D5.1

Interim LCMW materials assessment and utilisation pathways: templates, models and status quo

30.06.2016

About greenGain project

The greenGain project is looking for solutions to increase the energy use of biomass feedstock coming from landscape conservation and maintenance works (LCMW) carried out in the public interest. The main target groups are regional and local players, who are responsible for maintenance and conservation work and for the biomass residue management in their regions. Moreover, the focus will be on service providers - including farmers and forest owners, their associations, NGOs and energy providers and consumers.

The three year project which started on January 2015 is supported by the Horizon 2020, European program to foster research and innovative solutions in the EU. The project is gathering partners and researchers from Germany, Italy, Spain and Czech Republic. Researchers will map biomass potential coming from landscape conservation and maintenance work, various technological options to utilise it, identify possible obstacles and provide recommendations to a wide range of stakeholders in the EU 28.

Project coordinator

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Project partners

Comunità Montana
Associazione dei Comuni
"Trasimeno - Medio Tevere"

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About this document

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Summary

A fundamental part of the greenGain project is the initiation and realisation of strategies to utilize biomass from landscape conservation and maintenance work (LCMW) in model regions of the four project countries. For this, the involvement of local stakeholders is vital, which was ensured by linking seven regions to the project either as associated partners, forming part of the consortium, or as external stakeholders committed with the project.

This deliverable describes country by country the dedicated region(s) in terms of geography, extent, population and economic activity. Further, a status quo assessment was done on the existing LCMW types in these regions. A total of 18 types were defined: five in Spain, Italy and Czech Republic, and three in Germany. In the assessment in this document the already performed work, existing feedstock, harvest, logistic and conversion techniques for every LCMW type are elaborated.

A key part to promote the energetic use of the defined LCMW material and the elaboration of promising utilisation pathways is the demand for the biomass. To include this aspect, the main biomass consumers in the areas of interest were identified in the last part of the status quo assessments. The results presented here show the current and potential future niches for the LCMW biomass types in every project region.

Finally, the promotion of the utilisation of LCMW biomass requires multiple local / regional stakeholders to get involved, as they are the actors who produce, handle and consume the feedstock. For this purpose an approach was carried out in all model regions in order to detect those stakeholders of relevance, and to build a relationship. This deliverable describes and analyses the gathered groups of relevant stakeholders, named Local Working Groups (LWGs). Each country followed a different strategy to engage these actors. How the LWGs were organised, inaugurated and officially announced can be obtained from the last section of the chapters on each country.

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1. Scope of the document

1.1. Introduction to greenGain and model regions

The general greenGain target is to provide an EU-wide platform to raise awareness on the availability of landscape conversation and maintenance work (LCMW) biomass sources for energy production. The overall strategy of greenGain is: (1) a top-down strategy to identify the European overall state-of-the-art including studies and projects done or underway, the legal and regulatory frameworks and stakeholder perceptions; (2) a bottom-up strategy to validate the concepts from biomass classification, harvesting and transport up to choosing the most appropriate conversion pathway for market uptake in four project countries.
Therefore, a set of so called "model regions" was integrated as a key part of greenGain strategy from the beginning. The contribution of the "model regions" bottom-up approach to greenGain can be summarised as next:

- screen the local frameworks: policy practices, finance tools, and legal regulations, public participation measures and governance in model regions (object of greenGain work package (WP) 6)
- identify barriers, opportunities and good practices for LCMW biomass in the regions
- identify the potential of local LCMW biomass resources in model regions based on local inventories and local expertise (part of WP5, which results are described in deliverable report D5.2)
- select strategies to exploit available LCMW biomass according to the specific local frameworks: regulations, incentives, existing infrastructure, relevant land conservation and management works, stakeholders, etc. (which results are partly described in this document, and in the deliverable report D5.2)
- to activate the interest and motivate to implement policy measures (as part of WP6)
- the capacity to create local knowledge a that can be exchanged with other similar relevant players in the EU (through workshops and conferences organised in WP2)
- provide capacity to transfer the results of local experiences and the knowledge gained during the interaction with local stakeholders and during the implementation of pilot experiences to a EU wide group of stakeholders in form of contributions to the report "Good practice Guidelines" (in WP3, through deliverable reports D3.6 and D3.7)
- use gained experience and steps achieved by the model regions to raise awareness of regional and national actors, to activate their interest and to promote new advances of LCMW utilisation in other areas (as part of WP3)

The execution of activities at local scale is therefore a fundamental part of greenGain strategy.
The involvement of model regions was ensured by linking to the project either as Associated Partners, either forming part of the consortium (OMEZYMA in Spain and CM-ACT in Italy) or

as external stakeholders committed with the project (like the administration counties Friesland and Rotenburg (Wümme) in Germany, or the PROD ODPAD citizen association and the Energetica Knezice public energy company in Czech Republik.

