in the region are sited.
- **Sugar industry:** there is only one industry which is currently closed and therefore it could be a good opportunity to be transformed into a biomass logistic centre.
- **Distilleries:** the area of wine is very reduce, limited in the center or Auvergne. There is only one distillery.

Apart from those sectors, the oil extraction industries could also be considered as target if they dedicate one line to the production of solid biomass. There are only two industries of this sector in the north.

All these agro-industries together with the cellars can be considered as suppliers of biomass resources.

4.2. Identification of biomass resources in Auvergne

Biomass assessment carried out at regional scale indicates that available biomass, that not subjected to competitive uses, amounts for about 0.13 Mt yearly. Maize stalks are the main agricultural residues, whereas rape and cereal straw are of secondary importance, though still of interest from a regional perspective. Allier and Puy-de-Dôme are the departments with relevant biomass resources, whereas Cantal and Haute-Loire have quite scarce available biomass. Even though 0.1 Mt of yearly based biomass is not an important amount at regional level, by department and locally, several areas concentrate the productions.

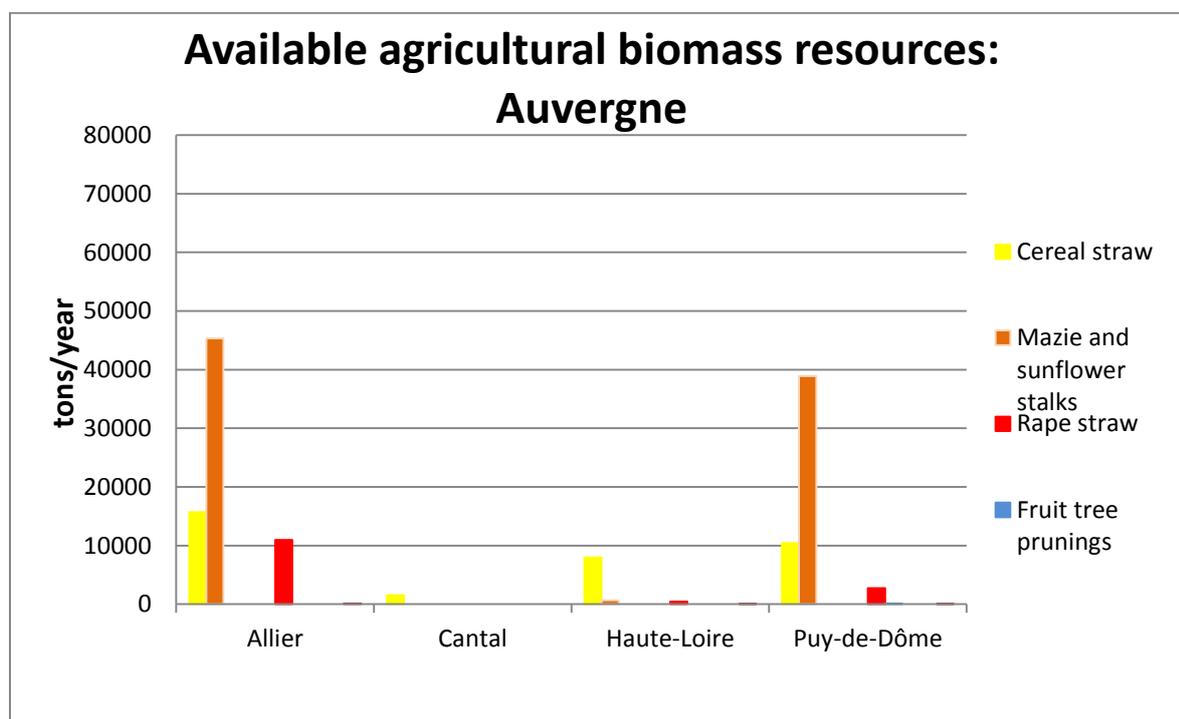


Figure 1: Summary of available agricultural biomass residues in Auvergne.

Main conclusions in Auvergne:

- The provinces of Allier and Puy-de-Dôme are the ones presenting the major variety of resources. On the other hand, Cantal seems to be not so interesting for developing a logistic centre of agrarian biomass.
- As in most of the French regions, the most extended crops are annual crop residues, in this case cereals and maize for Auvergne. The principal resource is maize stalks, available in large quantities and still with minor competitive uses.
- The straw of colza and grains is also of relevance and could be of importance especially in the province of Allier.
- Woody residues from vineyard prunings are not relevant at regional scale. However in very local scale, a facility might find some amounts of this woody residues. This fact has to be taken into consideration for local scale studies.

- Industrial by-products such as broken grain and dust (from cereal dryers), husks (from oil extraction industries), sugar beet pulp (from the sugar sector) and distillation production residues.

4.3. Localization of resources and agro-industries in Auvergne

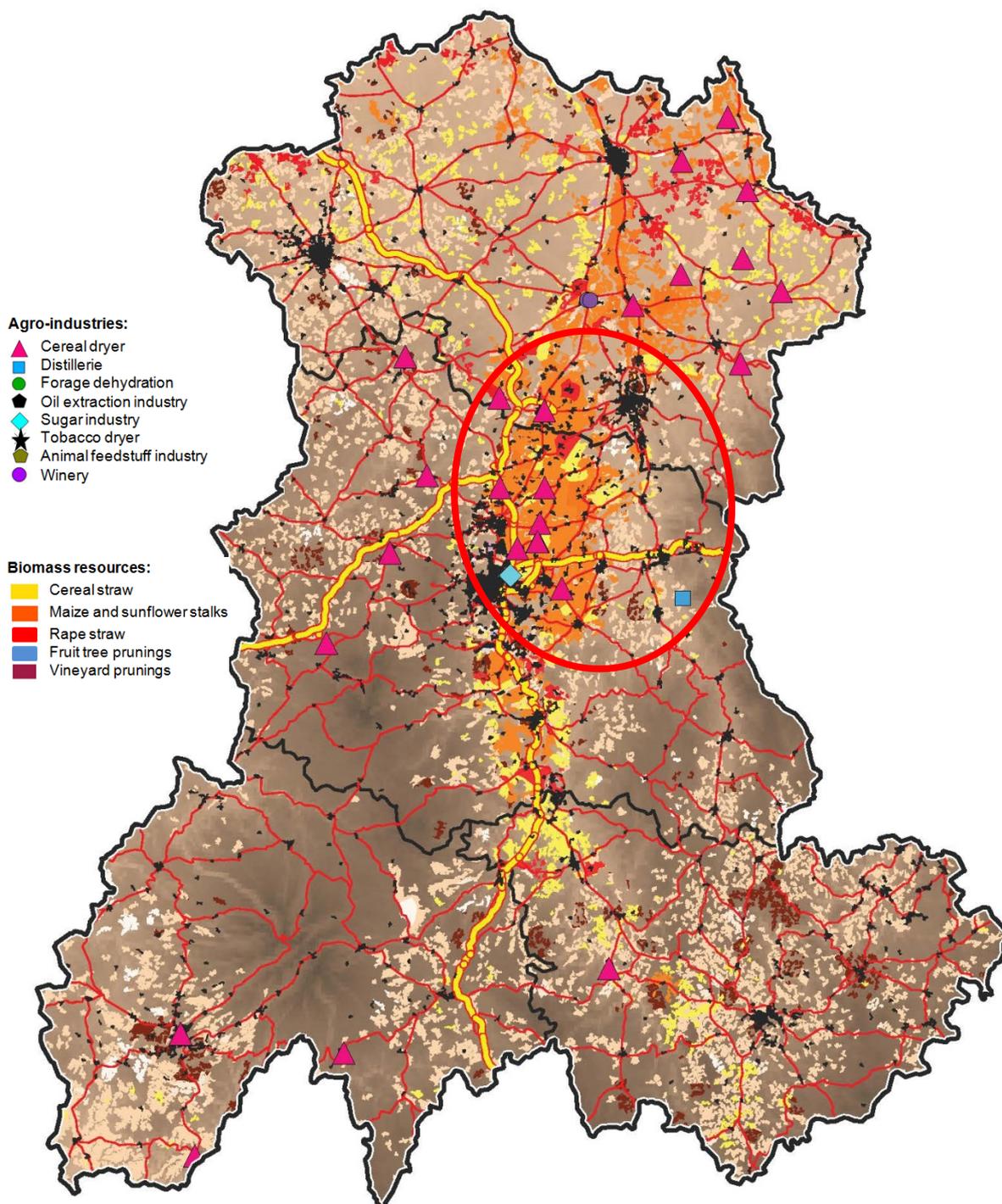


Figure 2: Localization and type of agro-industries and resources in Auvergne.

4.4. Priority areas in Auvergne

One potential area for the development of an agro-industry logistic centre has been detected in Auvergne and is shown in Figure 2. As already mentioned in the introduction, this area has been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 3, and their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also been taken into consideration.

Table 3: Availability of equipment and biomass resources in Auvergne.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal dryer												
Distillery												
Sugar industry												
Cereal straw												
Maize straw and cobs												
Rape stalks												
Husks and silo dust from cereal dryers												
Distillery residues												
Husks and residues from oil seeds												
Beet pulp												

In Auvergne there is only one potential area for the development of SUCELLOG, which has been selected for the following reasons:

- The high concentration of available maize straw and one potential industry able to pre-treat it and transform it into solid biomass: the sugar industry. This centre could also take the husks from seeds as a complement and specially rely on forest residues and sawdust from the wood industry to upgrade fuel characteristics.
- The seasonality of distillery is not compatible with maize straw and its long storage is complicated due to the high moisture content when harvested. However, the distillery itself could also process their own residues into solid biomass or sell the grape pits to the cereal industries to be dried in their facilities to achieve quality standards.
- The concentration of cereal dryers in the area (important biomass consumers) and the good infrastructure for transport logistics should also be highlighted.

5. Regional Framework of CENTRE

5.1. Identification of agro-industries in Centre

The interesting agro-industries to become a logistic centre in Centre are:

- **Cereal dryers:** about 500.000 tons of cereal straw every year on the region. The most important quantities are mobilisable in two agrarian area of Eure-et-Loire and Loiret.
- **Sugar industry:** there are only two cooperative groups in the region. The sugar beets crops are concentrated in the North of the region between Eure-et-Loire and Loiret.
- **Distilleries:** only one distillery in the region.
- **Forage dehydration facilities:** only one site in the North of the region.

Apart from those sectors, the feedstuff producers could also be considered as target for the implementation of a logistic centre if they dedicate one line exclusively to the production of solid biomass.

The agro-industries identified as biomass resources suppliers, apart from the ones above, are the cellars (vineyards are centered in a line in the middle of the region, in Touraine and Sancerre).

5.2. Identification of biomass resources in Centre

Centre region is, with difference, the French target region accounting with the largest biomass available for energy uses. The total biomass is larger than 1 Mt, quite an important figure, specially when accordingly to the evaluation done, it has no current use, that is, there are no competitive uses. Straw is the principal residue and contributes in all the departments with more than 80 kt. Beyond the predominant role of straw, rape has also important potentials in all departments. Only Indre-et-Loire has a larger amount of residual biomass from maize than rape straw.

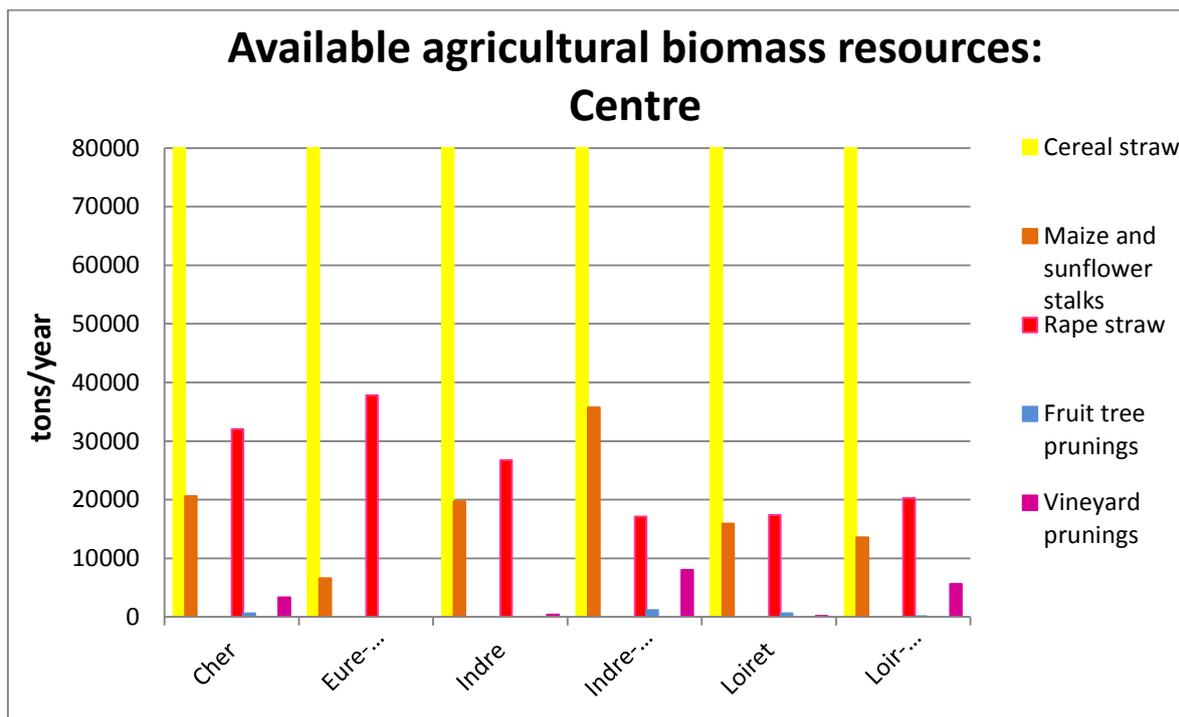


Figure 3: Summary of available agricultural biomass residues in Centre.

Main conclusions in Centre:

- The most important resource in Centre is cereal straw, adding more than 0.8 Mt/yr of biomass available. Even though this is the main resource, maize and rape contribute to the available biomass with very important amounts in all departments. Centre is the region with more production of rape after Champagne-Ardenne.
- Vineyard prunings in the central part of the region could be a good woody resource for an upgrading of the solid biomass quality. This fact is relevant for decision making in the strategy when starting a new logistic centre. Biomass from fruit tree prunings can play a similar role locally in the department of Indre-et Loire.
- Residues from the agro-industry of the cereal dryers, sugar industry, feedstuff producers and wine sector should also be considered.

5.3. Localization of resources and agro-industries in Centre

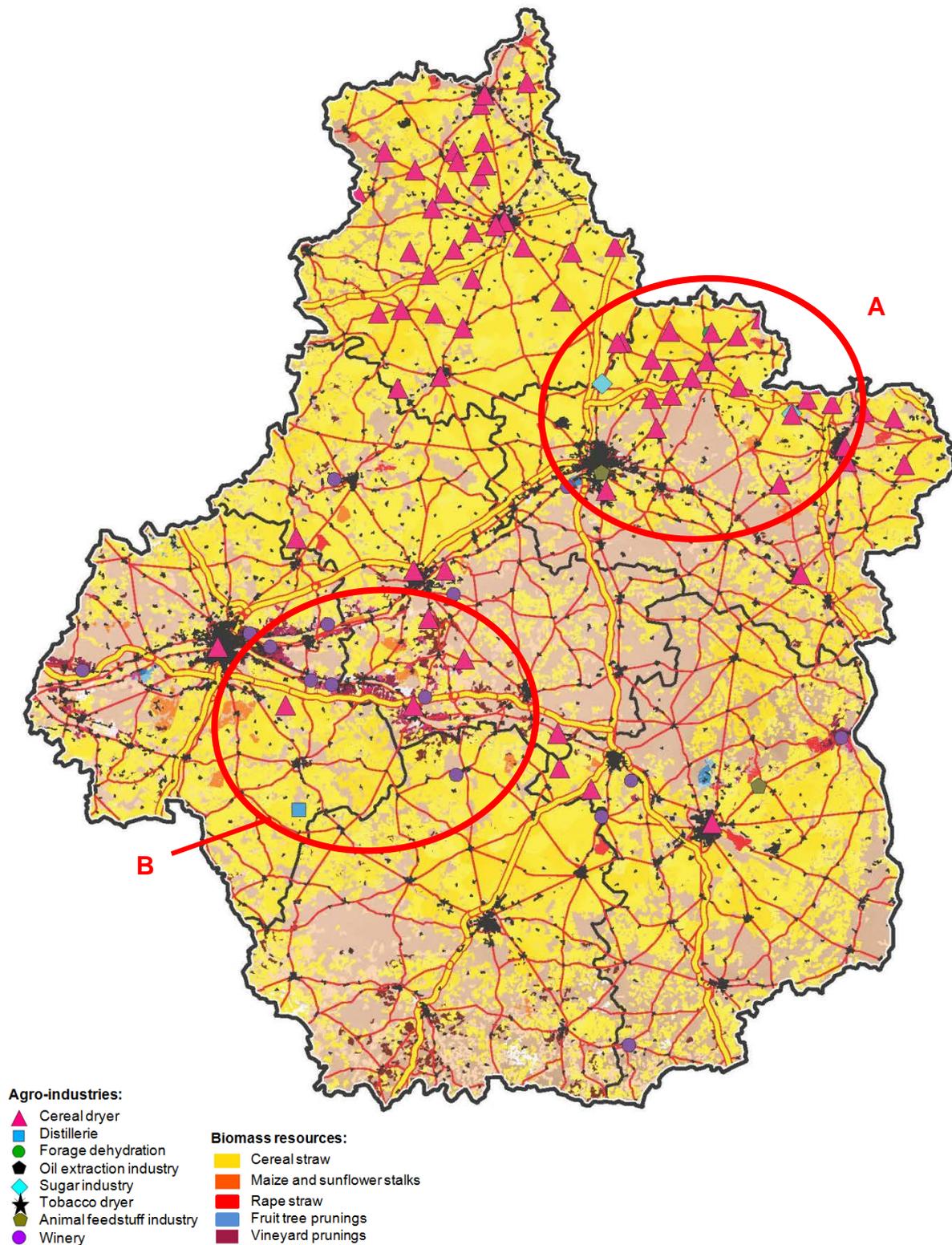


Figure 4: Localization and type of agro-industries and resources in Centre.

5.4. Priority areas in Centre

Potential areas for the development of an agro-industry logistic centre have been detected in Centre and are shown in Figure 4. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 4, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 4: Availability of equipment and biomass resources in Centre.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal dryer	■	■	■	■	■	■						
Distillery					■	■	■	■	■			
Sugar industry	■	■	■	■	■	■						
Forage dehydration	■	■	■								■	■
Cereal straw						■	■	■				
Maize straw and cobs										■	■	
Rape stalks							■	■				
Husks and silo dust from cereal dryers							■	■	■	■	■	■
Grape marc and stems								■	■	■	■	
Distillery residues	■	■	■	■						■	■	■
Beet pulp								■	■	■	■	■
Permanent crop prunings	■	■	■								■	■
Feedstuff residues	■	■	■	■	■	■	■	■	■	■	■	■

The potentiality of the areas selected is described below:

- **Area A:** this area is interesting due to the high amount of straw resources available that could be processed in the forage dehydration industry or even in the sugar industry after a larger period of storage. Husks and other residues from cereal dryers could be used as a complement but especially woody residues from forest industry should be required to upgrade the quality.
- **Area B:** this area presents availability of vineyard prunings, together with the grape stem, which could be conditioned in the cellar if a new line is installed for this purpose.

6. Regional Framework of CHAMPAGNE-ARDENNE

6.1. Identification of agro-industries in Champagne-Ardenne

The interesting agro-industries to become a logistic centre in Champagne-Ardenne are:

- **Cereal dryers:** specially located in south of Marne and North of Aube.
- **Forage dehydration facilities:** Champagne-Ardenne is a very good region for this sector which is very represented in an important part of the territory. The most important part is in Marne and Aube.
- **Distilleries:** la Montagne de Reims is a very concentrated area with lots of wine cooperatives and the distilleries in the region. The area of Rosé des Riceys is also of importance for wine production although no distilleries are sited.
- **Sugar industries:** sugar beet can be found in all the department of Marne, in the South of Ardennes and the north of Aube.

Apart from those sectors, the feedstuff producers and the oil extraction industries could also be considered as target if they dedicate on line to the production of solid biomass.

The agro-industries identified as biomass resources suppliers, apart from the ones above, are: cellars (vineyards are centered in a line in the middle of the region, in Touraine and Sancerre) and animal feedstuff producers.

6.2. Identification of biomass resources in Champagne-Ardenne

The profile of Champagne-Ardenne is similar to Picardie or Centre regions in terms of the profile in biomass availability. Straw is the main resource, which amounts to important quantities available still without other competitive use. Whereas straw adds a total of 250 kt of biomass available per year, rape contributes with 150 kt. The profile of all departments is quite similar, being in all of them rape the second source of agricultural biomass in importance.

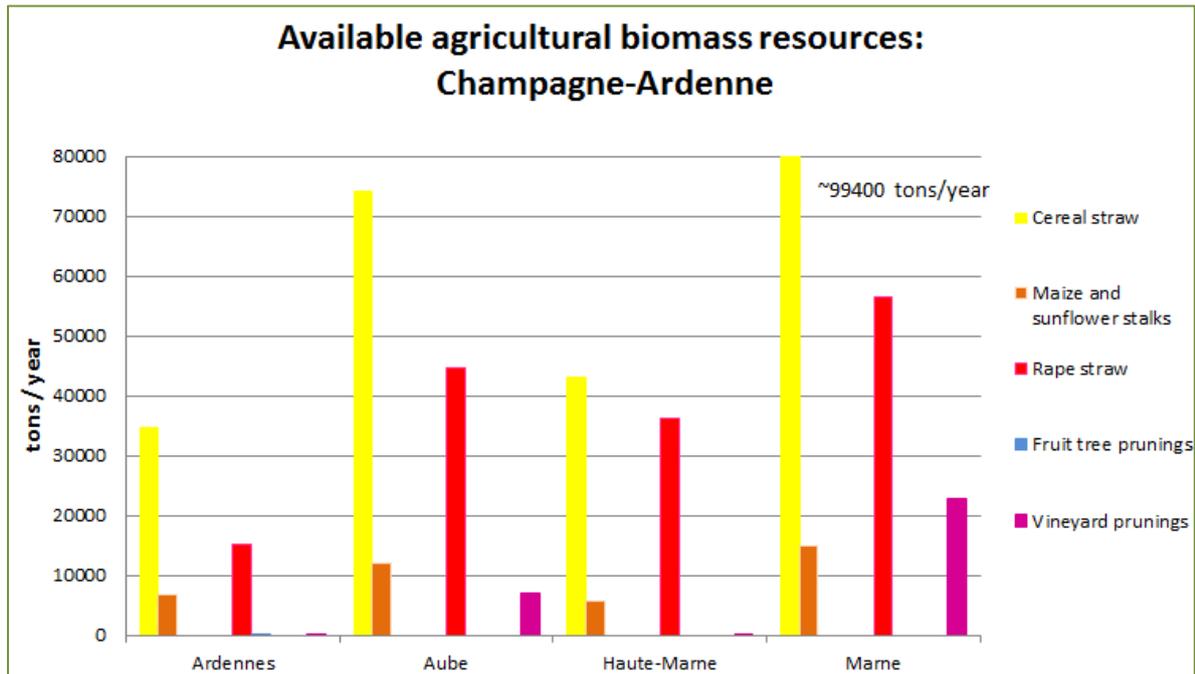


Figure 5: Summary of available agricultural biomass residues in Champagne-Ardenne.

Main conclusions in Champagne-Ardenne:

- In Champagne-Ardenne, residues from herbaceous crops (straw from cereals, maize and rape) are the main source to be considered. Straw from cereals is the prevailing residue, even though the straw from rape, as second resource in most departments, is very. More than 290 kt per year is the total available potential of the annual crop residues. All departments account with a significant amount.
- The provinces of Aube and specially Marne present also an interesting availability of prunings from vineyard, a woody material very appreciated for the production of solid biomass. Marne accounts with a potential available of more than 20 kt, which is a fact to be considered for any energy planning.
- Agro-industry residues from cereal dryers mainly but also from the sugar industry and the distilleries should also be considered as complement for mixed pellets.

6.3. Localization of resources and agro-industries in Champagne-Ardenne

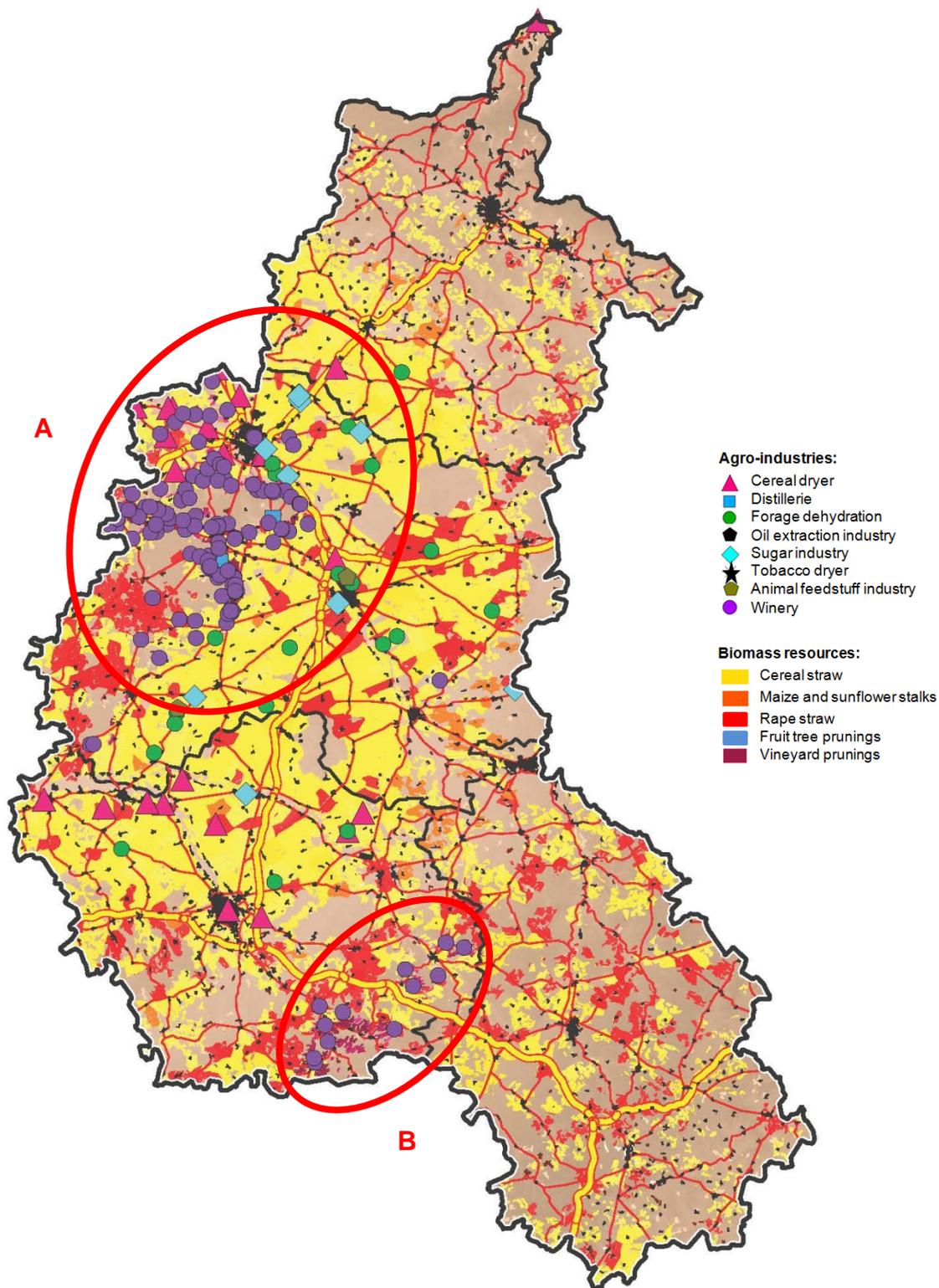


Figure 6: Localization and type of agro-industries and resources in Champagne-Ardenne.

6.4. Priority areas in Champagne-Ardenne

Potential areas for the development of an agro-industry logistic centre have been detected in Champagne-Ardenne and are shown in Figure 6. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 5, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 5: Availability of equipment and biomass resources in Champagne-Ardenne.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forage dehydration												
Cereal dryer												
Distillery												
Sugar industry												
Cereal straw												
Maize straw and cobs												
Rape stalks												
Husks and silo dust from cereal dryers												
Grape marc and stems												
Distillery residues												
Husks and residues from oil seeds												
Beet pulp												
Permanent crop prunings												
Feedstuff residues												

The situation could be summarised as follows:

- Area A: the potentiality of this area lies on the different agro-industry sectors available, together with the amount of woody residues from the important vineyard cultivations. Among all, the most interesting synergy in this region would be the forage dehydration and sugar industry facilities processing the prunings from the vineyards existing in the area. Cereal and rape straw together with the residues from cereal dryers, distillation process and feedstuff industries could be used as a complement for the production of a mixed pellet.

Cereal dryers could also become logistic centres if a new dryer is installed for this purpose, using the storage and handling facilities of their regular activity.

The concentration of agro-industries makes this area an important centre for the consumption of the solid biomass produced in the logistic centre.

- **Area B:** this area has been defined as potential due to the amount of vineyard prunings available that could be the raw material of possible logistic centres implemented in the cellars (a new line for this purpose should be constructed).

7. Regional Framework of ILE-DE-FRANCE

7.1. Identification of agro-industries in Ile-de-France

The interesting agro-industries to become a logistic centre in Ile-de-France are:

- **Cereal dryers:** important concentration of cooperatives just in the border with Yonne (Bourgogne), Loiret (Centre) and in the area of East of Seine et Marne.
- **Sugar industries:** sited in the area of Paris.

These agro-industries can also be considered as biomass resources suppliers.

7.2. Identification of biomass resources in Ile-de-France

Île de France presents a disparity among the departments. The urban predominant profile of the departments which from part of the metropolitan area of Paris have no agrarian production, and therefore, no residues available. The rest of the departments have straw as principal residue available, and rape as second in importance. Maize is only present with relevance to be mentioned at regional scale in Seine-et-Marne department. The total biomass available, that is, the biomass evaluated as not having competitive uses, adds a total of 192 kt/yr.

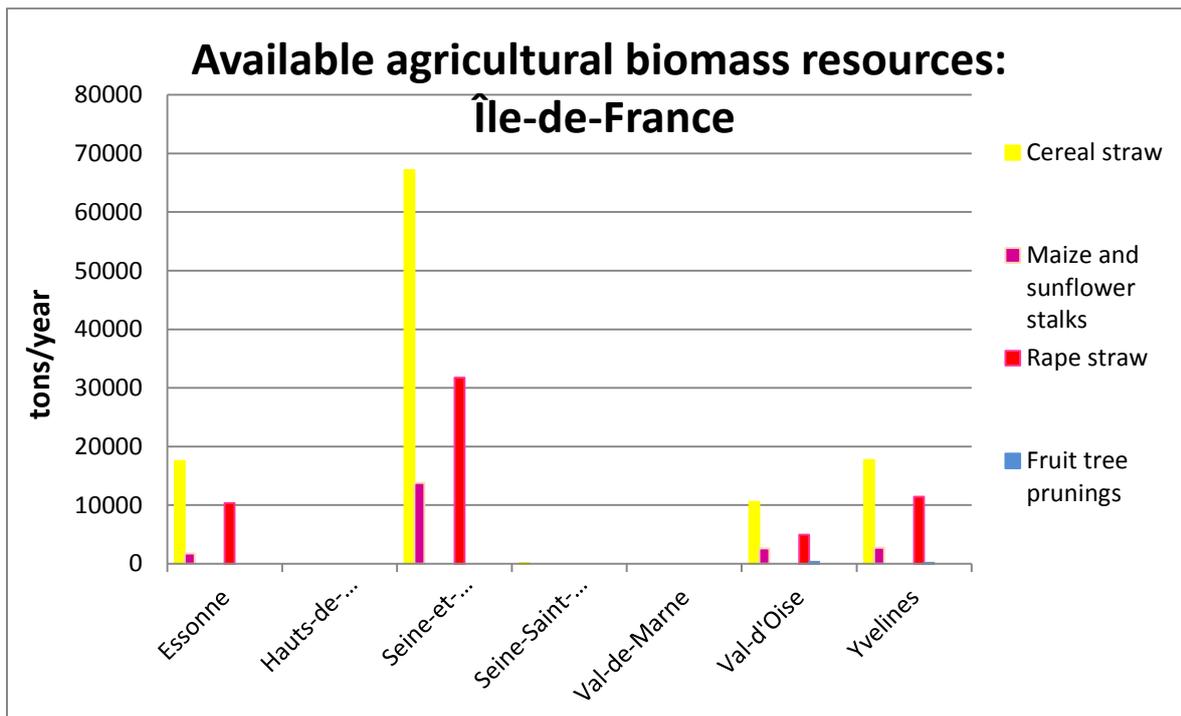


Figure 7: Summary of available agricultural biomass residues in Ile-de-France.

Main conclusions in Île-de-France:

- The provinces to take into account in the region of Ile de France, from the point of view of biomass resources, are Essone, Seine-et-Marne, Val-d'Oise and Yvelines.
- As in all France, in these provinces, the main resources available come from herbaceous crops straw (cereal, rape and maize/sunflower). The main source of biomass still available is cereal straw, even though rape straw is also important source. Maize and sunflower stalks can contribute as complement biomass source in rest of departments. Only can be a source of biomass for logistics centres on its own in Seine-et-Marne.
- No woody crops from agriculture are present in this region and therefore forest residues should be considered if wood is needed to improve the quality of the biomass to be commercialised.
- Residues coming from cereal dryers and sugar industry can also be a complement for the existing resources to produce a mixed pellet.

7.3. Localization of resources and agro-industries in Ile-de-France

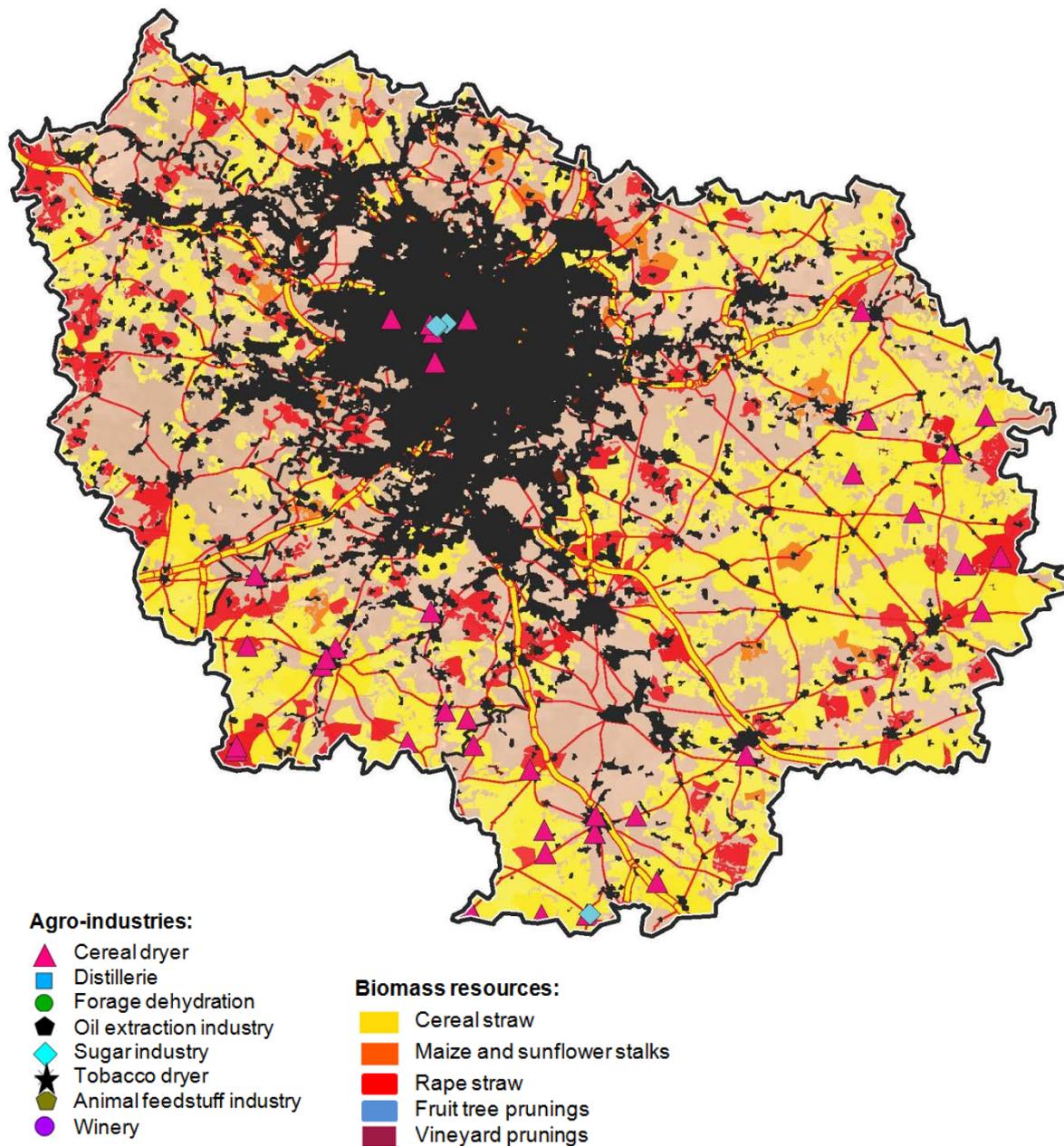


Figure 8: Localization and type of agro-industries and resources in Ile-de-France.

7.4. Priority areas in Ile-de-France

No clear potential areas for the development of an agro-industry logistic centre have been detected in Ile-de-France. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources and agro-industries (both woody and herbaceous) as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 6, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 6: Availability of equipment and biomass resources in Ile-de-France.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal dryer	■	■	■	■	■	■						
Sugar industry	■	■	■	■	■	■	■					
Cereal straw						■	■	■				
Maize straw and cobs										■	■	
Rape stalks							■	■				
Husks and silo dust from cereal dryers							■	■	■	■	■	■
Beet pulp									■	■	■	■

The region presents an important population area, Paris, which takes a great part of the total surface. Although the industrial area of the city can be considered as an important consumer market, there are not so many agro-industries where to implement the biomass logistic centre. No clear potential areas have been detected.

In any case, if an agro-industry logistic centre wants to be developed, forest residues and sawdust should be an important complement to the available straw (cereal and rape). A new line for processing the raw material should be implemented either in the sugar or in the cereal dryers.

8. Regional Framework of PICARDIE

8.1. Identification of agro-industries in Picardie

The interesting agro-industries to become a logistic centre in Picardie are:

- **Cereal dryers:** The most important quantities of cereal production can be found in a triangle formed between Amiens, Beauvais, Compiègne. Around 50 facilities can be found in the region mostly located in the central part.
- **Sugar industries:** a quite important sector with 6 facilities in the region.

Apart from these two sectors, the additional agro-industries identified as biomass resources suppliers are: cellars (in the south of Aisne, around Chateau Thierry with 2.400 ha cultivated).

8.2. Identification of biomass resources in Picardie

Among the target regions of SUCELLOG in France, Picardie is the second region in importance when the availability of agrarian biomass resources is the question of analysis. The available biomass has been evaluated to be over 650 kt/yr, mainly produced as straw from cereal and rape plantations. Cereal is predominant with respect to rape, which still is quite abundant from the perspective of implementing new logistics centres. The profile is similar to Champagne-Ardenne and Centre, with the difference that here wood from permanent crops can be only obtained in very limited amounts in Aisne department.

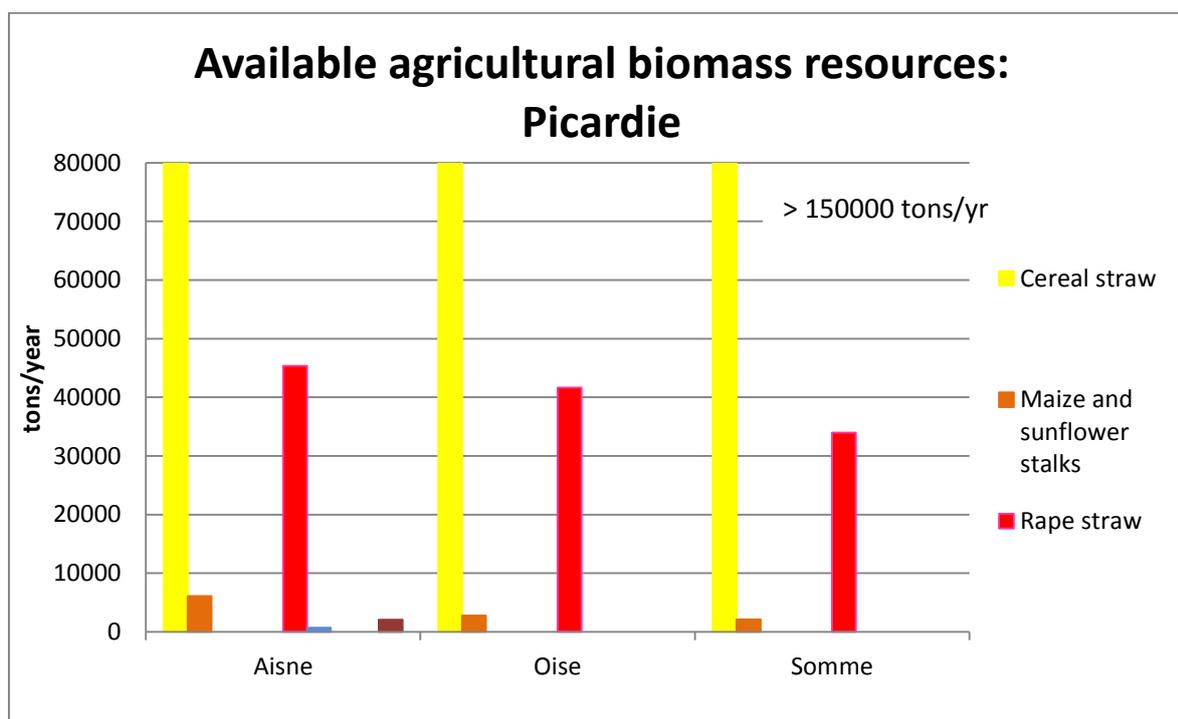


Figure 9: Summary of available agricultural biomass residues in Picardie.

Main conclusions in Picardie:

- Picardie region is notable for the production of cereal and rape straw and therefore is a territory where this kind of resources could be used for the production of solid biomass commodities.
- The prunings from permanent crops (vineyards and fruit tree) are also present in a very specific area of the region of Aisne, where they could be considered as a local biomass source.
- Agro-industry residues coming from the cereal dryers and sugar beet pulp could also be of interest as a complement to other sources.

8.3. Localization of resources and agro-industries in Picardie

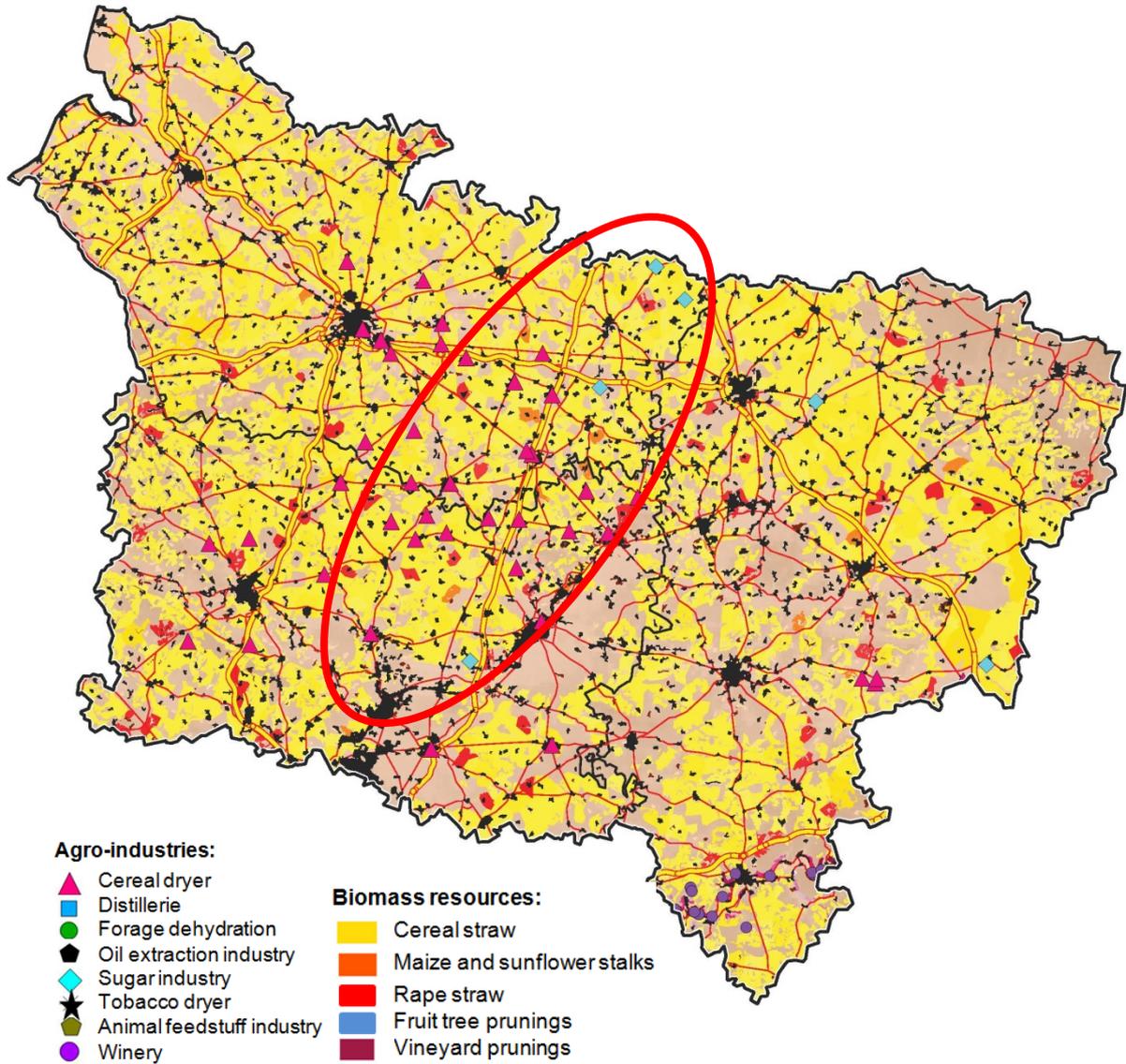


Figure 10: Localization and type of agro-industries and resources in Picardie.

8.4. Priority areas in Picardie

As already mentioned in the introduction, the criteria to select potential areas takes into account the diversity of resources (both woody and herbaceous) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 7, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 7: Availability of equipment and biomass resources in Picardie.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal dryer	■	■	■	■	■	■						
Sugar industry	■	■	■	■	■	■	■					
Cereal straw						■	■	■				
Maize straw and cobs										■	■	
Rape stalks							■	■				
Husks and silo dust from cereal dryers							■	■	■	■	■	■
Beet pulp								■	■	■	■	■
Permanent crop prunings	■	■	■									■

The creation of the logistic centre in Picardie will rely on the supply of forest residues and sawdust as a quality complement for the herbaceous crops present in the region (straw from cereals and rape) since no agricultural woody resources of relevance are available.

One potential area has been detected to allocate an agro-industry logistic centre (see Figure 10). It presents sugar industries able to process the straw and forest residues producing solid biomass to be consumed in the large amount of cereal dryers present in the area.

9. Regional Framework of RHÔNE-ALPES

9.1. Identification of agro-industries in Rhône-Alpes

The interesting agro-industries to become a logistic centre in Rhône-Alpes are:

- **Cereal dryer:** the major part of agro-industries is placed along the Rhône/Saône river with an important area of corn cultivation. Along the Upper Rhône River it can also be found some cereals suppliers in this region, but only little cooperatives.
- **Distilleries:** one of the biggest is in Ardèche (South).
- **Tobacco industries:** 3 tobacco industries are sited in the region.

Apart from those sectors, the feedstuff producers and oil extraction industries could also be considered as target if they dedicate one line exclusively to the production of solid biomass.

Other biomass resources suppliers are: cellars (most of the wine industries are in the Saône/Rhône valley since vineyards are concentrated in this part of the territory).

9.2. Identification of biomass resources in Rhône-Alpes

Rhône-Alpes, similar to Auvergne, is a region where the principal available biomass by-product is composed by maize and/or sunflower stalks. This type of biomass is quite abundant in Ain, Drôme and Isère. In the rest of departments this type of biomass is also predominant, but, however, from the perspective of starting a new logistic centre on biomass, it is insufficient. These departments have limited residues produced by agrarian activities.

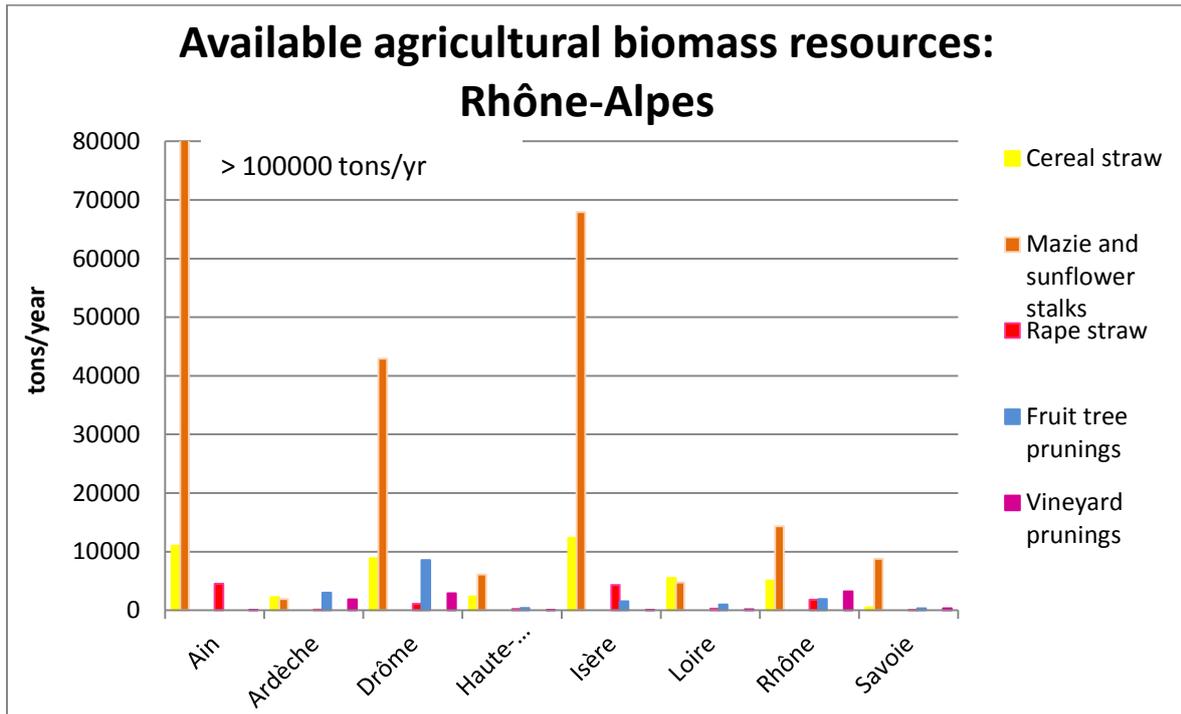


Figure 11: Summary of available agricultural biomass residues in Rhône-Alpes.