1.2. Status quo

The status quo report is aimed to describe the current situation of the LCMW biomass in the greenGain model regions: existing LCMW sources and the already performed LCMW work in the model regions, like existing feedstock, harvest, logistic and conversion techniques. The report forms part of greenGain WP5 “Pilot experiences for market supply of LCMW”.
The status quo, as designed in greenGain, consists of four components:

1. general description of the model regions
2. LCMW of relevance for the region
3. biomass consumers (current and future niches for LCMW biomass)
4. stakeholders, as they are the actors who will be involved in producing, handling and consuming the LCMW biomass

The present document describes country by country the LCMW status quo following the structure of these four main items. In terms of strategy, Figure 1 depicts conceptually its relevance, and the need to assess it in order to detect which biomass types can constitute a real opportunity for the territory.

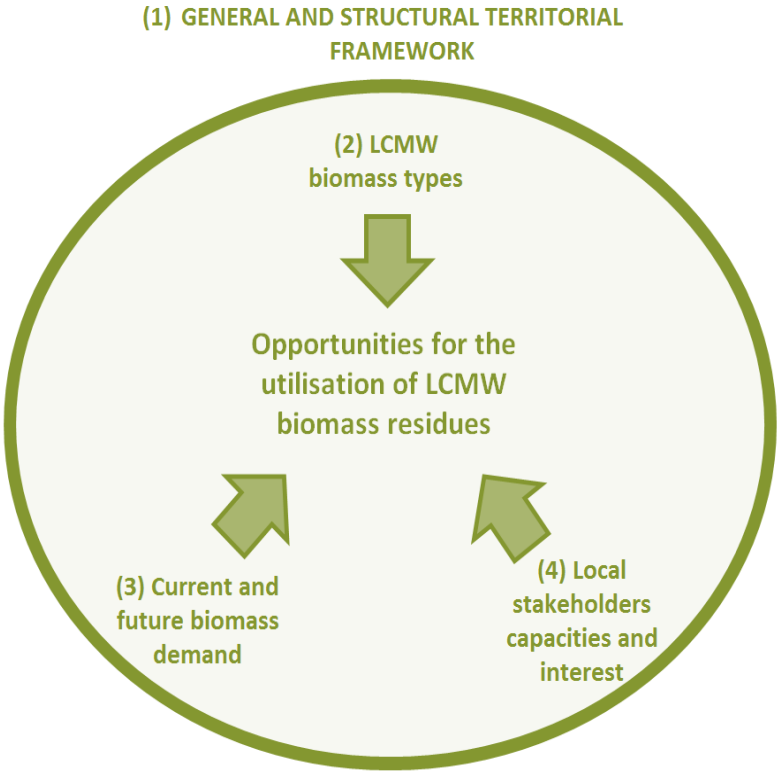


Figure 1: Conceptual diagram of the four items needed to describe the status quo for LCMW biomass.

(1) General description

The greenGain project incorporates the following seven model regions (Figure 2):

- Matarraña and Bajo Aragón counties in Spain
- Comunita Montana Trasimeno – Medio Tevere in Italy
- Counties Friesland and Rotenburg (Wümme) in Germany
- Obec Kněžice municipality and Vltavotýnsko Mikroregion in Czech republic