Main conclusions in Rhône-Alpes:

- Maize and/or sunflower stalks is definitively the main biomass to be considered for starting a new activity in the distribution of solid biomass products. This is particularly true for Ain, Drôme and Isère departments, which account with important resources. Rest of departments have biomass available under 10 kt/yr, which is insufficient for starting new logistic biomass centres.
- Prunings from fruit trees and vineyard can be an option to be considered when aiming to develop a logistic centre of solid biomass. The amounts available of relevance at regional to be mentioned correspond to Drôme. In some other departments woody biomass from prunings may play a role locally, even though these departments do not account with sufficient biomass resources from the agrarian sector, and so, are quite in principle not targets for SUCELLOG logistics centres.
- Residues from the wine and cereal dryer sector could also be taken into account.

9.3. Localization of resources and agro-industries in Rhône-Alpes

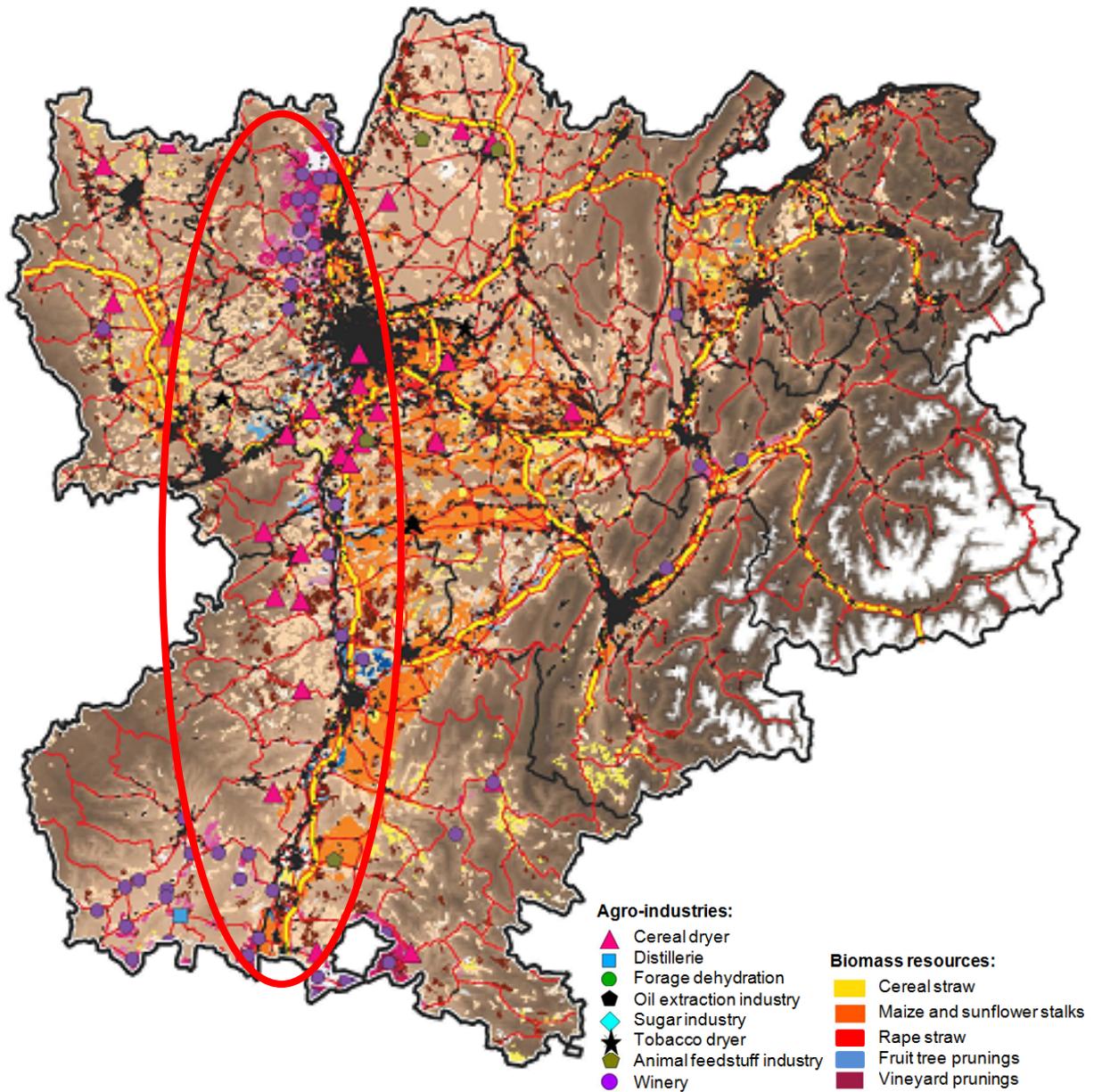


Figure 12: Localization and type of agro-industries and resources in Rhône-Alpes.

9.4. Priority areas in Rhône-Alpes

One potential area for the development of an agro-industry logistic centre has been detected in Rhône-Alpes and is shown in Figure 12. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources and agro-industries and the compatibility among them. Compatibility has been defined according to their seasonality, see Table 8, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 8: Availability of equipment and biomass resources in Picardie.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cereal dryer												
Distillery												
Tobacco dryer												
Cereal straw												
Maize straw and cobs												
Husks and silo dust from cereal dryers												
Grape marc and stems												
Oil extraction residues												
Tobacco residues												
Permanent crop prunings												
Feedstuff residues												

The potential area in this region covers mainly the Saône/Rhône Valley. The production of biomass could be focused on the use of maize straw and fruit tree/vineyard prunings as a complement. Logistic centres could be hosted in the cellars or in cereal dryers where a new line for drying and pelletising should be implemented. Residues from the cereal dryers and feedstuff producers can also serve as a complement for mixed pellets.

The distillery present in the south could diversify its activity conditioning their own residues to fulfill solid biomass standards.

10. Summary of the situation in France

SUCELLOG project has evaluated the six target regions in France (Auvergne, Centre, Champagne-Ardenne, Ile-de-France, Picardie and Rhône-Alpes) in terms of agrarian resources and agro-industry sectors for the development of biomass logistic centres.

Regarding the quantity of available resources, the straw from herbaceous crops (cereal, rape and maize) is the most interesting resource to be taken into account in France. However, to be able to upgrade the quality of the resulting fuel, a woody source should be acquired, being in some regions possible to come from agrarian sources (prunings from vineyards) but in others only forest residues would be available. Residues from the agro-industry could be a complement for a mixed pellet although they do already have a market, which in some cases is even bioenergy (biogas production from sugar or distillery process residues for example).

Concerning the agro-industry sectors, the ones evaluated within the project in France have been: forage dehydration facilities, cereal dryers, sugar industry, distilleries, tobacco dryers, cellars, oil extraction industries and feedstuff producers. All of them have been considered target for the project except the last two, since the extraction industries and the feedstuff producers, even if they have compatible equipment for the production of solid biomass, do work during the whole year having no idle period for this new activity, unless a new line is installed or their current production decreases due to market issues. From the rest, forage dehydration facilities are already a very integrated industry, working in many cases as logistic centres to diversify their activity for the production of animal feed or even to produce woody pellets coming from forest sources. Cereal dryers, due to their vertical drying system, are not really compatible with the majority of available residues in France (with no granulated format) and therefore their strength as logistic centre rely on their handling and storage equipment. In the case of the cellars, they have been included as target, even if they do not own compatible equipment but their easy access to an agrarian woody residue (vineyard prunings) and the interest shown by the sector, makes this particular case interesting for the project.

Potential areas for the development of logistic centres have been identified in all regions except in Ile-de-France which does not imply that it could be not placed in that region. Association among nearby industries should be promoted in France in order to take advantage of the different idle periods and equipment and it won't be a barrier since the agrarian sector is used to it.

For further details please see the document in French "D3.2- Analyses régionales : ressources en biomasse et aires d'action prioritaires en France" prepared by CIRCE in deep collaboration with Services Coop de France.

Annex I: Table of ratios y availability percentage per region

Table 9: Ratios of biomass production (t/ha) in FRANCE per region.

Crop	Auvergne	Centre	Champagne-Ardenne	Ile-de-France	Picardie	Rhône-Alpes
Wheat	3,5	3	3,3	3,3	3,5	3,5
Rye	1	1	1	1	1	1
Barley	3	3,64	3,3	3,3	4	3
Oat	1	1	1	1	1	1
Maize	5	5,9	3,3	3,3	5	5
Rice	2	2	2	2	2	2
Pulses	1	5	2,6	2,6	4,5	5
Tobacco	2,5	-	-	-	-	2,5
Hemp	-	-	-	-	-	-
Rape	2	1,2	2	2	2,5	2
Sunflower	1	2,5	2,5	2,5	2,5	1
Soya	2,7	2,7	2,7	2,7	2,7	2,7
Linseed	1	1	1	1	1	1
Seed_other	1	1	1	1	1	1
Fruit_temp	1,5	1,5	1,5	1,5	1,5	1,5
Fruit_subtrop	1,5	1,5	1,5	1,5	1,5	1,5
Berry	-	1,5	1,5	1,5	1,5	1,5
Nuts	-	1	-	-	-	1,1
Citrus	-	-	-	-	-	-
Olive	-	-	-	-	-	-
Vineyard	3,5	1,5	1,8	-	1,5	1,5

Table 10: Percentage of availability of biomass in FRANCE per region.

Crop	Auvergne	Centre	Champagne-Ardenne	Ile-de-France	Picardie	Rhône-Alpes
Wheat	5	30	14,4	14,4	30	5
Rye	30	30	14,4	14,4	30	30
Barley	30	50	14,4	14,4	30	30
Oat	30	50	14,4	14,4	30	30
Maize	50	5	17,4	17,4	5	50
Rice	-	-	-	-	-	-
Pulses	-	0	0	0	0	0
Tobacco	90	-	-	-	-	90
Hemp	-	0	-	0	-	-
Rape	50	50	50	50	50	50
Sunflower	50	50	50	40	50	50
Soya	70	70	-	-	-	70
Linseed	-	75	75	80	75	-
Seed_other	75	75	75	75	75	75
Fruit_temp	90	90	90	90	90	90
Fruit_subtrop	-	-	-	-	-	-
Berry	-	90	90	90	90	90
Nuts	-	90	-	-	-	90
Citrus	-	-	-	-	-	-
Olive	-	-	-	-	-	-
Vineyard	20	90	90	90	90	20

SUCELLOG: IEE/13/638/SI2.675535

D3.2c Summary of the regional situation, biomass resources and priority areas of action in Italy

1st November 2014



About SUCELLOG project

The SUCELLOG project - Triggering the creation of biomass logistic centres by the agro-industry - aims to widespread the participation of the agrarian sector in the sustainable supply of solid biofuels in Europe. SUCELLOG action focuses in an almost unexploited logistic concept: the implementation of agro-industry logistic centres in the agro-industry as a complement to their usual activity evidencing the large synergy existing between the agro-economy and the bio-economy. Further information about the project and the Partners involved are available under www.sucellog.eu.

Project Coordinator



Project Partners



About this document

This report corresponds to D3.2 of the SUCELLOG project - Summary of the regional situation, biomass resources and priority areas of action in Italy. It has been prepared by:

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Table of contents

About SUCELLOG project	1
About this document.....	1
Table of contents.....	2
List of Tables	3
List of Figures.....	3
1. Introduction	4
2. Agro-industries: profile, barriers and opportunities	5
3. Evaluation of available biomass	9
3.1. Agrarian residues	10
3.2. Other residues:.....	12
3.3. Methodology.....	13
3.4. Results	14
4. Regional Framework of EMILIA-ROMAGNA.....	17
4.1. Identification of agro-industries in Emilia-Romagna	17
4.2. Identification of biomass resources in Emilia-Romagna.....	17
4.3. Localization of resources and agro-industries in Emilia-Romagna.....	19
4.4. Priority areas in Emilia-Romagna.....	20
5. Regional Framework of MARCHE	21
5.1. Identification of agro-industries in Marche.....	21
5.2. Identification of biomass resources in Marche	21
5.3. Localization of resources and agro-industries in Marche	23
5.4. Priority areas in Marche	24
6. Regional Framework of PUGLIA	25
6.1. Identification of agro-industries in Puglia.....	25
6.2. Identification of biomass resources in Puglia	25
6.3. Localization of resources and agro-industries in Puglia	27
6.4. Priority areas in Puglia	28
7. Regional Framework of SARDEGNA	29
7.1. Identification of agro-industries in Sardegna	29
7.2. Identification of biomass resources in Sardegna.....	29
7.3. Localization of resources and agro-industries in Sardegna.....	31
7.4. Priority areas in Sardegna.....	32

8. Regional Framework of TOSCANA	33
8.1. Identification of agro-industries in Toscana	33
8.2. Identification of biomass resources in Toscana.....	33
8.3. Localization of resources and agro-industries in Toscana.....	35
8.4. Priority areas in Toscana.....	36
9. Summary of the situation in Italy	37
Annex I: Table of ratios y availability percentage per region	39

List of Tables

Table 1: Classification of biomass resources in Italy.	10
Table 2: Profile of provinces in Italian target regions according to the prevailing agricultural biomass.....	15
Table 3: Most strategic resources by target region.....	16
Table 4: Availability of equipment and biomass resources in Emilia-Romagna.....	20
Table 5: Availability of equipment and biomass resources in Marche.	24
Table 6: Availability of equipment and biomass resources in Puglia.	28
Table 7: Availability of equipment and biomass resources in Sardegna.....	32
Table 8: Availability of equipment and biomass resources in Toscana.....	36
Table 9: Ratios of biomass production (t/ha) in ITALY per region	39
Table 10: Percentage of availability of biomass in ITALY per region.....	39

List of Figures

Figure 1: Summary of available agricultural biomass residues in Emilia-Romagna. 18	
Figure 2: Localization and type of agro-industries and resources in Emilia-Romagna.	19
Figure 3: Summary of available agricultural biomass residues in Marche.	22
Figure 4: Localization and type of agro-industries and resources in Marche.....	23
Figure 5: Summary of available agricultural biomass residues in Puglia.	26
Figure 6: Localization and type of agro-industries and resources in Puglia.....	27
Figure 7: Summary of available agricultural biomass residues in Sardegna.....	30
Figure 8: Localization and type of agro-industries and resources in Sardegna.	31
Figure 9: Summary of available agricultural biomass residues in Toscana.	34
Figure 10: Localization and type of agro-industries and resources in Toscana.	35

1. Introduction

SUCELLOG focuses on the implementation of biomass logistic centres into agro-industries as complement to their usual activity with minor investments. Agro-industry facilities can be utilised in their idle periods to handle and pre-treat biomass feedstock (mainly from their own residues or agricultural residues nearby) to produce solid biomass to be introduced into the market.

This document shows the results of the work carried out within SUCELLOG WP3-“Regional framework and stakeholders’ engagement” in Italy. During this WP, four main actions were carried out in the project target regions (Emilia-Romagna, Marche, Puglia, Sardegna and Toscana):

- Allocate biomass resources.
- Evaluate with the stakeholders both the technical and the non-technical barriers of the implementation of SUCELLOG concept in the agro-industries.
- Determine the potential areas for the development of agro-industry logistic centres.
- Engage agro-industries to the project.

For the first action, an evaluation of the real potential of primary agrarian biomass has been carried out inside Task 3.1. The methodology selected corresponds to a “Resource focussed approach”, as described by BEE standardised classification (project Biomass Energy for Europe), which starts with statistical data from agrarian inventories. This data has been complemented with the real availability indices (the share of biomass that is not currently being used for other aims including soil sustainability issues) gathered in the regional workshops with the agrarian sector during Task 3.3. As a first result, primary biomass resources have been firstly catalogued according to existing competitive uses and relevance in terms of current unused quantities. This assessment has been performed in by country level since no regional differences has been observed. Secondly, a map of the distribution of real available primary resources and a table of the available tons per year in dry base were built per target region. Even though the use of agro-industry residues is a target of SUCELLOG, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Therefore the maps and tables presented do not include this type of resources, which will be deeply assessed for particular cases of logistic centres monitored or audited during in WP4-WP6.

As a second action, an assessment of the barriers and opportunities for the development of logistic centres was carried out through personal interviews with each target sector in Task 3.2. Existing agro-industries from the potential sectors (those owning compatible equipment for the conditioning and storage of raw material) were asked about: idle periods, residues produced in their facilities and upstream in the crop cultivation, the economic situation of the sector and possible upcoming changes

due to the Common Agricultural Policy, practical and legal incompatibilities in using their facilities for the production of solid biomass, social barriers for the development of this new activity and, finally, opportunities detected. Section 2 presents the situation of the country since no regional differences were appreciated. After this analysis, target sectors were identified per region and specific agro-industry locations were included inside the biomass resource map.

To determine the potential areas inside each target region for the development of agro-industry logistic centres, it has taken been into account the diversity and quantity of available agrarian resources (both woody and herbaceous) and of agro-industries present in the region as well as the compatibility among them. Compatibility has been defined according to their seasonality (matching the months of biomass production with the idle period of the agro-industry) and their technical compatibility of use. Logistic issues such as good communication networks and proximity to consumption areas has also been taken into consideration. Potential areas have been identified per region and are shown in this document. However, it is important to highlight that the selection of a potential area does not mean that an agro-industry non belonging to it could not start a new activity and the opposite. The size of the future logistic centre has not been a limiting factor for the selection of the potential area (even if SUCELLOG target is a production of 10 kt/yr per centre) since no data of the total amount of biomass is available (agro-industry residues missing as mentioned before).

The following sections show the results obtained about the above mentioned issues (passing from a country to a regional perspective). A summary of the situation in Italy is included in the last part.

As a last activity belonging to this WP, workshops and personal contacts were carried out with agro-industries in Task 3.3 with the aim of engaging them to the services offered by the project (technical and decision-making support to become biomass logistic centres). The result of this action is shown in the document “D3.1-Report on engagement actions”.

2. Agro-industries: profile, barriers and opportunities

The main potential agro-industry sectors to become a solid biomass logistic centre in Italy have been evaluated in the following lines, describing the equipment they usually own and their idle period, as well as the residues produced both in the agrarian practice and the production process. Finally the barriers and opportunities they would face when thinking to start this new activity have been identified. The information has been provided through interviews with representative industries of the sector and agrarian experts.

Forage dehydration:

Forage dehydration sector in Italy has an important idle period of 5 months (from November to April approximately) and owns compatible equipment (horizontal dryers, pelletisers and silos). From the 5 regions evaluated in SUCELLOG, they are only sited in the regions of Emilia-Romagna and Marche and normally linked to cereal dryers.

The forage dehydration facilities do not produce any important biomass residue, either in the agrarian or processing phase, meaning that the raw material for the production of solid biomass should be acquired.

Dehydration sector is not really familiar with biomass issues and, although the sector does think that there are no technical barriers to start this new activity within their installations, there is a lack of knowledge on finding possible financial schemes.

Cereal dryers:

This sector shows an interesting potential to become a solid biomass logistic centre from a technical point of view, offering a long idle period of around 7 months (from October to May approximately and depending on the crop) as well as proper equipment such as vertical dryers, screening equipment, silos for storage and transport means. In Emilia-Romagna, some of this type of agro-industry is dedicated to dry seed for sowing, with an idle period from January to May.

Regarding the raw material available for a possible logistic centre, farmers supplying the grain to be dried in the facilities produce important quantities of straw which main market is the livestock feeding or bedding. Depending on the year, a considerable amount of straw is not able to enter the market.

The agro-industry itself produce residues such as the grain that for some reasons do not satisfy the quality /aesthetics requirements to be sold in the market or silo dust (although normally are sold for animal feeding).

In some regions like Marche, the sector reaches high profitability, which together with the natural resistance to innovation and lack of pilot initiatives to demonstrate the feasibility of this kind of projects, the result is a complete lack of interest to start this new activity. In general they situation of the sector in Italy is not the best, not being able to afford large investments in the next years.

It should be highlighted that the vertical dryers of this type of facility are not as versatile as the horizontal dryers that some other sectors own. More concretely they are only compatible with granulated products (as olive pits, milled almond husks, grape pits or any other product with this kind of format).

Rice dryers:

The rice dryer industry has an idle period of around 9 months (from December to August approximately) and counts with vertical dryers presenting an interesting synergy to become a logistic centre. From the 5 target regions in Italy, only Emilia and Sardegna have rice dryers.

In what concerns the residues associated to this type of agro-industry, the straw is not harvested due to the technical difficulty of working in waterlogged areas in which rice is produced, being normally burnt or left on the soil for the conservation of their physical and chemical fertility. Regarding the residues from the agro-industry, husks are normally burnt due to the disposal cost associated. Broken grains obtained during the rice processing are sold as feedstock for animals.

Although no technical barriers for the development of a logistic centre in a rice dryer has been detected, the resistance to innovation and the extreme reluctance to perform investment from the agro-industries should be overcome to start this new activity in this sector. As it was mentioned in the case of the cereal drier, the vertical dryers that rice sector owns are only compatible with granulated raw material.

Tobacco dryers:

The agro-industry of the tobacco remain open the whole year but their dryers have an idle period of 7 months per year (from January to August approximately) presenting a good opportunity to become a biomass logistic centre from the technical point of view.

From the 5 Italian regions studied in the project, the sector is on present in Toscana region with small and medium producers that own dryers. Generally there are two kinds of producers: bright and black tobacco. The dryer devices are really different between the two kinds of tobacco: Black tobacco is dried with wood fired dryers while the bright virginia tobacco (cigarette tobacco) with gas-fired dryers. The idle period of the plant is from and the plants size are small-medium.

The agrarian practice of the tobacco generates residues stalks that are left on the soil and which could be studied as a possible biomass source.

The tobacco producers showed interest in the project but they have some restrictions from main buyers of tobacco which are big international companies. They do not allow the tobacco industries to use dryers for different purpose, therefore they will not be considered as a target industry of the project.

Wine sector:

The wine sector includes the cellars and the distilleries, the latter processing the residues obtained from the cellars. From both, it is only the distilleries the ones owning equipment (horizontal dryers) compatible with the production of solid

biomass. The idle period of these dryers in the distilleries is approximately from April to December (8 months).

The most important opportunities in the wine sector are the availability of biomass and their problems on disposing their residues.

Regarding the residues produced in the field, grape stems are mulched and spread on the soil. Prunings are most commonly burnt or left on the soil although some new initiatives are starting to use it as biomass source. Actually, from June 2014, the Decreto Sbloca Italia allows the burning of prunings of any crop (selecting the dates each municipality). The main barrier the sector appreciates when trying to make profit of their prunings is the high investment costs for harvesters, not sustainable from a single farm and the lack of a proper structure (consortium or association) responsible for the collection. In many situations, it is impossible to perform a mechanized harvesting due to the high slope of the land.

The residues produced in the cellars are sent to distilleries according to Italian laws. The residues from the distillation process are used for biodigestion or energy combustion.

The sector does not appreciate a technical barrier but investments should be carefully studied.

Olive oil sector:

The olive oil sector includes oil mills and oil pomace extraction industries. Similarly to the wine sector, the latter is processing the residue obtained in the oil mills owning horizontal dryers and pelletisers for this purpose. Even though the idle period is reduced, it is considered an interesting sector to develop a biomass logistic centre due to the capacity of using its own residues and to the idle period of 8 months approximately (from April to November).

Regarding the residues produced in the oil mill: the olive pits are currently being sold as solid biomass and the olive pomace is used for biogas production or as animal feedstuff. In some cases the latter is sold to the olive pomace processing industries, which after the extraction of the remaining oil produce also a residue (used for animal feeding or biogas production).

During the agrarian phase, the olive orchards produce important amounts of prunings to be transformed in high quality biomass enforcing this sector as a potential solid biomass logistic centre. The sector has shown a high interest due to the high costs for disposal of cultivation residues and sees no technical obstacle in the implementation of a logistic centre. However, the high investment cost for harvesters is the main barrier to deal with, fostering the creation of a structure responsible for the collection. Actually, from June 2014, the Decreto Sbloca Italia allows the burning of prunings of any crop (selecting the dates for this burn each municipality).

Technically they do not see any trouble for initiating a new activity as logistic centre. Additionally, it should be pointed out that the oil pomace industries are not currently in their best moment, due to the economic profitability of the extraction. There are also important social problems linked to the smell of the pomace. Therefore, SUCELLOG can be a good opportunity for the sector to know their possibility to diversify their activity.

Sugar industry:

The sugar industry presents, on the one side, an important idle period of 8 months which goes from November to July approximately and, on the other side, compatible equipment for the production of solid biomass such as horizontal dryers and generally also pelletizers. From the 5 regions evaluated by SUCELLOG in Italy, sugar industries are only present in Emilia-Romagna and currently are closed due to the fact that sugar beet cultivation is no more competitive with the brown sugar.

In the sugar industry, dryers and pelletiser are used in the production of beet pulp cake, a by-product from the sugar production, which is highly appreciated by the livestock sector. The sector does not produce residues during the agrarian practice to be taken into consideration.

Even if there is not activity in this sector at the moment, SUCELLOG considers that it can be a good opportunity for these companies to replace their activity and become a logistic centre and therefore have been included in this report.

3. Evaluation of available biomass

SUCELLOG considers that the development of agro-industry logistic centre should rely on agrarian biomass coming both from the agrarian practices (like straw or prunings) and from the agro-industry process (for example distilleries residues). The fact is that, for the first case, agro-industries have already a network with farmers providing the raw feedstock to be processed. For the second case, the use of their own residues is the opportunity to reduce their fuel consumption or avoid the cost of disposal if there is no market for it. Quantifying the biomass resources up-stream and down-stream the agro-industry is the object of this section since it is strategic for establishing new commercial relations with usual providers and clients.

A study about the available biomass resources has been performed, focusing in the agrarian biomass since it was not possible to have data about the production of agro-industries residues per region/country. When talking about availability of the residue, it is meant the amount of resources that do not have a market or that is not left on the soil to improve organic content, therefore having the opportunity to be used for energy purposes. Three examples to explain what availability is (see more detail about the methodology of work in section 3.3 and availability percentage in Annex I):

- If a farmer, after taking the wheat grain, leaves the straw on the soil due to agrarian recommendations then availability should be considered 0%.
- On the contrary, if the farmer leaves the straw on the soil just because the cost for harvesting does not cover the value in the animal feed market then availability is 100%.
- It can also happen that in one region the 40% of the straw is commercialized for animal feed (so it has a market), a 20% is left on the soil as a recommended agrarian practice. Therefore, 40% of the straw is available for other uses like the production of solid biomass.

3.1. Agrarian residues

Biomass resources can be catalogued in several groups in the Italian target regions, according to next two criteria:

- Competitiveness: existing competitive uses
- Amount of available biomass: relevance in terms of current unused quantities

From this scope, agricultural biomass resources in Italian target regions can be catalogued in average as next:

Table 1: Classification of biomass resources in Italy.

Criteria		Biomass resources
Competitiveness	Available unused biomass	
Competitive uses make biomass unavailable for energy	None	Fibre crops
Many competitive uses	Some source still available	Wheat and barley straw in Emilia-Romagna and Marche Fruit tree pruning wood.
Some competitive uses	Important source still available	Rest of cereal straw, maize and sunflower stalks. Pruning wood from rest of fruit types, nuts, cherry, citrus, olive. Vineyard pruning in Emilia Romagna.
Few or non-competitive uses	Relevant resource available	Pruning wood from vineyard except Emilia Romagna.
Some or few competitive uses	Marginal local amounts (may play a role in a singular facility)	Tobacco stalks, rape straw.
None due to preferred integration as soil input for organic matter	None	Leguminous plants
None due to technical barrier to be collected	None	Rice straw

As observed, in general, the resource with lowest risk derived from competitive uses is vineyard pruning wood in all regions but in Emilia Romagna, where it is reported to be already part of this wood in use.

There is a group of agricultural residues which are still available in important amounts and which still have not many competitive uses: the agricultural prunings. Woody biomass has been reported to be usually used for energy, and so considered that half of the potential is available for new uses. This biomass without use is currently burned or left in field due to management difficulties (distance from roads, slopes, poor accessibility). Integration into the soil is done more rarely, and in some crops like vineyard in Emilia Romagna, Marche, Puglia and Toscana integration into the soil is avoided to preserve the propagation of some plant diseases. Regarding energy use, its woody structure is an advantage for the preparation of solid biomass commodities, usually with better quality in terms of quality composition and suitability for existing energy conversion systems compared to herbaceous residues. However, starting new chains from prunings may involve the challenge of local farmers to start a new logistic chain, even though, as said, some of them are currently running.

In general, other group with important resources and with only moderate competitors for the resources are maize, sunflower and soya stalks. Maize is currently used for cattle bed, animal feed and incorporation to the top-soil as source of organic matter. Sunflower is mostly being utilised for the top-soils. In contrast, soya is being used for animal feeding. Integration into the top-soil is voluntary and/or done in ecological farming but in some areas it is just the way to manage the residue in the easiest way.

Rest of herbaceous biomass is comprised by cereals. In case of oat and wheat straw, it is usually also utilised for cattle feeding, and therefore is less available in few regions like Emilia Romagna and Marche. Wheat also is demanded in some areas by the pulp and paper industry. When biomass is not utilised it is just bunt on the fields to be disposed in forms of ash. Sorghum is a similar case to winter cereals in terms of management, and can be locally of relevance.

There are other minor residues like tobacco stalks that can be locally interesting for future logistic centres as complement to the main feedstock, as it has been seen in Toscana.

In the group of not principal crops, and no availability of resources, two main cases have been observed: leguminous plants and fibre crops. In the case of residues from leguminous plants, they are usually integrated into the top-soil because they provide nitrogen to the soil, so farmers can save money on fertilizers (nitrogen supply is used for the rotation with winter cereals). About fibre crops like hemp and line seed (flax), they produce very little significant straw (short fibre and shaves). In the past was used for domestic heating, now has a market for many uses, including green building.

Rice straw shall not be considered as a possible resource due to its difficulty to be harvested in waterlogged, being usually integrated into the field as amendment or even burnt.

3.2. Other residues:

Even though in SUCELLOG a comprehensive list of agro-industries has been compiled by region, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Agro-industry residues are interesting in the case of the oil, wine and nut fruit sector because of their amount, while in the case of the cereal, rice and feedstuff sector, for example, these residues could be a complement in the production of the solid biomass since their production is not of significance in amount. The use of agro-industry residues is a target of SUCELLOG, but its actual use will be decided for the particular cases of logistic centres monitored or audited during WPs 4, 5 and 7. There, the local reality and capacity of neighbour facilities to become reliable biomass suppliers will be assessed.

Even though the potential has not been estimated, a general idea of the possible key residues from agro-industries is presented in the next lines at a country level since no data about availability can be provided by region.

In the wine industry it has been identified that grape stalks and skins are fully available and can provide important amounts in Puglia, Sardegna or Toscana. Competitors are currently biogas plants (grape skins), cosmetics (skins and grape seeds) and pharmaceutical industries.

Agro-industry residues still with not much competitive uses (it can be considered that half of the potential is available), is olive pomace, reused as a fuel (only cake from oil mill three phases) for biomass power plants, soil amendment (seldom) and livestock feed.

There are other residues from the agro-industry that, even they have already a market, some amounts are still available. So, they may be a source locally, and contracts may be feasible. Rice husk is used for poultry bed but some part is also burnt due to the lack of alternative market. Fruit kernels and shells can be locally important, but they are as well quite utilised.

Other residues have been observed to be fully utilised by other sectors. In the sugar industry, sugar beet molasses and pressed beet pulp is mostly used for animal feed, or inside the industry, as a source of energy to supply energy demands.

With respect to forestry biomass, SUCELLOG has not carried out any specific assessment since the project is focused on fostering agricultural residues as a source of solid biomass. However, the feedback obtained from the target regions shows that forestry residues may be at the reach of future logistic centres, and can

be an option in few provinces for upgrading the properties of biomass mixtures to be commercialised. Biomass directly from forestry exploitation for energy purposes can be done under the framework of regulated forestry management plans but it has been considered that it is not a source for the short-time term in SUCELLOG. Residual biomass from sawmills can be considered in the very local scope, since usually is completely sold for other existing uses.

3.3. Methodology

An analysis performed by regions instead of by resources is carried out in section 4. Biomass assessment in the present work involves the study of 5 regions of Italy, adding a total area of 98.234 km², about 33% of the total area of Italy. For this scale of work the use of existing data from inventories was needed as an input data source. The aim of the approach is to provide a framework of the available sources in the region. It is not aimed to be the specific biomass assessment for a facility, which will be object of task 4.2, and which requires other type of approaches.

The methodology selected corresponds to a “Resource focused approach”, as described by BEE standardised classification (see project BEE). It starts with statistical data from agrarian inventories, and complemented with the availability indices and utilization for soil preservation leads to a technical potential, including soil sustainability issues.

The method followed is based on ratios of residual biomass production per hectare of cultivated area (tons of residue per hectare). The use of ratios is a widespread methodology for biomass assessments, appropriate for both large and small scale. The main issue is to account with reliable inventories and ratios. By multiplying the cultivated area (ha) by the ratios (t/ha) the theoretical potential is obtained:

$$\text{Biomass Potential [t]} = \text{Ratio [t/ha]} * \text{Area [ha]}$$

The methodology used here brings a step forward in the country analysis by including the competitiveness for biomass resources. For that purpose it is necessary to know the share of biomass that is currently being used for other aims, and that will be considered as not available for the present study. The availability index (I_{AV}) expressed as percentage is defined as next:

$$I_{AV} = 100 - I_{COMPET} - I_{SOILS}$$

Where :

I_{COMPET} : is the percentage of the total biomass in a region that other uses (power plants, cattle, industry) already are using.

I_{SOILS} : is the percentage of total produced biomass that remains in the soil. E.g.: if farmers prefer to leave part of the straw as soil organic amendment.

By using these indices it is possible to obtain the final biomass available by doing next operation:

$$\text{Available Biomass [t]} = \text{Potential Biomass [t]} * I_{AV} = \text{Ratio [t/ha]} * \text{Area [ha]} * I_{AV}$$

The data sources have been obtained as next:

- **Agricultural areas:** the biomass has been calculated on the base S2Biom project land areas (www.s2biom.eu) given by NUTs3 (Italian provinces), in order to have same base units than ongoing referential projects like S2Biom is. Since NUTs3 is a too large scale for the purposes of the SUCELLOLOG work, the biomass obtained by NUTs3 has been downscaled at LAU2 (former NUTs5) geographical resolution (Italian municipalities), by assigning each LAU2 unit a biomass share proportional to the area occupied by crop type.
- **Land distribution:** Corine Land Cover version 2006. Biomass per municipality has been allocated to land parcels actually used for agriculture
- **Ratios and availability indices:** a specific work has been carried out by region. For each region ratios have been obtained from direct contact with specialists and cooperatives, and in few cases, complemented with literature. The purpose of this effort has been to use ratios and availability indices representing the reality of the region, and not just ratios found in literature. The workshops done in task 3.3 have served to include the feedback from the sector to improve the final datasets. Ratio and availability percentage are shown in Annex I.

3.4. Results

In order to present a very fast scope of the situation and balance among woody and herbaceous biomass in Italy, next table shows where they are predominant or comparable in order of magnitude. It may serve as a very first fast feedback on the reality.

Table 2: Profile of provinces in Italian target regions according to the prevailing agricultural biomass

Region	Emilia Romagna	Marche	Puglia	Sardegna	Toscana
Herbaceous predominant	Bologna, Ferrara, Modena, Parma, Piacenza, Reggio Emilia	Fermo, Macereta, Pessaro e Urbino	---	---	---
Herbaceous similar to woody	Forlì, Secena, Ravenna, Rimini	Ancona, Acoli Piceno	---	Carbonia-Iglesias, Medio Campidano, Cagliari, Oristano, Sassari	Arezzo, Livorno, Lucca, Pisa, Pistoia, Prato, Siena
Woody predominant	---	---	ALL	Oligastro, Nuoro	Firenze, Massa Carrara

Next table classifies provinces according to the most strategic resources for SUCELLOG.

Table 3: Most strategic resources by target region.

Region	Cereal straw	Maize + Sunflower straw	Olive + Fruit + Vineyard prunings	Others
Emilia Romagna	Possible complement in all	ALL, but really significant resources in Ferrara (mainly), Bologna, Modena, Piacenza.	Ravea and Regio Emilia (as complement). Rest may be locally of interest.	Soya in Ferrara In Bologna possible complement
	Rimini and Forti Secena account with scarce resources, and so, are not considered in the analysis of biomass			
Marche	Macereta (Ancona and Pessaro e Urbino less than 6 kt/yr)	Macereta and Ancona (Pessaro e Urbino, as complement)	Ascona as complement. Rest only locally.	---
	Province with largest potential reaches a moderate value, about 17 kt/yr. The size of the biomass resources must be taken into account when reading this table for Marche. Fermo and Ascoli Piceno have total available biomass about 10 kt in total. They are not considered in the analysis for simplification			
Puglia	As complement in Foggia and Bari	---	ALL (mainly Lecce, Foggia, Bari and Brindisi)	---
Sardegna	Cagliari and Sassari	Oristano and Sassatri (as complement)	ALL	Rice straw in Oristano (only as complement)
	Province with largest potential reaches a moderate value, about 16 kt/yr. The size of the biomass resources must be taken into account when reading this table for Sardegna. Carbonia-Iglesias, Medio Campidano, Ogliastra, Olbia-Tempio and Nuoro account with scarce resources, and so, are not considered in the analysis of biomass.			
Toscana	Arezzo, Pisa, Siena (but not as sole main feedstock in logistic centres). Complement in Firenze.	Arezzo and Pisa (not as main unique feedstock in logistic centres). Firenze and Siena can be a complement	Firenze and Siena. In Arezzo and Pisa can be a complement.	Tobacco stalks (Locally in Arezzo and Siena)
	Several provinces with potential quite under 10 kt/yr: Livorno, Lucca, Massa-Carrara, Pistoia and Prato. They are not taken into account for the analysis			

4. Regional Framework of EMILIA-ROMAGNA

4.1. Identification of agro-industries in Emilia-Romagna

The interesting agro-industries to become a logistic centre in Emilia-Romagna are:

- **Cereal dryers:** There are around 100 agro-industries belonging to this sector spread in the whole region.
- **Forrage dehydration:** 12 industries in the territory of Ferrara, Bologna and Ravenna.
- **Rice industry:** only 3 industries located in the region, being the main one located in Ferrara province in the most important rice production area of the region.
- **Sugar industry:** 2 agro-industries in Bologna province stopped their activity since last year. Even though they are considered as target industries for SUCELLOG.
- **Distilleries:** 27 sites spread in the whole region.

The agro-industries identified as biomass resources suppliers are, apart from the ones above producing residues, the oil mills (at least 6 in the region) and the cellars (264 sites).

4.2. Identification of biomass resources in Emilia-Romagna

Emilia Romagna is, among the target regions of SUCELLOG project in Italy, the region with the largest amounts of available biomass. It has been estimated that non-used agricultural biomass adds almost 300 kt/yr, 80% coming from annual herbaceous crops and 20% from permanent crops pruning. Emilia Romagna profile as region is as next: most of provinces the predominant biomass type is herbaceous, mainly from maize. In contrast, Forlì, Secena, Ravenna and Rimini the potential from herbaceous and woody biomass is similar in order of magnitude. However several provinces account with scarce resources, as Rimini and Forlì Secena, and so, the possibilities to start logistic centres may be limited due to the quantity of biomass.

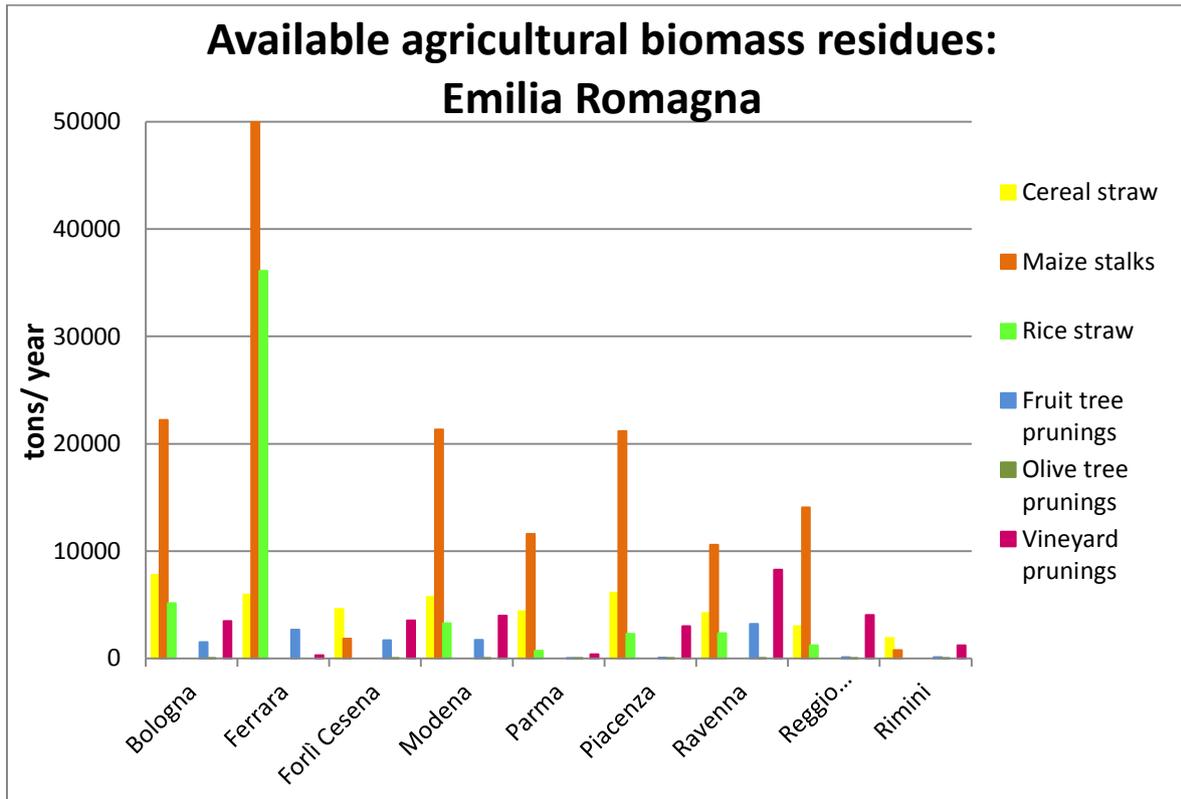


Figure 1: Summary of available agricultural biomass residues in Emilia-Romagna.

Main conclusions in Emilia-Romagna:

- The main resource of this region is the herbaceous straw, mainly maize straw available in large quantities and still with not major competitive uses. Cereal straw can be a complement to the production of solid biomass commodities, being the second resource in relevance in most provinces. However always with a provincial potential under 10 kt/yr.
- Remarkable is the straw from soya, which is quite relevant in Ferrara, and would allow new biomass chains based on it as main feedstock.
- Woody residues from vineyard and fruit tree pruning are available in interesting amounts in all provinces, even though always under 10 kt/yr, and so, to be considered as a possible feedstock to improve the properties of the biomass product prepared in the agro-industry logistic centre.
- Industrial by-products such as husks, broken grain and dust (from cereal and rice dryers) as well as distillation production residues, cellars and oil mills should be also taken into account. Grape stalk and skins are also available in the region, and may be locally interesting in areas with activity in wine production.

4.3. Localization of resources and agro-industries in Emilia-Romagna

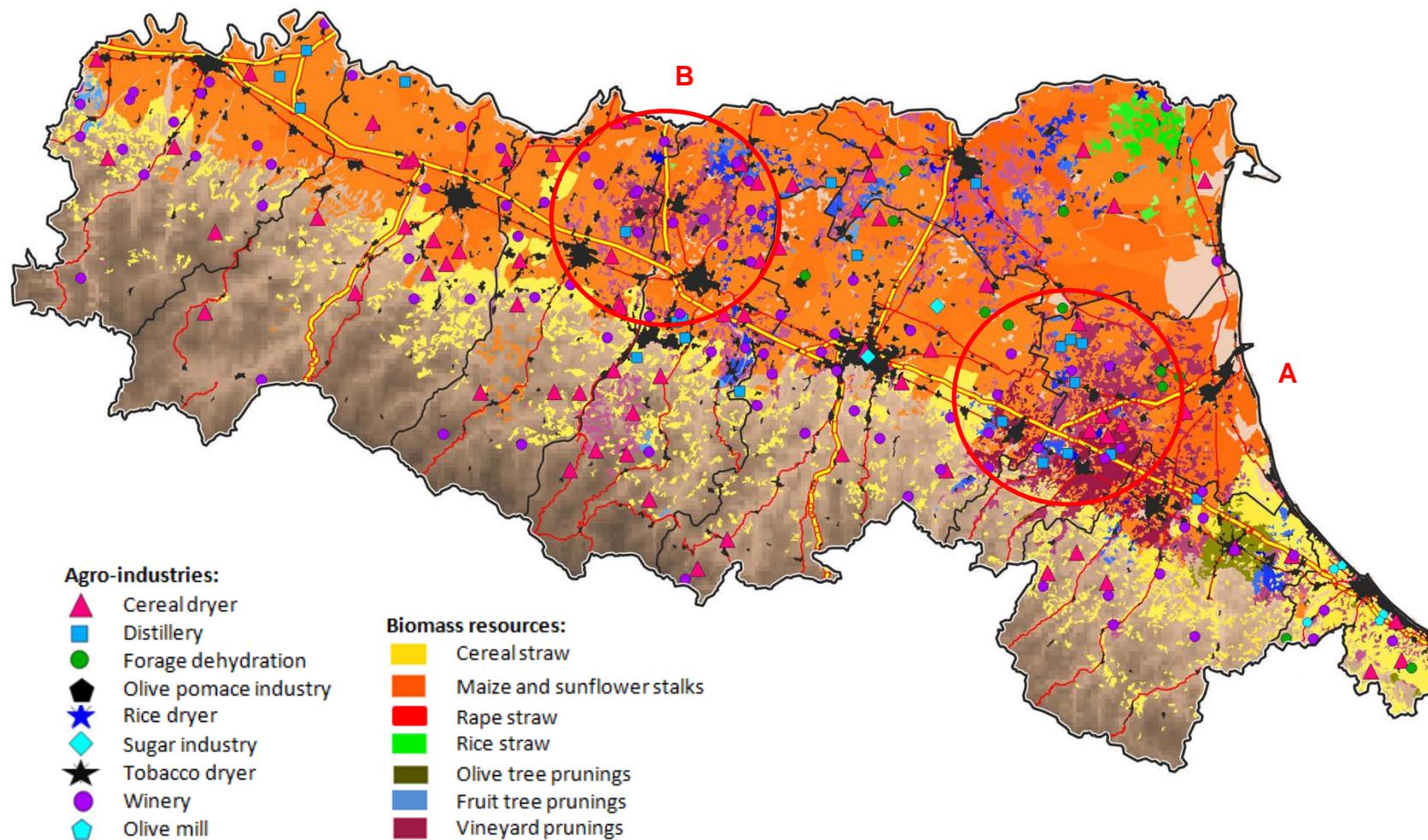


Figure 2: Localization and type of agro-industries and resources in Emilia-Romagna.

4.4. Priority areas in Emilia-Romagna

Potential areas for the development of an agro-industry logistic centre have been detected in Emilia-Romagna and are shown in Figure 2. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both herbaceous and woody) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 4, and their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also been taken into consideration.

Table 4: Availability of equipment and biomass resources in Emilia-Romagna.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forrage dehydration												
Distillery												
Cereal dryer												
Rice dryer												
Sugar industry												
Cereal straw												
Maize straw and cobs												
Soya straw												
Permanent crop prunings												
Husks and silo flour from cereals												
Rice husks												
Grape marc and stem												
Grape pits												
Olive pits												

The possible synergies in this region are several and the network connection favours good logistic conditions. However, below are shown the most interesting potential areas of Emilia-Romagna and their main following characteristics:

- **Area A:** this area presents an important diversity of agro-industries and feedstocks as well as good transport connection. More concretely, the most interesting synergy has been found among the forrage dehydration industry and the processing of permanent crop prunings coming mainly from the vineyards. Maize and cereal straw could serve as a complement for a possible mixed pellet.
The distilleries in the area could also become logistic centre conditioning their own residues to reach quality standards or it could be acquired by the cereal driers for that purpose.
- **Area B:** this area presents more availability of herbaceous crops compared to Area A, specially maize straw that could be processed in the forrage dehydration and distillery to produce a pellet. For the upgrading of quality, woody resources from fruit and vineyard prunings should be considered since

their availability is important. Residues from cereal and rice dryers could also be considered as a complement.

5. Regional Framework of MARCHE

5.1. Identification of agro-industries in Marche

The interesting agro-industries to become a logistic centre in Marche are:

- **Cereal dryers:** 44 dryers are spread in the whole region being important the area of Ancona-Monte Conero.
- **Forrage dehydration:** there are 6 agro-industries developing this activity in the region located all in the province of Pesaro-Urbino.
- **Distilleries:** 6 industries are present in the region, being the most important located in Ascoli Piceno.

The agro-industries identified as biomass resources suppliers are, apart from the ones above producing residues: cellars (are concentrated in the area of Jesi-Manterata Spontini) and oil mills (78 industries, mainly located in the area of Fermo and Ascoli Piceno).

5.2. Identification of biomass resources in Marche

Available agricultural biomass is estimated in Marche to be about 70 kt/yr. Main sources for biomass are the annual crops, specially in Ancona, Macereta, and Pessaro e Urbino. Woody biomass is not relevant enough for establishing new logistic centres as some size running on them, but can be a good complement specially in Ancona and Acoli Piceno provinces. The balance between herbaceous and woody available biomass is, like in the case of Emilia Romagna, in a relation 80 / 20 % respectively.

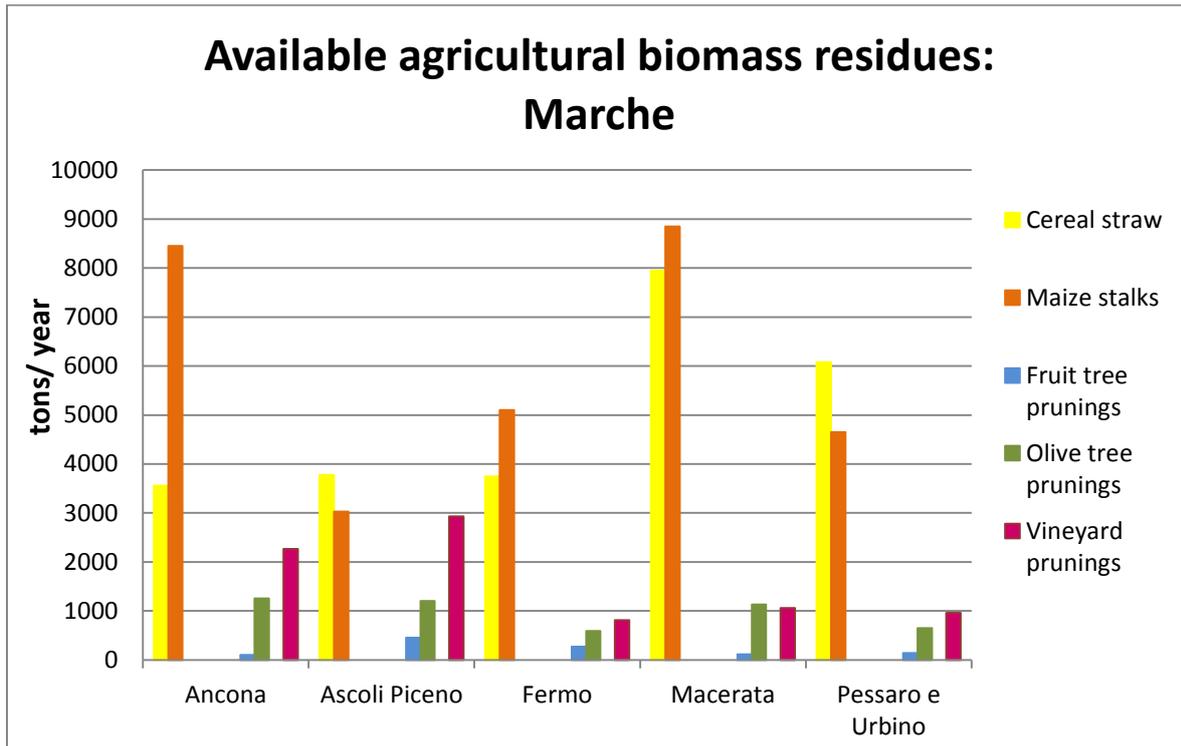


Figure 3: Summary of available agricultural biomass residues in Marche.

Main conclusions in Marche:

- The most important resources in Marche are cereal straw, and maize and sunflower stalks, accounting for more than 55.000 tons/year. This resource is predominant over the rest of agricultural biomass types in Fermo, Macerata, and Pessaro e Urbino. In these provinces the amounts range from 8 to 18 kt/year. Therefore there is not, a priori, much room for implementing several logistic centres running on this feedstock type
- Vineyard and olive tree prunings, although not so important in quantity, could be a good woody resource for an upgrading of the solid biomass quality. In general its amount ranges from 1.5 to 5 kt, and therefore to be used as complement, not as main feedstock.
- Residues from the agro-industry of the cereal dryers, cellars, oil mills and distilleries should also be considered. Also grape stalks and skins in the wine producing areas.

5.3. Localization of resources and agro-industries in Marche

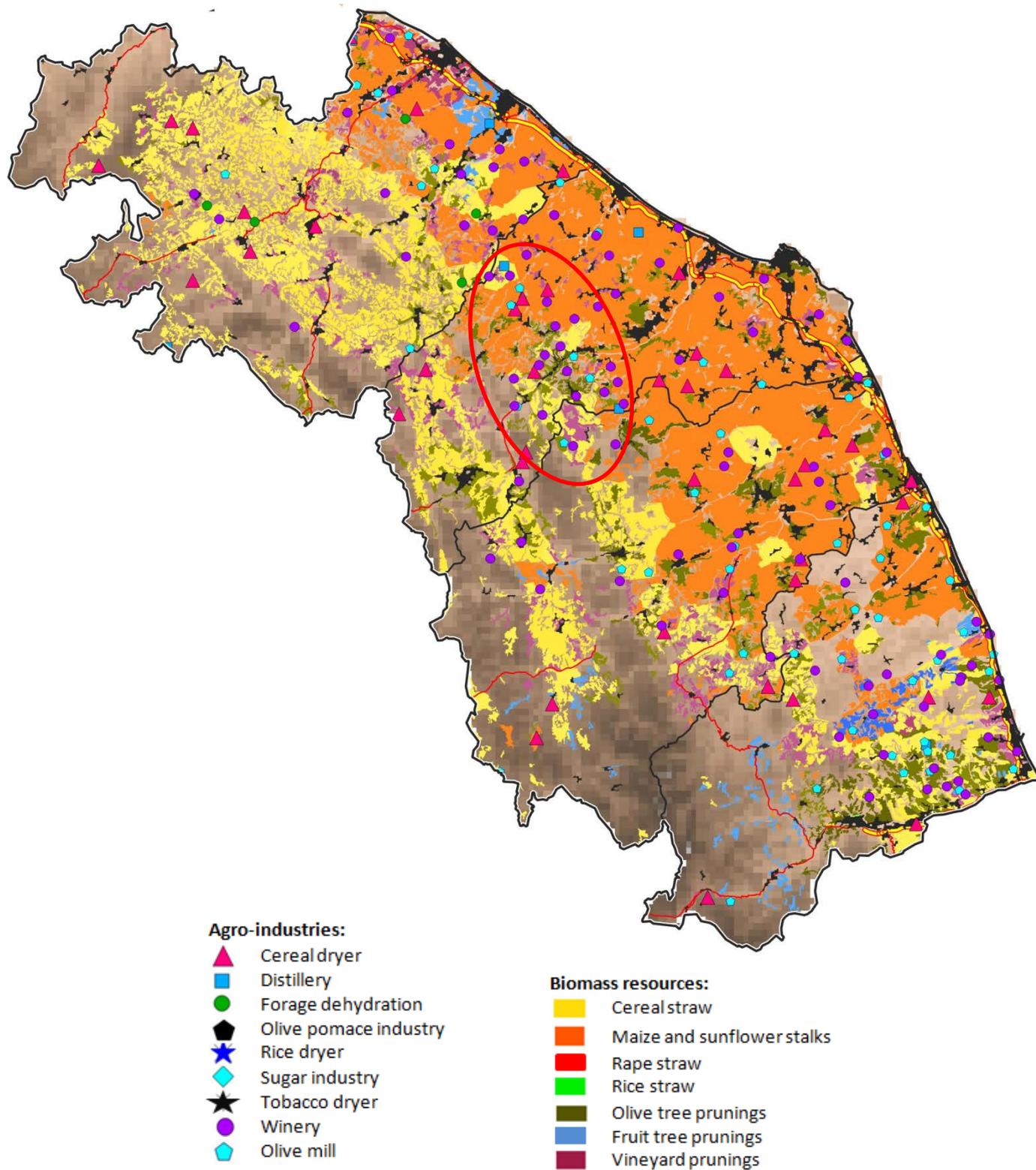


Figure 4: Localization and type of agro-industries and resources in Marche.

5.4. Priority areas in Marche

Potential areas for the development of an agro-industry logistic centre have been detected in Marche and are shown in Figure 4. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both herbaceous and woody) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 5, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also been taken into consideration.

Table 5: Availability of equipment and biomass resources in Marche.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forrage dehydration												
Distillery												
Cereal Dryer												
Cereal straw												
Maize straw and cobs												
Pruning from permanent crops												
Husks and silo flour from cereals												
Grape marc and stem												
Grape pits												
Olive pits												

In the region of Marche the area which shows the highest potentiality for the creation of the logistic centre has been detected. The area of Jesi-Manterata Spontini presents woody resources from the vineyard and olive tree prunings that could be processed together with the straw (from maize and cereal) in the distilleries of the zone. Cereal dryers could also condition the olive and grape pits produced in the zone. Although the area is small, the road network is sufficiently developed to supply to the agro-industries sited nearby which are potential biomass consumers.

6. Regional Framework of PUGLIA

6.1. Identification of agro-industries in Puglia

The interesting agro-industries to become a logistic centre in Puglia are:

- **Oil pomace industries:** even though there are around 600 oil mills in the region, only 4 oil pomace industries are present (2 in Bari, 2 in Lecce).
- **Distilleries:** there are 11 industries in the region being the most important the one located in the area of Foggia-San Severo.

The agro-industries identified as biomass resources suppliers are, apart from the ones above producing residues: cellars (a total of 218 in the region) and oil mills (being Bari and Lecce the most important region on olive oil production).

6.2. Identification of biomass resources in Puglia

Puglia is by far the region with the largest amount of woody residues available. As a matter of fact, in all of its provinces woody residues are predominant over herbaceous. The amounts are quite significant, meaning about 260 kt/yr in the region. Woody residues from prunings amount for 90% of the resources. The prunings of olive tree, fruit tree, vineyard and citric represents around 230 kt/year of biomass. All provinces have sufficient biomass potentials to allow the penetration of new biomass transformation and distribution activities. Since it has been stated that residues from the wine and olive production industries are quite available, it must be highlighted that residues like grape stalks and skins and olive pomace may be of relevance and should be taken into consideration.

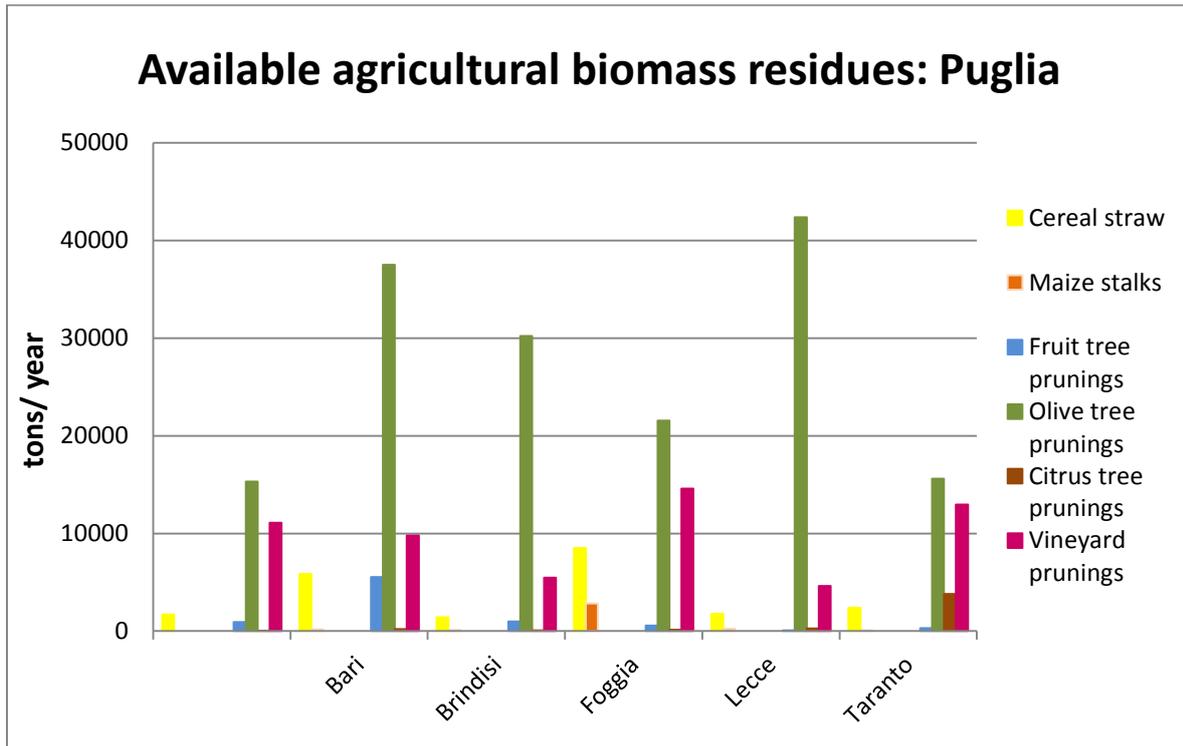


Figure 5: Summary of available agricultural biomass residues in Puglia.

Main conclusions in Puglia:

- Prunings from vineyard and olive tree becomes the most interesting raw material for the production of solid biomass. They are the largest source for biomass, and all provinces account with sufficient residues of this type.
- Residues from herbaceous crops (straw from cereals mainly) could be considered a feedstock to be evaluated locally, since in none of the provinces the potential gets over 10 kt/yr.
- Agro-industry residues from oil pomace industries, wine industries, cellars, oil mills and distilleries should also be considered as interesting biomass resources.
-

6.3. Localization of resources and agro-industries in Puglia

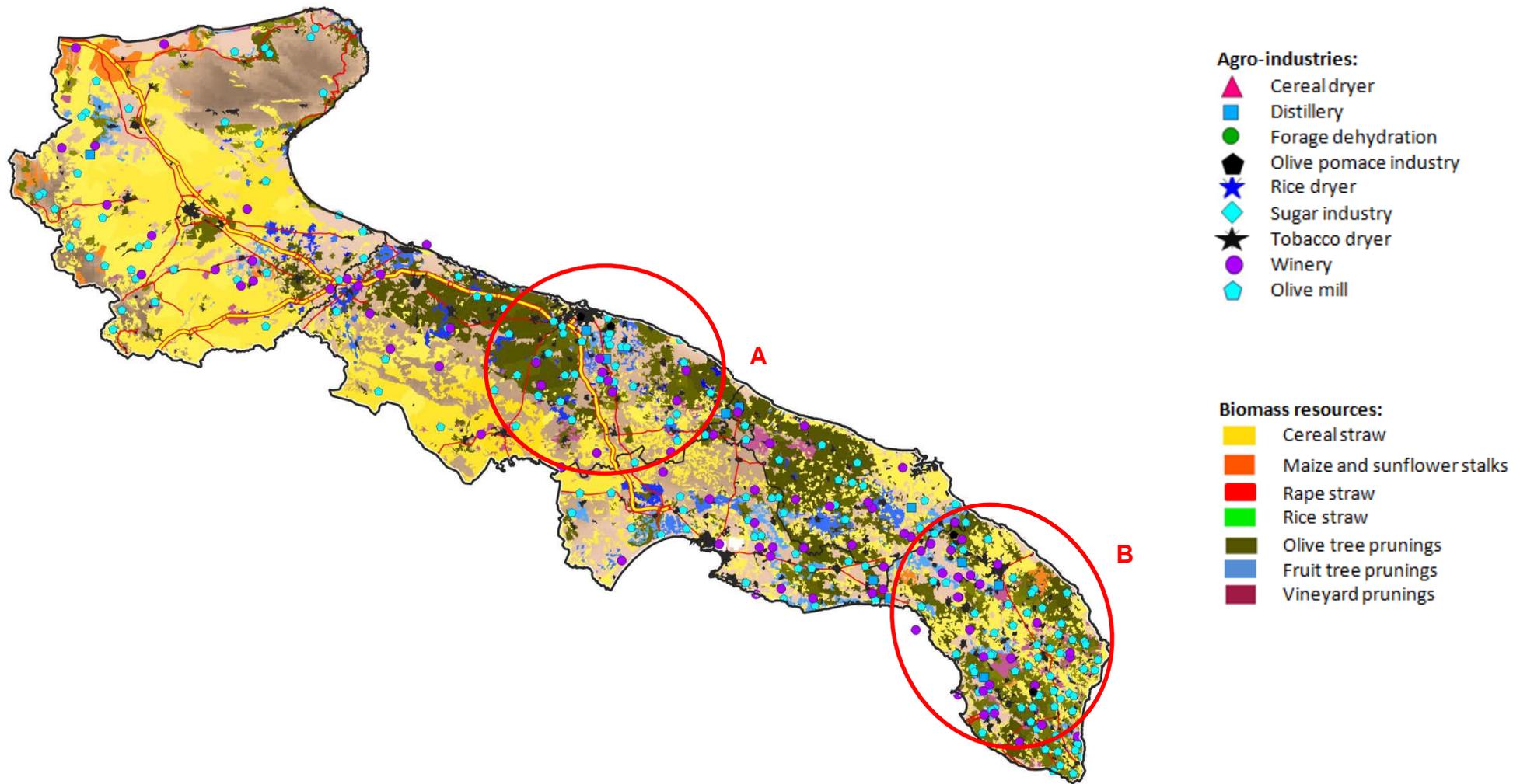


Figure 6: Localization and type of agro-industries and resources in Puglia..

6.4. Priority areas in Puglia

Potential areas for the development of an agro-industry logistic centre have been detected in Puglia and are shown in Figure 6. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both herbaceous and woody) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 6, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 6: Availability of equipment and biomass resources in Puglia.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Distillery												
Oil pomace industry												
Cereal straw												
Maize straw and cobs												
Pruning from permanent crops												
Rice husks												
Grape marc and stem												
Grape pits												
Olive pits												
Olive oil pomace												

The two potential areas in Puglia present the same characteristics:

- Olive tree prunings is the main agrarian resource to be used when producing solid biomass (chip or pellet format). In the case of producing a mix pellet, straw can be used as a complement.
- Distillery and oil pomace industries could become an agro-industry logistic centre. Olive prunings should be stored till April, which seems not to be an inconvenient due to the favourable climate conditions of the region.
- Oil mills appear to be the best possible consumers of biomass and the road connection for their supply is optimum.

7. Regional Framework of SARDEGNA

7.1. Identification of agro-industries in Sardegna

The interesting agro-industries to become a logistic centre in Sardegna are:

- **Rice dryers:** There is only one big industry in Arborea region, where the production of rice of the island is located.
- **Distilleries:** Oristano area is hosting the majority of the alcohol production in the 23 distilleries of the region.

The agro-industries identified as biomass resources suppliers are, apart from the ones above producing residues: cellars (a total of 109 in the region) and oil mills (around 80 sites).

7.2. Identification of biomass resources in Sardegna

Sardegna total available biomass resources from the agriculture amount for 70 kt/yr. The resources from prunings and herbaceous crops are approximately the same in quantity, being the former slightly higher. When observing the amounts per province it is observed that only 3 of them have more than 10 kt of residues: Cagliari, Oristano and Sassari. The profile of the provinces is different in terms of the biomass. Whereas Oligastra and Nuoro have a predominant abundance of woody pruning biomass, in the rest the amounts from herbaceous and woody resources are of similar magnitude. For the analysis, the case of provinces with small amounts of resources is not considered.

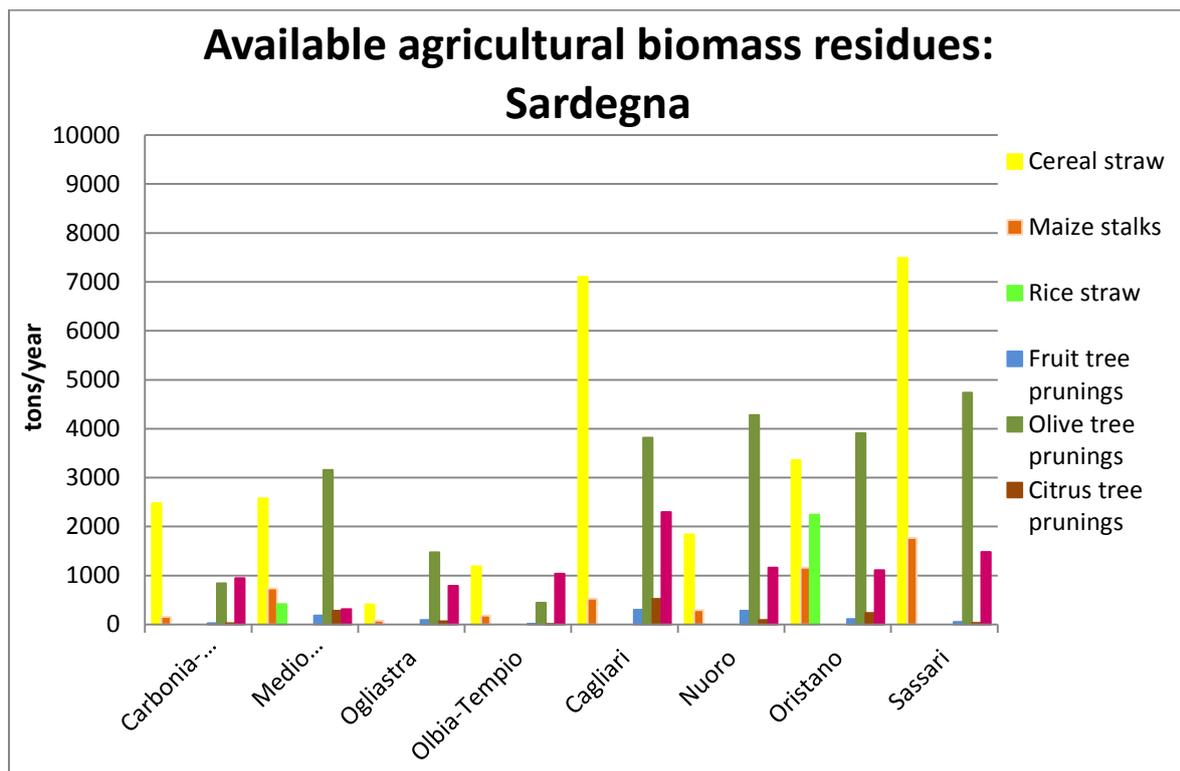


Figure 7: Summary of available agricultural biomass residues in Sardegna.

Main conclusions in Sardegna:

- From the herbaceous crops, is the cereal straw the one present in all provinces, being of special importance in Cagliari and Sassari. Even though, its potential is under 10 kt/yr, and so, starting new logistics centres may require support of other biomass types.
- Prunings from olive tree and vineyards are an interesting source to be taken into account when producing a logistic centre for the production either of woody chips or a pellet mixed with cereal straw. Olive tree resources are more abundant than those from vineyard, in general from two-fold to three-fold.
- Residues like husks coming from rice dryers, olive pomace, grape stalks and skins and distillery residues can also be a complement for the existing resources.

7.3. Localization of resources and agro-industries in Sardegna

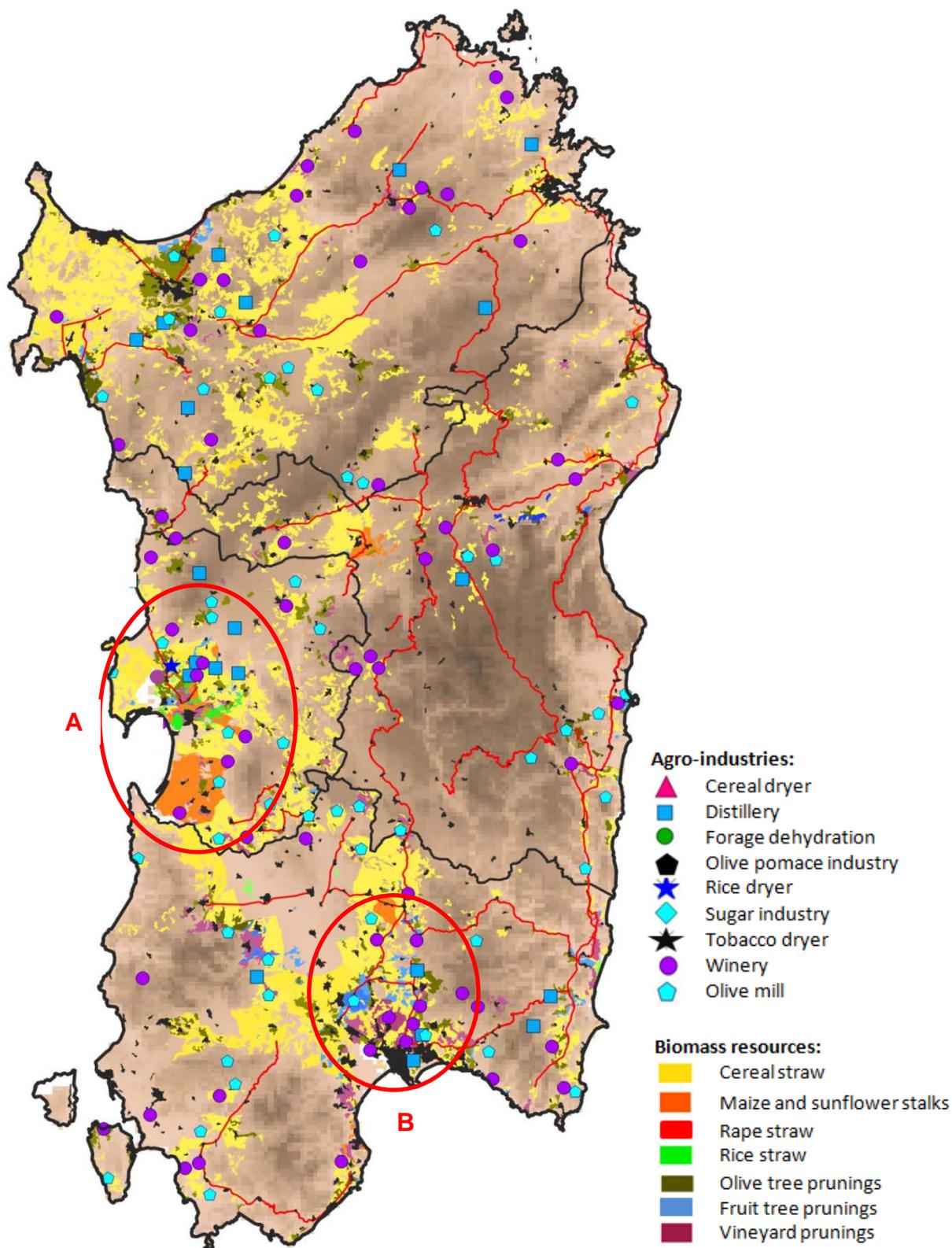


Figure 8: Localization and type of agro-industries and resources in Sardegna.

7.4. Priority areas in Sardegna

Potential areas for the development of an agro-industry logistic centre have been detected in Sardegna and are shown in Figure 9. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both herbaceous and woody) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 7, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 7: Availability of equipment and biomass resources in Sardegna.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Distillery												
Rice Dryer												
Cereal straw												
Maize straw and cobs												
Pruning from permanent crops												
Rice husks												
Grape marc and stem												
Grape pits												
Olive pits												

The potential areas to develop a logistic centre in Sardegna are very influenced by communication network and morfology in comparison with other regions, therefore it has been considered an important limiting factor to take into account.

There are two areas which presents the following characteristics:

- **Area A and B:** The flat morphology of Oristano and Cagliari favours both crop productivity and ease of collection and the costs of transport. The most interesting synergies found has been the possibility of distilleries to use their facilities for processing the straw (of cereal or maize) and the prunings (from olive tree and vineyard) into a mixed pellet. Rice husks and the own distillation residues could be a complement for this product. Distilleries could also be used for the drying and conditioning of the olive pits to be sold in bulk format. Rice dryers from Area A could also process the grape and olive pits.

The area of Sassari has not been elected as a potential area but only when a local logistic centre is planned. There are two reasons for this consideration: (1) Presents a good availability of residues (prunings and straw) but fragmented; (2) Even if there is an interesting amount of agro-industries (which could be consumers of solid biomass), the area is characterized by a less efficient road network and rough morphologies that determines high transport costs.

8. Regional Framework of TOSCANA

8.1. Identification of agro-industries in Toscana

The interesting agro-industries to become a logistic centre in Toscana are:

- **Cereal dryers:** 41 industries mainly located in the northern area.
- **Distilleries:** 41 facilities in the region.
- **Oil pomace industries:** 3 facilities in the region.

The agro-industries identified as biomass resources suppliers are, apart from the ones above producing residues: cellars (a total of 1409 wine producers, especially in Siena and Firenze provinces) and oil mills (141 sites spread in the whole region).

8.2. Identification of biomass resources in Toscana

In Toscana the agricultural biomass resources add up to almost 100 kt/yr of both herbaceous and woody pruning residues. Both resources amount for a share of about 50% of the total available resources. When observing the reality by province, it is observed that in Firenze the main predominant source of biomass are permanent crops pruning from olive groves and vineyards mainly). Rest of provinces show more balanced shares for herbaceous and woody resources. When regarding the total amounts per province, it is observed that some of them may account with scarce resources: Livorno, Lucca, Massa-Carrara, Pistoia and Prato. Therefore the analysis will centre in the rest (Arezzo, Firenze, Pisa and Siena) having all of them available biomass over 10 kt/yr.

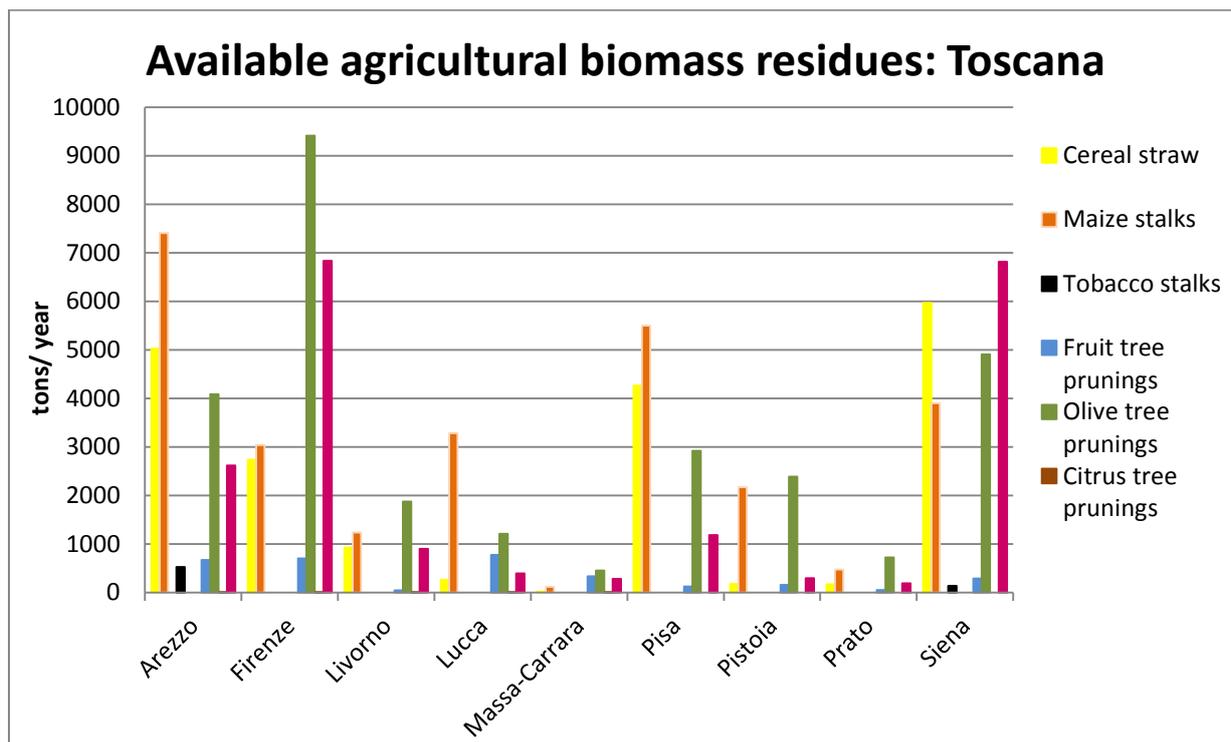


Figure 9: Summary of available agricultural biomass residues in Toscana.

Main conclusions in Toscana:

- The provinces of Arezzo, Pisa and Siena account with herbaceous residues larger than 10 kt/yr. There it is feasible to create new chains on herbaceous residues as a main feedstock. Both, cereal straw, and maize and sunflower stalks contribute to reach this figure.
- The prunings from permanent crops (vineyards and olive tree) are of importance in the provinces of Firenze and Siena. There new logistics centres can run on woody biomass as main resource. In Arezzo and Pisa woody resources can be a complement for the production of mixed solid biomass commodities.
- Agro-industry residues coming from the cereal dryers, cellars, wineries, oil mills and oil pomace industry could also be considered interesting sources.

8.3. Localization of resources and agro-industries in Toscana

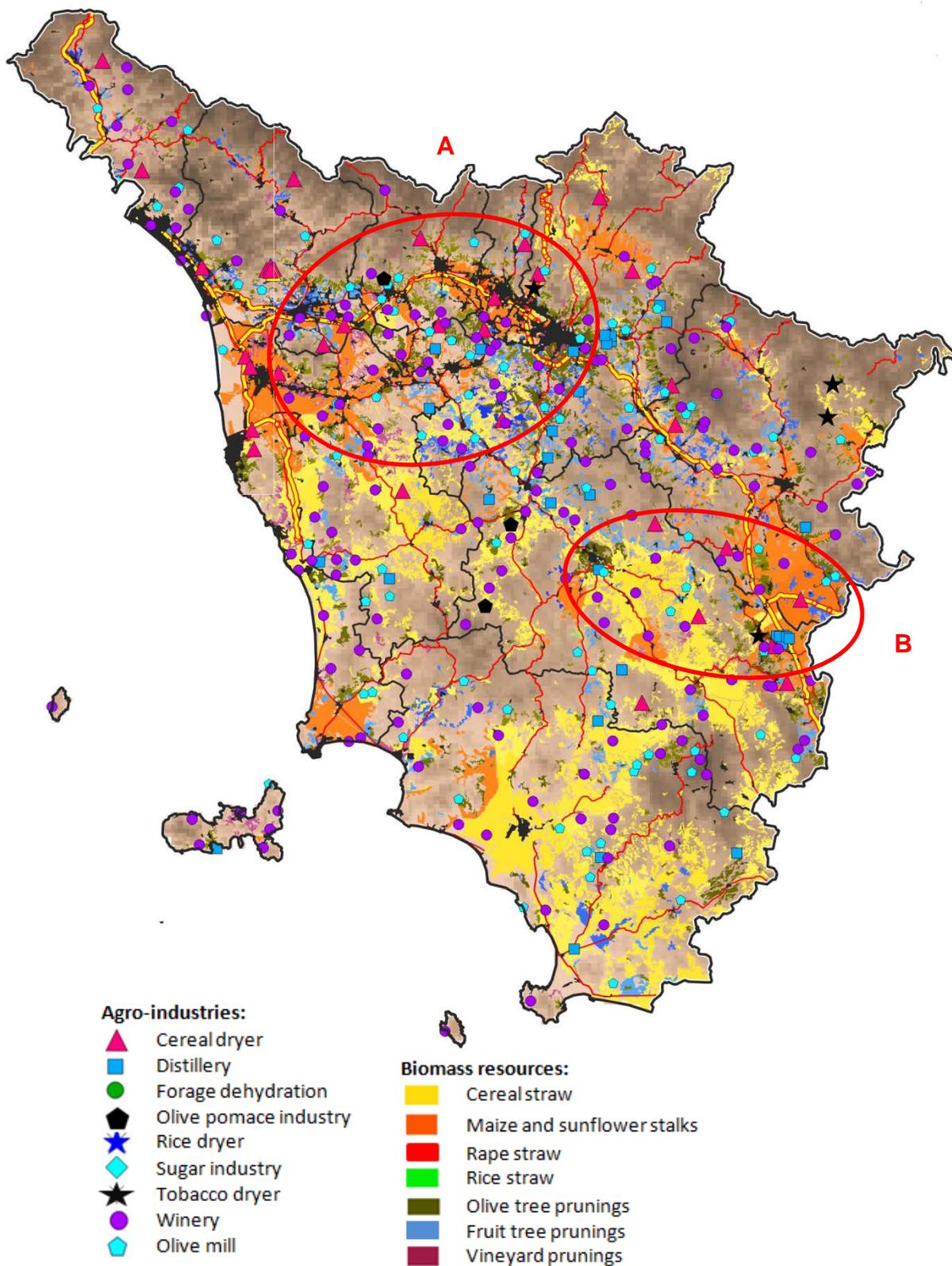


Figure 10: Localization and type of agro-industries and resources in Toscana.

8.4. Priority areas in Toscana

Potential areas for the development of an agro-industry logistic centre have been detected in Toscana and are shown in Figure 10. As already mentioned in the introduction, these areas have been selected taking into account the diversity of resources (both herbaceous and woody) and agro-industries as well as the compatibility among them. Compatibility has been defined according to their seasonality, see Table 8, and to their compatibility of use. Logistic issues such as good communication roads and proximity to consumption areas has also taken into consideration.

Table 8: Availability of equipment and biomass resources in Toscana.

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oil pomace industry												
Distillery												
Cereal dryer												
Cereal straw												
Maize straw and cobs												
Pruning from permanent crops												
Cereal husks and silo flour												
Grape marc and stem												
Grape pits												
Olive pits												
Olive oil pomace												
Tobacco stalks												

Toscana presents a high variety of resources, an interesting amount of agro-industries and good transport connection. However there are two main areas to be highlighted for the establishment of a logistic centre. Both areas, A and B, have synergies among the distilleries and the oil pomace industries with the production of solid biomass from a mixture between prunings and straw in a pellet format. Residues from cereal dryers could be a complement for such product. Apart from that, their logistic centre could only be focused on processing their own residues. Cereal dryers could condition the olive and grape pits to be sold as a bulk product.

9. Summary of the situation in Italy

The situation of the five target regions in Italy (Emilia-Romagna, Marche, Puglia, Sardegna and Toscana) have been analysed in order to evaluate their potentiality to set an agro-industry logistic centre. The evaluation has been carried out from the perspective not only of the available resources but also of the existing agro-industries compatible with this new activity according to SUCELLOG concept.

Regarding the resources, the potential feedstock are several: straw from cereal and maize mainly, prunings from olive tree and vineyards and agro-industry residues coming from the olive and wine sectors. A large number of types of resources do have not a market (or do not have a place in the market because there is less demand) and are left on the soil or burnt to avoid the cost of harvesting/disposal

The agro-industries evaluated by the project have been the following ones: forage dehydration facilities, cereal dryers, rice dryers, tobacco dryers, distilleries, oil pomace industries and sugar industries. They all own equipment that can be used for the production of solid biomass like dryers and/or pelletisers and idle period in their regular activity (not working the whole year). They have all been considered as target for the project since no important technical barriers for the development of a logistic centre in their facilities have been detected. More concretely, from all of them cereal and rice dryers are the less versatile installations because of their existing drying system, which can be only compatible with a granulated product (like olive pits, grape pits and crushed almond shells). The rest of sectors could be able to pre-treat a large variety of resources format (straw, chips or granulated) since they have horizontal dryers. Cellars and oil mills have also been considered as target industries since, even if not owning compatible equipment, their easy access to biomass residues (from the agrarian practice of from the industrial process) make them interesting for the project. Therefore, in their case, investment in a new pre-treatment line should be made. The tobacco dryers have been also considered for the project even though now they are not allowed to use their dryers with other resources due to commercial restrictions. Due to the fact that the sector is in decline and a restructuration will be needed, it can be a good possibility to include it as a possible new business line using existing equipment.

The situation of Italy is promising in terms of available resources and amount of agro-industries. However, it should be highlighted that there are still barriers to be faced when developing the project and which have come up during the interviews with the sector. The first can be the lack of trust that the society has in services that are provided for free (even if the project will not finance any investments or analysis, giving only technical support) which can lead to a lack of compromise. The second barrier is that, in some cases, the law is different according to the region and often differently interpreted in provinces. The best example is the definition of residue, whereas in Puglia the olive pomace is considered as by-product and it can be used as biomass, in other regions (i.e. Tuscany) it is considered as waste, and it can't be

used as biomass, because of the chemical treatment to extract oil using hexane. Different provinces can give an own more or less strict interpretation of the rule, allowing or not to consider the raw material as a by-product. The third barrier can be the target consumers since the main market for SUCELLOG, which is the agro-industry sector, is not really familiar with biomass being highly dependent on natural gas whose network is really developed in Italy. However, the project considers that these barriers will be overcome with a good pilot example that can show that developing a biomass logistic centre can be a good business line for the agro-industry to diversify their activity. Association among industries (even if from different sectors) can be a good option to avoid high investment costs that could discourage possible entrepreneurship.

Annex I: Table of ratios y availability percentage per region

Table 9: Ratios of biomass production (t/ha) in ITALY per region

Crop	Emilia-Romagna	Marche	Puglia	Sardegna	Toscana
Wheat	2,71	1,96	1,51	2,27	2,48
Rye	2,16	0	0,73	0	1,12
Barley	5,28	3,67	1,23	1,99	2,55
Oat	2,47	2,35	1,2	1,67	1,81
Maize	4,08	6,43	4,04	6,6	4,12
Rice	1,92	0	0	2,27	3,21
Beans	3,81	2,41	1,88	1,84	2,83
Pulses_oth	4,89	2,26	1,65	1,2	3,3
Tobacco	0	0	0	0	0,47
Hemp	0	0	0	0	5
Rape	0	0	0		0
Sunflower	2,75	1,15	1,52	1,54	1,57
Soya	3,75	0	0	0	0
Linseed	0	0	0	0	2,5
Seed_other	0	14,74	0	0	0
Fruit_temp	1,6	2,2	1,11	1,1	1
Fruit_subtrop	0	0	2	1,45	0,45
Berry	0,81	1,01	0,83	0,9	0,65
Nuts	1	1	1,45	1,38	0,96
Citrus	0	0	2,01	1,45	0,47
Olive	0,06	1,27	1,32	2,3	1,39
Vineyard	1,68	1,59	1,82	1,61	1,55

Table 10: Percentage of availability of biomass in ITALY per region

Crop	Emilia-Romagna	Marche	Puglia	Sardegna	Toscana
Wheat	10	35	35	25	25
Rye	40	0	40	40	40
Barley	10	30	35	30	30
Oat	40	40	40	40	40
Maize	50	45	45	50	45
Rice	40	0	0	40	40
Beans	0	0	0	0	0
Pulses_oth	0	0	0	0	0
Tobacco	0	0	0	0	85
Hemp	0	0	0	0	0
Rape	0	0	0	0	0
Sunflower	40	40	40	40	40
Soya	70	0	0	0	0
Linseed	0	0	0	0	0
Seed_other	0	0	0	0	0
Fruit_temp	20	20	25	20	20
Fruit_subtrop	0	0	0	0	0
Berry	40	40	40	40	40
Nuts	0	40	40	40	40
Citrus	0	0	40	35	40
Olive	47	47	55	45	45
Vineyard	50	90	90	90	90

SUCELLOG: IEE/13/638/SI2.675535

D3.2d Summary of the regional situation, biomass resources and priority areas of action in Austria

1st December 2014



About SUCELLOG project

The SUCELLOG project - Triggering the creation of biomass logistic Lower Austrias by the agro-industry - aims to widespread the participation of the agrarian sector in the sustainable supply of solid biofuels in Europe. SUCELLOG action focuses in an almost unexploited logistic concept: the implementation of agro-industry logistic centres in Austria in the agro-industry as a complement to their usual activity evidencing the large synergy existing between the agro-economy and the bio-economy. Further information about the project and the Partners involved are available under www.sucellog.eu.

Project Coordinator



Project Partners



About this document

This report corresponds to D3.2 of the SUCELLOG project - Summary of the regional situation, biomass resources and priority areas of action in Austria. It has been prepared by:

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Table of contents

About SUCELLOG project	1
About this document.....	1
Table of contents.....	2
List of Tables	3
List of Figures.....	3
1. Introduction	4
2. Agro-industries in Austria: profile, barriers and opportunities to become a logistic centre.	5
3. Evaluation of available biomass resources	9
3.1. Agricultural residues:.....	9
3.2. Other biomass resources:	11
3.3. Methodology of work	12
4. Regional Framework of Carinthia	15
4.1. Identification of agro-industries in Carinthia	15
4.2. Identification of biomass resources in Carinthia	15
4.3. Localization of resources, agro-industries and priority areas in Carinthia.	16
5. Regional Framework of LOWER AUSTRIA.....	17
5.1. Identification of agro-industries in Lower Austria	17
5.2. Identification of biomass resources in Lower Austria	17
5.3. Localization of resources, agro-industries and priority areas in Lower Austria	18
6. Regional Framework of STYRIA.....	20
6.1. Identification of agro-industries in Styria.....	20
6.2. Identification of biomass resources in Styria	20
6.3. Localization of resources, agro-industries and priority areas in Styria	21
7. Regional Framework of UPPER AUSTRIA.....	23
7.1. Identification of agro-industries in Upper Austria	23
7.2. Identification of biomass resources in Upper Austria	23
7.3. Localization of resources, agro-industries and priority areas in Upper Austria	24
8. Summary of the situation in Austria	26
Annex I: Table of ratios y availability percentage per region	27

List of Tables

Table 1: Classification of biomass resources in Austria.....	10
Table 2: Most strategic resources by target region.....	14
Table 3: Availability of equipment and biomass resources in Lower Austria.....	18
Table 4: Availability of equipment and biomass resources in Styria.	21
Table 5: Availability of equipment and biomass resources in Upper Austria.....	24
Table 6: Ratios of biomass production (t/ha) in AUSTRIAN target regions.	27
Table 7: Percentage of availability of biomass (%) in AUSTRIAN target regions.	27

List of Figures

Figure 1: Summary of available agricultural biomass residues in Carinthia.....	15
Figure 2: Localization and type of agro-industries and resources in Carinthia.....	16
Figure 3: Summary of available agricultural biomass residues in Lower Austria.	17
Figure 4: Localization and type of agro-industries and resources in Lower Austria.	19
Figure 5: Summary of available agricultural biomass residues in Styria.....	20
Figure 6: Localization and type of agro-industries and resources in Styria.....	22
Figure 7: Summary of available agricultural biomass residues in Upper Austria.	23
Figure 8: Localization and type of agro-industries and resources in Upper Austria.	25

1. Introduction

SUCELLOG focuses on the implementation of biomass logistic centres into agro-industries as complement to their usual activity with minor investments. Agro-industry facilities can be utilised in their idle periods to handle and pre-treat biomass feedstock (mainly from their own residues or agricultural residues nearby) to produce solid biomass to be introduced into the market.

This document shows the results of the work carried out within SUCELLOG WP3-“Regional framework and stakeholders’ engagement” in Austria. During this WP, four main actions were carried out in the project target regions (Carinthia, Lower Austria, Styria and Upper Austria):

- Allocate biomass resources.
- Evaluate with the stakeholders both the technical and the non-technical barriers of the implementation of SUCELLOG concept in the agro-industries.
- Determine the potential areas for the development of agro-industry logistic centres.
- Engage agro-industries to the project.

For the first action, an evaluation of the real potential of primary agrarian biomass has been carried out inside Task 3.1. The methodology selected corresponds to a “Resource focussed approach”, as described by BEE standardised classification (project Biomass Energy for Europe), which starts with statistical data from agrarian inventories. This data has been complemented with the real availability indices (the share of biomass that is not currently being used for other aims including soil sustainability issues) gathered in the regional workshops with the agrarian sector during Task 3.3. As a first result, primary biomass resources have been firstly catalogued according to existing competitive uses and relevance in terms of current unused quantities. This assessment has been performed in by country level since no regional differences has been observed. Secondly, a map of the distribution of real available primary resources and a table of the available tons per year in dry base were built per target region. Even though the use of agro-industry residues is a target of SUCELLOG, the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Therefore the maps and tables presented do not include this type of resources, which will be deeply assessed for particular cases of logistic centres monitored or audited during in WP4-WP6.

As a second action, an assessment of the barriers and opportunities for the development of logistic centres was carried out through personal interviews with each target sector in Task 3.2. Existing agro-industries from the potential sectors (those owning compatible equipment for the conditioning and storage of raw material) were asked about: idle periods, residues produced in their facilities and upstream in the crop cultivation, the economic situation of the sector and possible upcoming changes

due to the Common Agricultural Policy, practical and legal incompatibilities in using their facilities for the production of solid biomass, social barriers for the development of this new activity and, finally, opportunities detected. Section 2 presents the situation of the country since no regional differences were appreciated. After this analysis, target sectors were identified per region and specific agro-industry locations were included inside the biomass resource map.

To determine the potential areas inside each target region for the development of agro-industry logistic centres, it has taken been into account the diversity and quantity of available agrarian resources (both woody and herbaceous) and of agro-industries present in the region as well as the compatibility among them. Compatibility has been defined according to their seasonality (matching the months of biomass production with the idle period of the agro-industry) and their technical compatibility of use. Logistic issues such as good communication networks and proximity to consumption areas has also been taken into consideration. Potential areas have been identified per region and are shown in this document. However, it is important to highlight that the selection of a potential area does not mean that an agro-industry non belonging to it could not start a new activity and the opposite. The size of the future logistic centre has not been a limiting factor for the selection of the potential area (even if SUCELLOG target is a production of 10 kt/yr per centre) since no data of the total amount of biomass is available (agro-industry residues missing as mentioned before).

The following sections show the results obtained about the above mentioned issues (passing from a country to a regional perspective). A summary of the situation in Austria is included in the last part.

As a last activity belonging to this WP, workshops and personal contacts were carried out with agro-industries in Task 3.3 with the aim of engaging them to the services offered by the project (technical and decision-making support to become biomass logistic centres). The result of this action is shown in the document “D3.1-Report on engagement actions”.

2. Agro-industries in Austria: profile, barriers and opportunities to become a logistic centre.

The main potential agro-industry sectors to become a solid biomass logistic centre in Austria have been evaluated in the following lines, describing the equipment they usually own and their idle period, as well as the residues produced both in the agrarian practice and the production process. Finally, the barriers and opportunities they would face when thinking to start this new activity have been identified. The information has been provided through interviews with representative industries of the sector and agrarian experts.

Cereal dryers:

The cereal drying sector in Austria presents a high potential to become a solid biomass logistic centre from the technical point of view, since the working period of the year is reduced (the idle period in this sector is from January to September)

They have equipment (dryer, silos) that can be used for pre-treatment of other raw materials and in very minor cases they also own pelletisers. However, the drying equipment of these facilities cannot be used for drying other type of raw material, so for the creation of a logistic centre in this sector considerable investments should be done. Their pelletisers, silos and handling equipment could be used without any barrier.

Regarding the raw material available for a possible logistic centre, farmers supplying the grain to be dried in the facilities produce important quantities of straw which is normally given for animal feed or left on the soil, leaving some still available straw that could be used for energy purposes.

Corn cobs are starting to be considered as a biomass resource for combustion in Austria, either than left on the soil and some machinery has been developed to collect them. A special method allows farmers to harvest the entire cob. This approach, which takes place directly on the field, accomplishes the entire harvest without a significant amount of additional effort and holds impurities to a minimum. Equipped with a special module, the harvester separates the corn from the cobs, which are then placed in a separate container for transport.

The agro-industry itself produce residues such as the grain that for some reasons do not satisfy the quality/aesthetics requirements to be sold in the market or the silo dust. Both are normally sold for animal feeding industry.

The professionalization of the sector is very high and they are familiar with bioenergy issues. About their economic situation to start a new activity as a biomass logistic centre, investments will depend on a legal basis for the combustion of agrarian biomass in Austria. At this stage a respective law is under discussion.

Sugar industry:

The sugar industry presents, on the one side, an important idle period of 7 months which goes from February to September approximately and, on the other side, compatible equipment for the production of solid biomass such as horizontal dryers and pelletizers.

This equipment is used in the conditioning of the residues generated during the sugar production process. The majority of the processed waste (small parts of turnips, beet pulp and molasses) goes, due to the high nutrients contained, into the animal feed industry. The sector does not produce residues during the agrarian practice.

Even if it seems a very interesting sector from the SUCELLOG point of view, there is only one sugar industry in Austria and it has not shown a great interest for initiating a new activity as biomass logistic centre since they are not really familiar with bioenergy issues. The production of biomass fuels will be feasible for them if the price of the sub-produced destined to animal feed decrease by the half. In that case they would consider serious investments in technical adjustments of the installed plants in order to start with the production of agrarian fuels for energetic use.

Feedstuff producers

This sector has been identified as a potential one to become a solid biomass logistic in Austria. It counts with many proper equipment types that might be used for the new activity such as pelletisers, silos for storage and, in rare cases, also dryers. However, pelletisers present no fixed idle periods, meaning that they stop production according to demand.

No available residue is produced in the process, so biomass residues should be acquired.

Although high interest has been shown by part of the sector, the main barrier would be technical since it is expensive and difficult to change from the production of feedstuff to solid biomass in short periods. The machines must be re-cleaned due to high hygiene standards and adjusted. However, SUCELLOG considers that this sector has a potentiality to become a logistic centre and therefore it will be considered in the study.

Oil extraction industries:

The oil extraction industries are dedicated to rape and pumpkin seeds mainly working all the year. The facilities count with pressers and silos but not with driers, since they buy the material already dried from farmers.

In the production of oil from oil seeds, oil scrap and press cake is produced as residue. These residues are very rich in protein and are sold as animal feed. Almost 100% of oil scrap is sold as animal feed and achieve good prices on the market. Regarding the residues obtained in the field, the straw from rape and soya is normally dedicated to animal feed and left on the soil, leaving some still available straw that could be harvested and used for the production of solid biomass.

They could be considered as a target industry for SUCELLOG only if the production decreases and there is some line that it is not used.

Cellars:

The sector of the wine production do not own compatible equipment for the production of solid biomass (no dryers, nor pelletiser) but it has been studied due to their easy access to the agrarian or production residues.

Regarding the agro-industry residues obtained during the wine elaboration, first of all the stems and combs are removed. After pressing the grapes, the press cake remains (consisting of shell remains, pulp and seeds). In Austria this pomace is mainly returned as humus and nutrient suppliers for the most part in the vineyard, although large producers are selling it to biogas plants.

Concerning the vineyard prunings, the sector considers the collection expensive and time-consuming. The recommendations from the wine department in the Chamber of Agriculture and Forestry advice against the removal of the prunings, as this not only reduces the humus content, but also increases erosion damage. These are big issues especially on the steep slopes, as they can be found quite often in Styria. In Lower Austria, in the wine district area it is because of other geographic features more feasible.

If the sector would be interesting in stating a new activity as logistic centre a new line should be installed for that purpose. For this reason, they will not be considered as main target for SUCELLOG project.

Breweries:

As it happens with the cellars, the breweries do not own compatible equipment for the production of solid biomass but they have the capacity to reach residues. A completely new line for the production should be built in case they would be interested in becoming logistic centres.

The residues of beer production, 78% spent grains and yeast residues 9% hot and cold break (9%) are currently used exclusively as animal feed. The still available barley straw (with no market or sustainability uses) could however be a source of biomass for agro-fuel pellet production.

They have shown interest in the project concept but an analysis of possible biomass to be used and investments to be made should be studied. For this reason, they will not be considered as main target for SUCELLOG project.

3. Evaluation of available biomass resources

SUCELLOG has considered that the development of agro-industry logistic centre should rely on agrarian biomass coming both from the agrarian practices (like straw or prunings) and from the agro-industry process (for example distilleries residues). The fact is that, for the first case, agro-industries have already a network with farmers providing the raw feedstock to be processed. For the second case, the use of their own residues is the opportunity to reduce their fuel consumption or avoid the cost of disposal if there is no market for it. Quantifying the biomass resources up-stream and down-stream the agro-industry is the object of this section since it is strategic for establishing new commercial relations with usual providers and clients.

A study about the available biomass resources has been performed, focusing in the agrarian biomass since it was not possible to have data about the production of agro-industries residues per region/country. When talking about availability of the residue, it is meant the amount of resources that do not have a market or that is not left on the soil to improve organic content, therefore having the opportunity to be used for energy purposes. Three examples to explain what availability is (see more detail about the methodology of work in section 3.3 and availability percentage in Annex I):

- If a farmer, after taking the wheat grain, leaves the straw on the soil due to agrarian recommendations then availability should be considered 0%.
- On the contrary, if the farmer leaves the straw on the soil just because the cost for harvesting does not cover the value in the animal feed market then availability is 100%.
- It can also happen that in one region the 40% of the straw is commercialized for animal feed (so it has a market), a 20% is left on the soil as a recommended agrarian practice. Therefore, 40% of the straw is available for other uses like the production of solid biomass.

3.1. Agricultural residues:

Agricultural biomass resources can be catalogued in different groups according to next two criteria:

- Competitiveness: existing competitive uses.
- Amount of available biomass: relevance in terms of current unused quantities.

From this scope, agricultural biomass resources in Austrian target regions can be catalogued in average as next:

Table 1: Classification of biomass resources in Austria.

Criteria		Biomass resources
Competitiveness	Available unused biomass	
Many competitive uses	Some source still available	Cereal straw
Some competitive uses	Important source still available	Rape and other seed crop stalks
Few or non-competitive uses	Relevant in some areas	Woody prunings
Some or few competitive uses	Marginal local amounts (may play a role in a singular facility)	Soya stalks
Environmental concerns for soil organic matter preservation limit its use	None	Sunflower, maize
Competitive uses and utilisation for soils	None (crops with small cultivated land).	Beans and pulses stalks

The crops resulting in larger available amounts of agricultural residues in Austrian target regions are either cereals or rape and oilseed crops. In case of cereals, there are several competitive uses that can make straw unavailable in some local areas or in some moments along the year. Main uses for straw are cattle bedding, even though also a part of the straw is usually left on the soil to prevent soils to be impoverished in terms of organic carbon. The fact that cereals (wheat, oat, barley, rye, etc.) are the most extended cultivated crops, make that, even there are competitive uses existing, there is still sufficient amounts ready to be utilised.

The case of rape and oilseed crops is also an issue. Several Austrian target regions account with important shares of agricultural land dedicated to produce oil seeds. Rape is by far the most extended oil crop in the target regions. Even though part of the straw is left on the soil to keep organic carbon levels of the topsoil, it is considered that half of the straw is available for new uses. Currently some uses already exist but they are not much extended.

Other oil seed crops can also be object of biomass production. However they have not been reflected in the analysis as regard of lack of statistical data from the sources consulted. The case is similar to rape, and their residues may play a role in the target areas where the project will be operating.

Soya bean is quite extended also in Austria, even though in the target regions its growth is not predominant over other oil seed crops. Soya is present in almost all the groups of districts (*Gruppen von Bezirken*) in the target regions, even though are relevant only in Oberösterreich from the point of view of the analysis of the potentials

at country level. Similarly to rest of oil crops, it has been considered that half of the total straw biomass produced is available.

Maize and sunflower stalks have been considered totally unavailable. The fact is that in the last years in Austria it has been stated the reduction of organic carbon in the soils of some crops like maize and sunflower. For this reason the biomass is not available and currently fully dedicated to keep good soil conditions.

With respect to woody agricultural prunings, they are the agricultural residue with lowest competitive uses, and keep practically unused in most of places. However permanent crops in Austria are only present in some groups of districts, namely in Upper-Austria (Waldviertel, Weinviertel, Wiener Umland/Nordtei and Wiener Umland/Südteilan) and in Steiermark (Oststeiermark and West-und Südsteiermark). However, its use involves the challenge to local farmers to start a new logistic chain although most of them have already shown interest in using them as a fuel and several initiatives have been carried out. The fact that the woody residues have good properties as biomass for energy and cause fewer problems in the combustion, make them quite interesting to complement and improve the quality of herbaceous biomass.

Other crops like beans and pulses are much less extended. The usual preferred form to manage their residues is to integrate in the soil or be used for animal feeding due to its nutritive properties.

3.2. Other biomass resources:

SUCELLOG has carried out a comprehensive search for potential agro-industries beneficiaries for the project. With this list of agro-industries it would have been possible to create a database of agro-industry residues. However two facts impeded its configuration. Firstly the fact that the data of the inventories was not sufficient to produce a reliable inventory of the biomass residues produced in the agro-industries processes. Secondly because it was stated that in the Austrian target regions agro-industry residues are already subject of use for other purposes. Here a list: oilseed oil extraction cake (utilised already for animal feeding), apple pomace (for animal feeding and which in any case is a wet residue), or pumpkin oil seed cake (used for animal feeding).

These agro-industry residues have revealed to be completely unavailable from a regional perspective, even though at local scale some contracts may be feasible. The use of agro-industry residues is a target of SUCELLOG, but its actual use will be decided for the particular cases of logistic centres monitored or audited during WPs 4, 5 and 6. There, the local reality and capacity of neighbour facilities to become reliable biomass suppliers will be assessed.

It was however stated that two residues can play a role for the purposes of SUCELLOG. The most important is corn cobs, which quantity and availability makes

it the most important resource to be taken into account for the possible development of a logistic centre. Also grapevine oilseed cake (residue after pressing seeds to extract its oil), that currently is sold for biogas production, can be a possible complement but in very small amounts in the wine producing areas.

With respect to forestry biomass, SUCELLOG has not carried out any specific assessment since the project is focused on fostering agricultural residues as a source of solid biomass. However, the feedback obtained from the target regions shows that forestry residues may be at the reach of future logistic centres, and can be an option in few provinces for upgrading the properties of biomass mixtures to be commercialised. Biomass directly from forestry exploitation for energy purposes has been considered as not a source for the short-time term in SUCELLOG. The research done in the project has shown that in Austria forestry residues and sawmill residues are quite unavailable. Therefore except at local scale, they are not considered for any decision-making.

3.3. Methodology of work

An analysis performed by regions instead of by resources is carried out in sections 4 to 7. Biomass assessment in the present work involves the study of 4 regions of Austria, adding a total area of around 57.000 km², about 68% of the total area of Austria. For this scale of work the use of existing data from inventories was needed as an input data source. The aim of the approach is to provide a framework of the available sources in the region. It is not aimed to be the specific biomass assessment for a facility, which will be object of task 4.2, and which requires other type of approaches.

The methodology selected corresponds to a “Resource focused approach”, as described by BEE standardised classification (project Biomass Energy for Europe). It starts with statistical data from agrarian inventories, and complemented with the availability indices and utilization for soil preservation leads to a technical potential, including soil sustainability issues.

The method followed is based on ratios of residual biomass production per hectare of cultivated area (tons of residue per hectare). The use of ratios is a widespread methodology for biomass assessments, appropriate for both large and small scale. The main issue is to account with reliable inventories and ratios. By multiplying the cultivated area (ha) by the ratios (t/ha) the theoretical potential is obtained:

$$\text{Biomass Potential [t]} = \text{Ratio [t/ha]} * \text{Area [ha]}$$

The methodology used here brings a step forward in the country analysis by including the competitiveness for biomass resources. For that purpose it is necessary to know the share of biomass that is currently being used for other aims, and that will be considered as not available for the present study. The availability index (I_{AV}) expressed as percentage is defined as next:

$$I_{AV} = 100 - I_{COMPET} - I_{SOILS}$$

Where :

I_{COMPET} : is the percentage of the total biomass in a region that other uses (power plants, cattle, industry) already are using.

I_{SOILS} : is the percentage of total produced biomass that remains in the soil. E.g.: if farmers prefer to leave part of the straw as soil organic amendment.

By using these indices it is possible to obtain the final biomass available by doing next operation:

$$\text{Available Biomass [t]} = \text{Potential Biomass [t]} * I_{AV} = \text{Ratio [t/ha]} * \text{Area [ha]} * I_{AV}$$

The data sources have been obtained as next:

- **Agricultural areas:** the biomass has been calculated on the base S2Biom project land areas (www.s2biom.eu) given by NUTs3 (groups of districts, "Gruppen von Bezirken"), in order to have same base units than on-going referential projects like S2Biom is. Since NUTs3 is a too large scale for the purposes of the SUCELLOG work to make any local analysis, the biomass obtained by NUTs3 has been downscaled at the level of land use (Corine Land Cover).
- **Land distribution:** Corine Land Cover version 2006. Biomass per NUTs3 has been directly assigned to the land parcels actually used for agriculture.
- **Ratios and availability indices:** a specific work has been carried out by region. For each region ratios have been obtained from direct contact with specialists and cooperatives, and in few cases, complemented with literature. The purpose of this effort has been to use ratios and availability indices representing the reality of the region, and not just ratios found in literature. The workshops done in task 3.3 have served to include the feedback from the sector to improve the final datasets. Ratio and availability percentage are shown in Annex I.

Next table classifies provinces according to the most strategic resources for SUCELLOG.

Table 2: Most strategic resources by target region.

Region	Cereal straw	Maize + Sunflower straw	Rape and oil seed plant straw	Olive + Fruit + Vineyard prunings	Others
Carinthia	Small amount in Unternkärnten	---	Marginal in Unternkärnten	---	ALL (Corn cob)
Upper-Austria	ALL Ç (mainly Innviertel and Linz-Wels)	---	Innviertel and Linz-Wels (as complement)	---	ALL (Corn cob)
Steiermark	Oststeiermark and West-Und Südsteiermerk	---	ALL	Öststeriemark. Locally West-und Südsteiermark	ALL (Corn cob) Locally grape seed oil cake
	Linzen and Westliche and Östliche Obersteiermark groups of districts have practically no resources				
Lower-Austria	ALL (Mostviertel-Eisenwurzen to a lesser extent)	---	Mainly Waldviertel and Weinviertel. Rest to a lesser extent.	Mainly Waldviertel and Weinviertel. Rest as complement for industries)	ALL (Corn cob) Possible grape seed oil cake
	Niederösterreich-Süd and Sankt Pölten groups of districts have scarce biomass resources (about 10 kt/yr), mainly cereal straw. For purposes of the project the biomass may be a limiting factor.				

4. Regional Framework of Carinthia

4.1. Identification of agro-industries in Carinthia

Carinthia presents very small variety of agro-industry sectors from the ones evaluated in section 2: cereal dryers and breweries.

However, the potential agro-industries to become a logistic centre in the region are the cereal dryers, although for the drying technology, as said previously, a separate line should be constructed. Handling, storage and transport means could be used in the idle periods. Those owning a pelletiser could also use it also for solid biomass production in the idle periods.

4.2. Identification of biomass resources in Carinthia

Agricultural resources to be used as biomass in Carinthia are quite scarce. The main reason is that, for those predominant agricultural activities, there is no availability of resources or it is very low due to a very competitive uses existing. The total amounts of biomass considered to be available (still not demanded by other final users) is quite under 10 kt, and therefore it can be considered a region with no available agricultural residues.

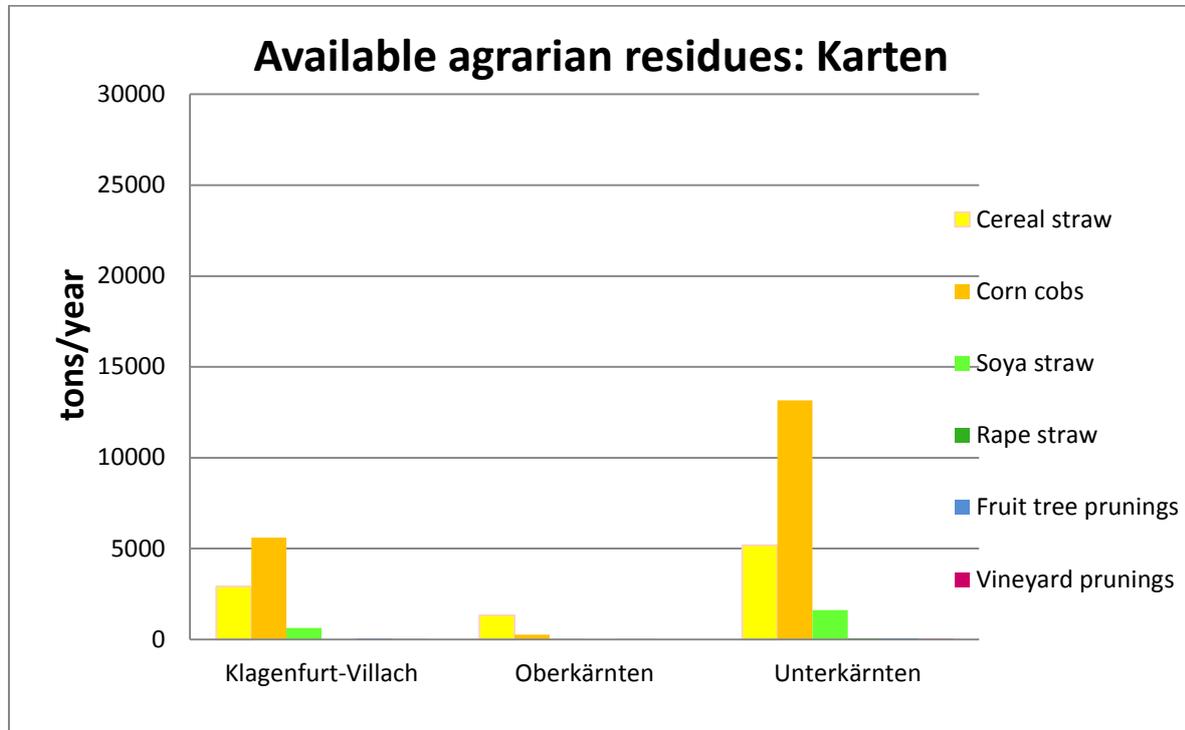


Figure 1: Summary of available agricultural biomass residues in Carinthia.

Main conclusions in Carinthia:

- The groups of districts of Carinthia (“Gruppen von Bezirken”) show that agricultural biomass is not relevant source of energy.
- Residues from cereal dryers and breweries could be considered if there is not market for animal feed.
- Corn cob is the only important source of biomass for this region. According to conversations with the agrarian sector of the area, the amount available is 20.000 tons/year.

4.3. Localization of resources, agro-industries and priority areas in Carinthia.

In Figure 2 it is shown the distribution of resources and agro-industries along the territory. One potential area for the development of agro-industry logistic centres has been detected in Carinthia (marked in the map). Due to the scarce resources available, the logistic centre should rely on corn cobs. Furthermore, cereal straw could be used only as a complement to produce a mixed pellet. The logistic centre could be installed in one of the cereal dryers and could supply solid biomass to the rest of industries present in the region.

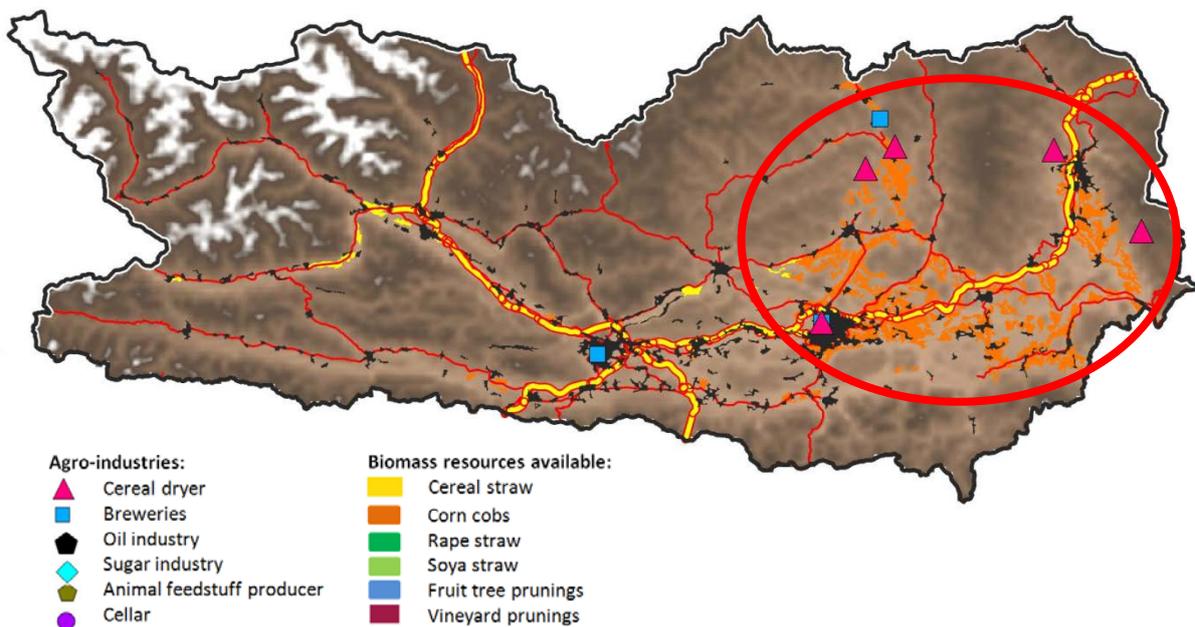


Figure 2: Localization and type of agro-industries and resources in Carinthia.

5. Regional Framework of LOWER AUSTRIA

5.1. Identification of agro-industries in Lower Austria

The interesting agro-industries to become a logistic centre in Lower Austria are:

- **Cereal dryers:** handling and storage facilities, transport means and pelletisers (if existing) could be used in their idle periods. A new drying line should be installed.
- **Sugar industry:** there is only one industry in Austria and is sited in this region.
- **Feedstuff industry:** have pelletisers, handling and storage means working with a no fixed period along the year but according to demand.

5.2. Identification of biomass resources in Lower Austria

Lower Austria is by far the Austrian target region with the largest amount and variety of biomass sources available. Here the total biomass sums up more than 450 kt per year. These ready available residues with no current competitive uses consists mainly of cereal straw as predominant source as well as corn cobs and rape straw. There are also some groups of districts where the vineyard pruning could complement or be an important source of energy.

There are however, few groups of districts where the biomass resources are scarce, and may limit their capacity for starting new logistics centres. They are Mostviertel-Eisenwurzen, Niederösterreich-Süd and Sankt Pölten.

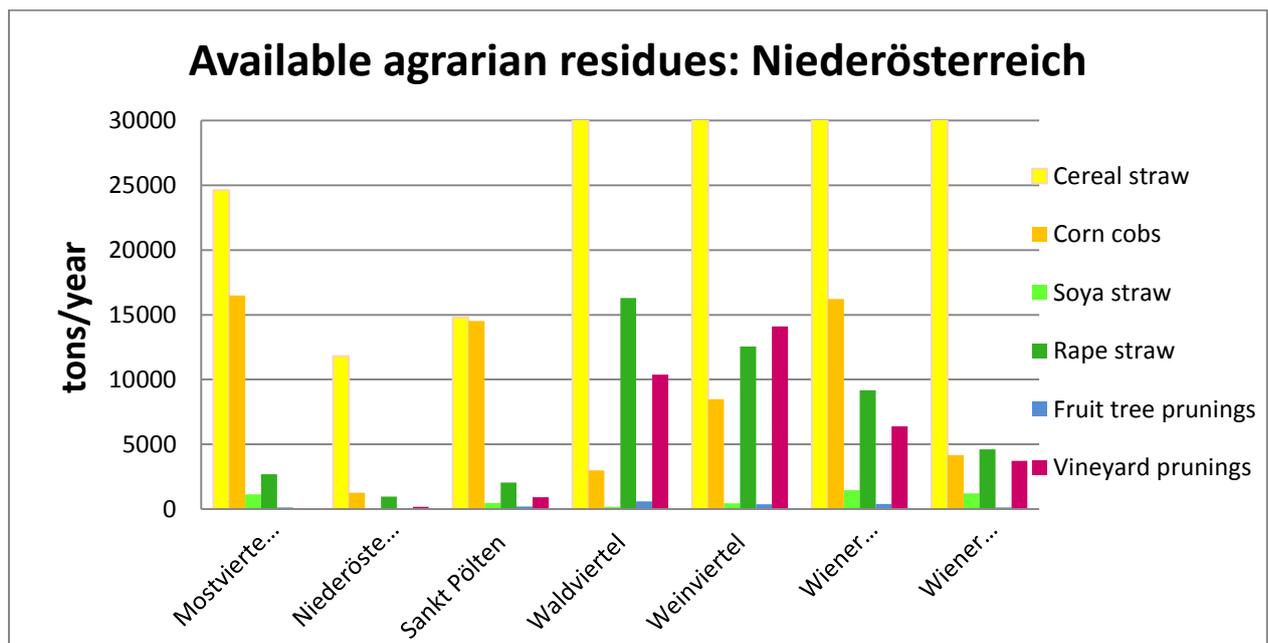


Figure 3: Summary of available agricultural biomass residues in Lower Austria.

Main conclusions in Lower Austria:

- The groups of districts with better biomass potentials are Waldviertel, Weinviertel, Wiener Umland/Nordteil and Wiener Umland/Südteil.
- The main available biomass resource in these states is cereal straw. Rape straw can contribute as well with important resources in Waldviertel, Weinviertel and Wiener Umland/Nordteil.
- Prunings from vineyards are relevant in Waldviertel and Weinviertel groups of districts. They can be also a complement more locally in Wiener Umland/Nordteil and Wiener Umland/Südteil.
- As regard of the activity in the production of wine, agro-industry residues like grapevine oilseed cake (residue after pressing seeds to extract its oil), can be a possible complement in the grape producing areas (see previous paragraph).
- Corn cobs can play a decisive role in the implementation of the logistic centre. Moreover, interviews with the sector stated an availability of 60.000 tons/year, being most important in Mostviertel-Eisenwurzen, Sankt Pölte, Wiener Umland/Nordteil.

5.3. Localization of resources, agro-industries and priority areas in Lower Austria

Here below it is shown the situation of available biomass resources and existing agro-industries in the region. Areas where rape is straw is produced are surrounded in green It is also marked the area considered for the project as the most feasible for the development of an agro-industry logistic centre. This area presents a high synergy potential between cereal dryers and feedstuff industries which can stablish a degree of association taking advantage on their equipment available (pelletisers, storage and handling systems) in order to built a logistic centre. Specially corn cobs should be taken into consideration as the raw material to be used. Straw from herbaceous crops (cereal mainly) and the punings from vineyards mainly, could also be an important source of raw material for the production of solid biomass depending on the months of production (see availability periods in Table 3). Grapevine oilseed cake could also be considered as a complement for a mixed pellet.

Table 3: Availability of equipment and biomass resources in Lower Austria.

	Jan	Feb	Mar	April	May	Jun	Jul	Agos	Sep	Oct	Nov	Dec
Cereal dryer												
Feedstuff producers												
Cereal straw												
Maize cobs												
Rape stalks												
Permanent crop prunings												
Grapevine oilseed cake												

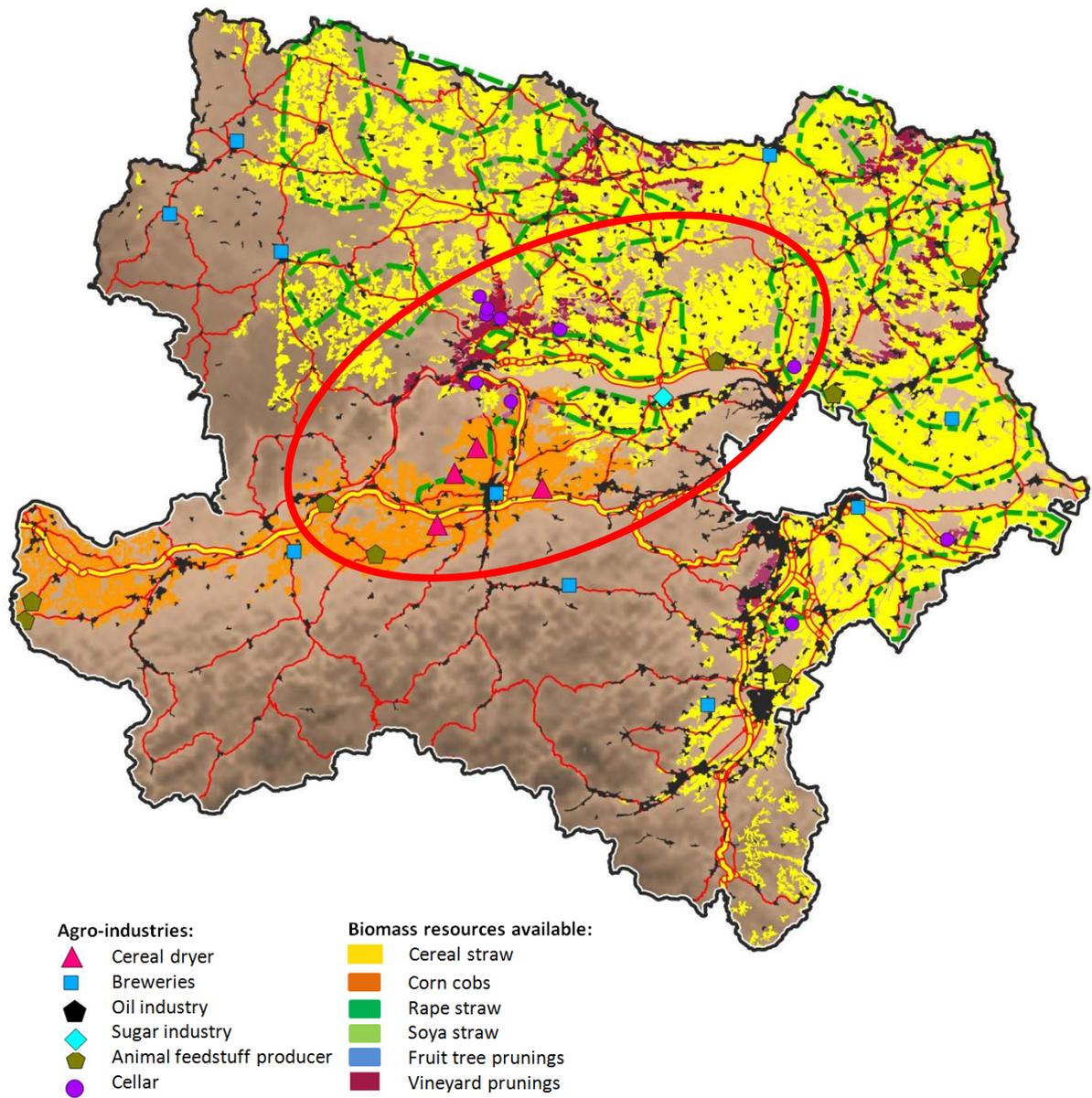


Figure 4: Localization and type of agro-industries and resources in Lower Austria.

6. Regional Framework of STYRIA

6.1. Identification of agro-industries in Styria

The interesting agro-industries to become a logistic centre in Styria are again cereal dryers and animal feedstuff producers with the conditions stated for the Lower Austria (see section 5.1).

Apart from those sectors, the oil extraction industries could also be considered as target if they dedicate on line to the production of solid biomass when for example production decreases.

6.2. Identification of biomass resources in Styria

Styria, together with Upper-Austria, are states with a predominant abundance of rape straw as unused agricultural residue. Rest of residues are quite scarce, or fully used as organic input for soils or for animal bedding. Linzen and Westliche and Östliche Obersteiermark groups of districts have practically no resources. The total biomass to be considered available is about 120 kt/yr.

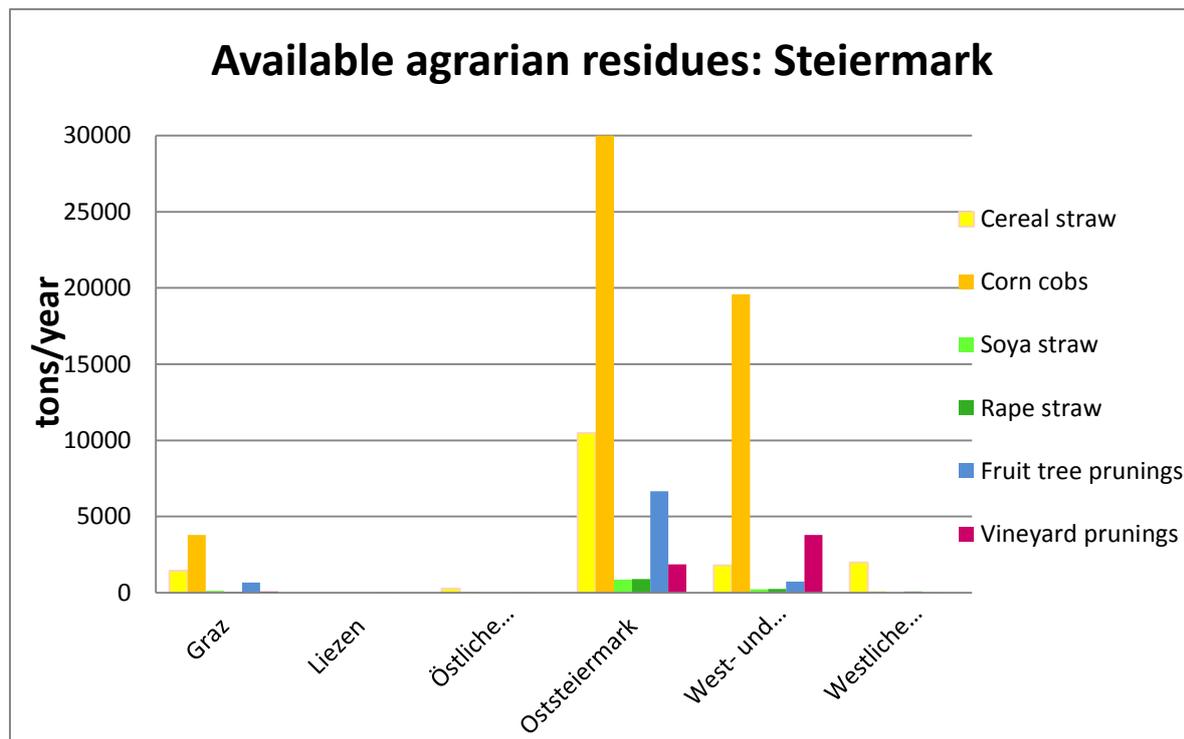


Figure 5: Summary of available agricultural biomass residues in Styria.

Main conclusions in Styria:

- Corn cob should play a decisive role when implementing a logistic centre due to the lack of other uses, accounting for more than 60.000 tons per year according to conversations with the agrarian sector.

- The groups of districts that can be object of new biomass logistic centres sited in the agro-industry are Oststeiermark and West-und Südsteiermark. They account with important amount of cobs and, in case of Oststeiermark also some relevant amounts of cereal straw
- In Oststeiermark pruning from fruit tree plantations and vineyards can be an interesting complement as secondary feedstock
- Agro-industry residues are considered unavailable, and not subject of analysis at state scale. However oilseed cake (residue after pressing seeds to extract its oil), can be a possible complement, but in very small amounts in Oststeiermark.

6.3. Localization of resources, agro-industries and priority areas in Styria

As it can be observed in Figure 6, the available resources and agro-industries of the region are concentrated in one area, which has been defined as the potential area for SUCELLOG. It presents a great amount of cereal dryers and some feedstuff producers that, as it was pointed out in other regions, could create and association to take advantage on their synergies in equipment and idle periods. The main resource to be considered in this case is the corn cobs. The logistic centre should focus their production mainly in this period. Cereal straw and prunings from fruit trees could be a puntual and local matter of raw material for a possible mixed pellet although their storage till production period should be optimised to ensure a natural drying of the wood. Areas where rape is straw is produced are surrounded in green. The seasonality of production of them can be seen in Table 4.

Table 4: Availability of equipment and biomass resources in Styria.

	Jan	Feb	Mar	April	May	Jun	Jul	Agos	Sep	Oct	Nov	Dec
Cereal dryer												
Feedstuff producers												
Cereal straw												
Maize cobs												
Permanent crop prunings												

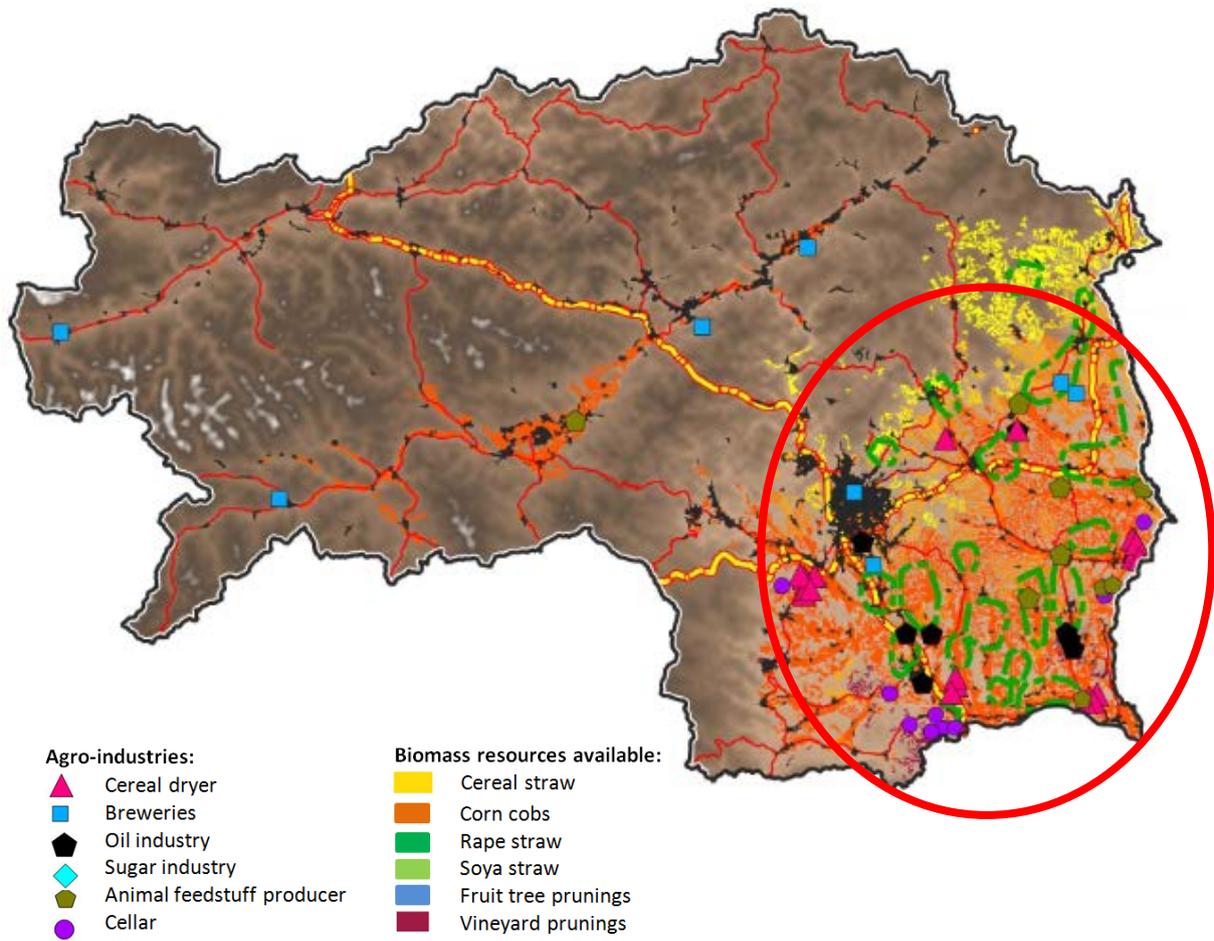


Figure 6: Localization and type of agro-industries and resources in Styria.

7. Regional Framework of UPPER AUSTRIA

7.1. Identification of agro-industries in Upper Austria

The interesting agro-industries to become a logistic centre in Upper Austria are the cereal dryers and the feedstuff producers as it happens in Lower Austria and Styria (see section 5.1).

7.2. Identification of biomass resources in Upper Austria

Upper Austria is a state with important sources specially from cereal straw in all the groups of districts. Rape straw is a second relevant resource. Woody biomass from permanent crops is a marginal by-product and cannot be considered in the analysis of the state. The total biomass sums more than 130 kt per year of herbaceous material, mainly sited in Innviertel and Linz-Wels groups of districts.

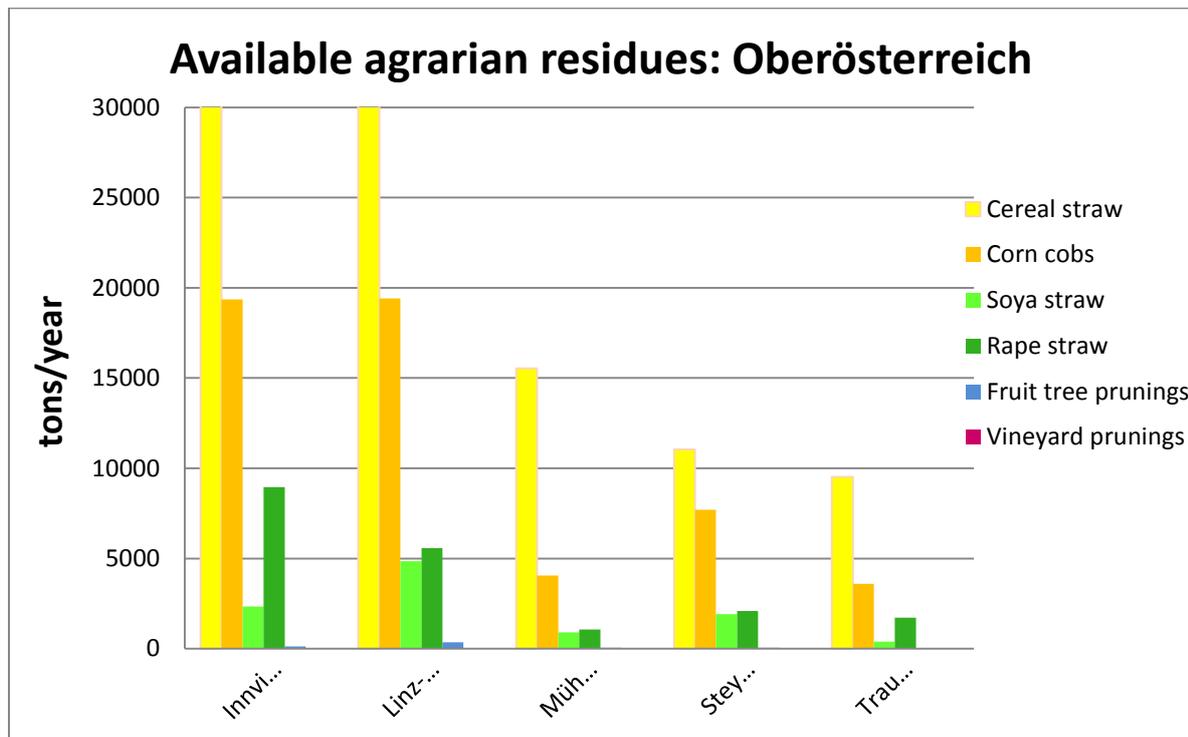


Figure 7: Summary of available agricultural biomass residues in Upper Austria.

Main conclusions in Upper Austria

- The groups of districts of in Upper-Austria account with an acceptable amount of biomass for starting new supply chains through agro-industry logistic centres based on herbaceous agricultural residues. Main resource is cereal straw and corn cobs.
- Corn cob is, as in the rest of region, a residue to be taken into consideration as biomass source whose potential is 50.000 tons/year.
- Rape and soya straw can be a complement to produce biomass mixtures.

- There are few plantations of fruit and grape crops and so, it cannot be considered as a resource, but at very locally scale
- Agro-industry residues, as in the rest of states, are already utilised for other purposes. Locally they may play a role, but they are not accounted for the region

7.3. Localization of resources, agro-industries and priority areas in Upper Austria

Figure 8 presents the situation of available biomass resources and their type as well as the situation of the agro-industry sectors present in the region. Areas where rape is straw is produced are surrounded in green It is also marked in the map the potential area for the development of a logistic centre to be placed, as in other regions, in the facilities of the cereal dryers and the feedstuff industries (taking into account available equipment and idle periods). Resources available for the production of solid biomass in the area are coming from corn cobs mainly but also straw from herbaceous crops (straw and rape) that are produced mainly from July to October as can be seen in Table 5. The production of the logistic centre should be therefore focused on this period (July-October).

Table 5: Availability of equipment and biomass resources in Upper Austria.

	Jan	Feb	Mar	April	May	Jun	Jul	Agos	Sep	Oct	Nov	Dec
Cereal dryer												
Feedstuff producers												
Cereal straw												
Maize cobs												
Rape stalks												

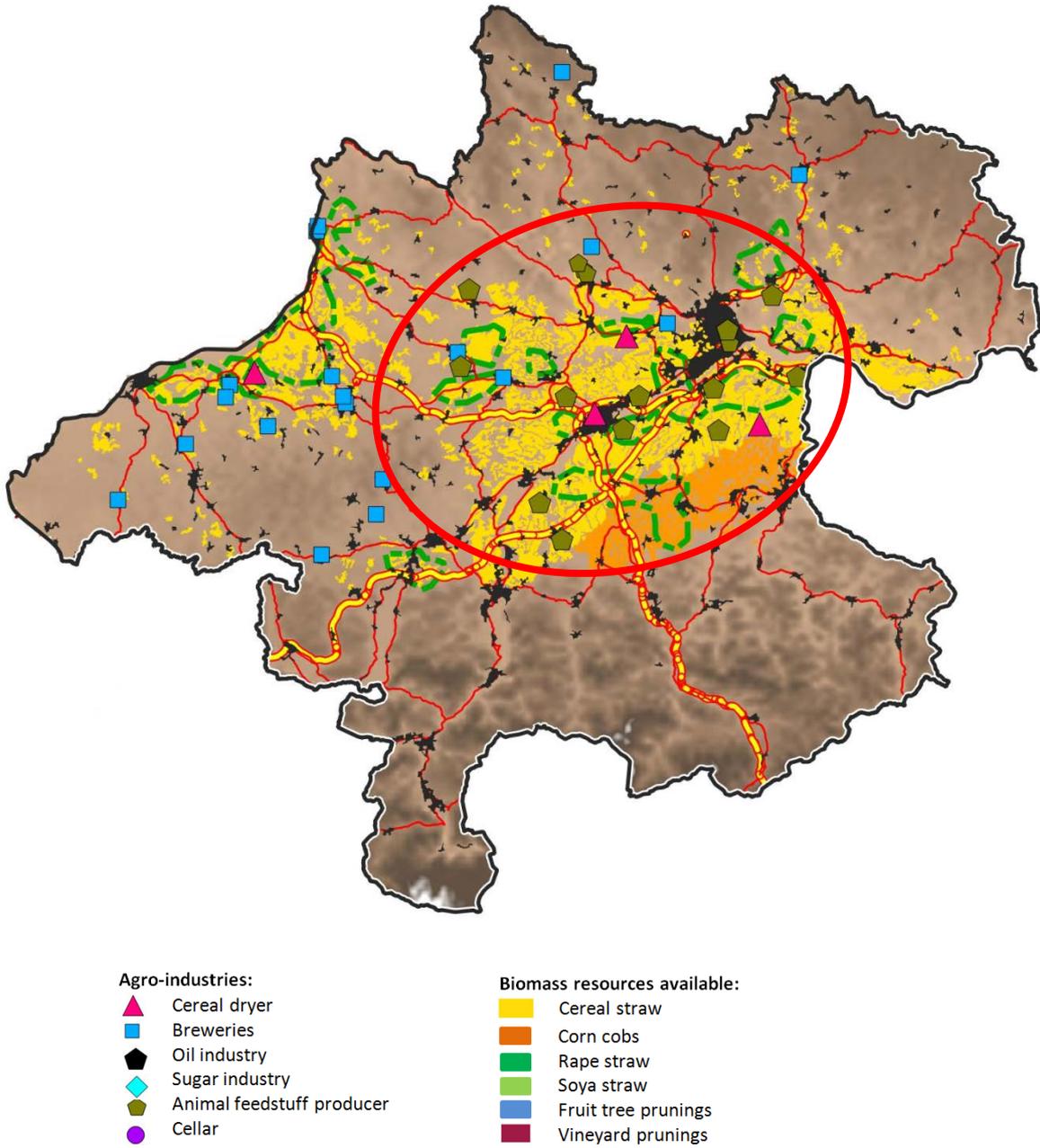


Figure 8: Localization and type of agro-industries and resources in Upper Austria.

8. Summary of the situation in Austria

The situation of the four target regions in Austria (Carinthia, Lower Austria, Styria and Upper Austria) was evaluated by SUCELLOG project in order to see the potential of the agro-industries to become solid biomass logistic centres.

From all the agro-industry sectors evaluated in Austria (cereal dryers, animal feedstuff producers, sugar industry, oil extraction industries, cellar and breweries) the project considers the cereal dryers and the animal feedstuff industry the only two sectors able to implement SUCELLOG concept, although with minor modifications. Sugar industry has been discarded since there is only one present in the target Austrian territory and their interest in starting this new activity has been low, even if their potential is interesting. The rest, either do not have compatible equipment or do not have idle period in the production.

In contrast to what happens in other countries, in Austria, the main biomass feedstock available to be used in a future logistic centre is clear: the corn cobs. In the case of cereal straw, even if some part is sold in the feed market and some is left on the soil there is still a 33% of availability. Maize straw has no availability mainly since it is used to increase the amount of organic content in the soil, which is currently a problem in the country. Residues produced in the agro-industries are also used for animal feed having an important market. In the cereal dryers, a new drying line should be implemented in the facility to be able to process this kind of biomass, but handling equipment as well as storage and transport means (and in minor cases also pelletisers) could be utilised in the idle period (9 months). The feedstuff producers own a drying system that works all the year but their pelletisers work according to demand, having the possibility to be adjusted for the production of agro-pellets. Even if both industries could work as logistic centres on their own, it is considered that an association among them, taking advantage on the synergies of available equipment and periods of work, could play an important role in the success of the new business activity.

Although the agro-industries see the idea as a good opportunity to diversify their activity, their main concern is the market of the product (reduced to large consumers or also to household), which will depend on the legal aspects of the combustion of agrarian biomass in Austria, currently under discussion. The situation in some regions, where corn cobs are already allowed to be used in households make the sector be optimistic about this new business line.

Annex I: Table of ratios y availability percentage per region

Table 6: Ratios of biomass production (t/ha) in AUSTRIAN target regions.

Crop	Austrian target regions
Wheat	4
Rye	4
Barley	3,5
Oat	2,6
Maize	4
Rice	10,3
Beans/Pulses	-
Tobacco	-
Hemp	0
Rape	4
Sunflower	10
Soya	2
Linseed	-
Seed_other	7
Fruit_temp	2
Fruit_subtrop	-
Berry	1
Nuts	1
Citrus	-
Olive	-
Vineyard	3

Table 7: Percentage of availability of biomass (%) in AUSTRIAN target regions.

Crop	Austrian target regions
Wheat	33
Rye	33
Barley	33
Oat	33
Maize	0
Rice	-
Beans/Pulses	0
Tobacco	-
Hemp	0
Rape	50
Sunflower	0
Soya	50
Linseed	-
Seed_other	50
Fruit_temp	70
Fruit_subtrop	-
Berry	70
Nuts	70
Citrus	-
Olive	-
Vineyard	70