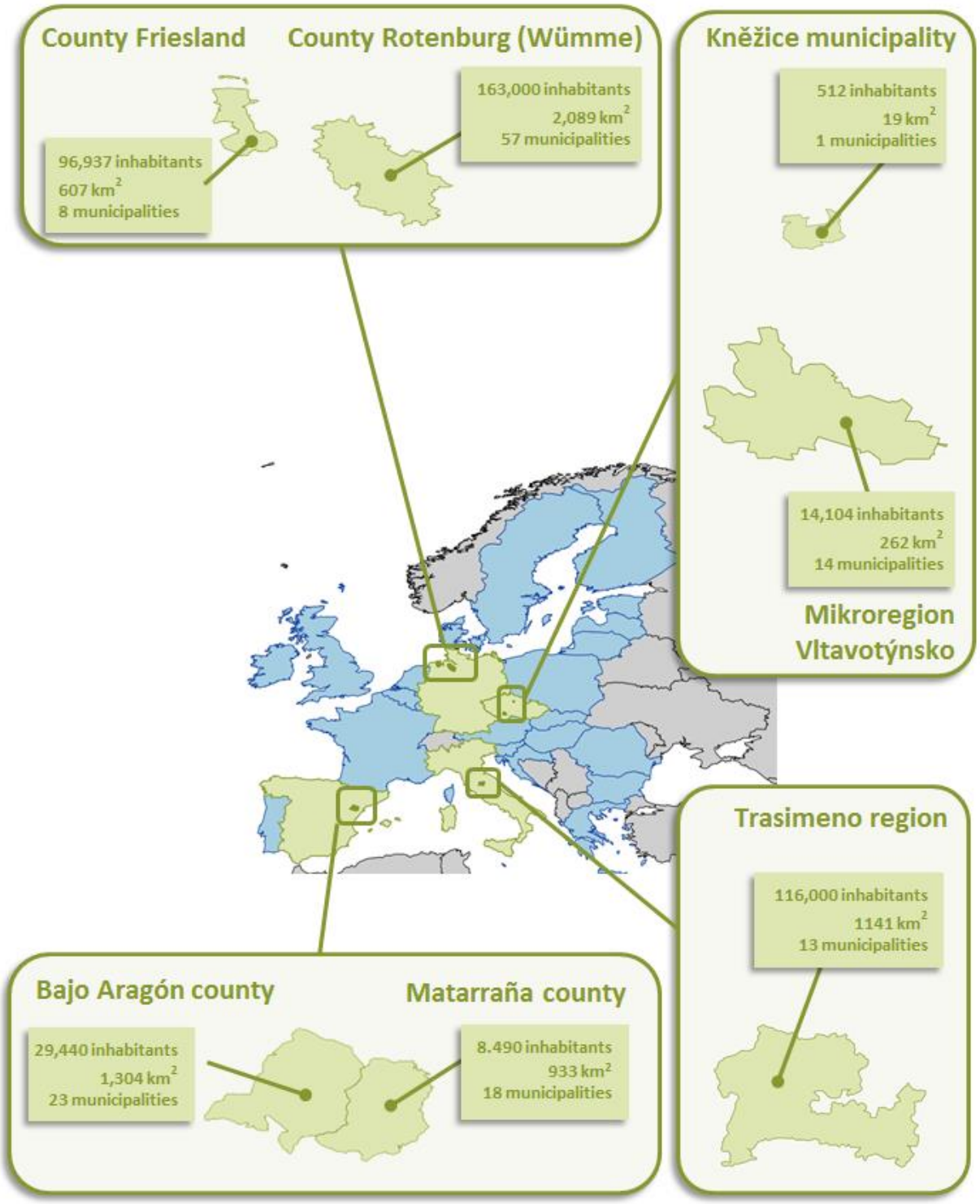


Figure 2: Location and main features of the greenGain model regions.

Each country´s status quo report includes a short description of the regions in terms of geography, extent, population and economic activity. The review of barriers, legal framework, etc. is not included, as it is part of the deliverable reports in WP6. For the unified description of the regions the template provided in Appendix 7.1 was utilised.

(2) LCMW Biomass status quo

This section of the LCMW reports describes what different LCMWs in the regions are carried out and which biomass residues may be subject of utilisation. It is described if the biomass is already being utilised, what LCMWs are being carried out, which local stakeholders are participating currently in such works, and which regulations attain to its exploitation. For the unified description of the LCMWs in the greenGain regions a series of templates was utilised, as provided in Appendix 7.2. The LCMW types pre-identified and object of this document are summarised in the following table.

Table 1: Overview of the LCMW types in the project countries analysed in this document

Country	LCMW	Short name	LCMW subtypes (if existing)
Spain (ES)	1)	Cleaning sides of agrarian and cattle tracks (track cleaning)	-
	2)	Fire protection belts along local paths and tracks (fire belts)	Build new
			Maintenance
	3)	Clearing vegetation along rivers and water courses (riverside cleaning)	Cleaning operations undertaken at an emergency level after a flood
			Reed removal
	4)	Restoration of abandoned agricultural lands in valleys (restore agricultural land)	Restoring tracks and access
			Removal of former fruit, olive and vineyards
			Removal of natural vegetation
	5)	Cleaning of recreational forests and parks (recreational forest)	-
Italy (IT)	1)	Olive groves	Maintenance
			Restore abandoned
	2)	Vineyards	No subtypes
	3)	Parks and Gardens	Woody biomass
			Herbaceous biomass
	4)	Roadside Maintenance	Woody biomass
			Herbaceous biomass

	5)	Water (grass-road)	-
Germany (DE)	1)	Maintenance of hedge- and treerows on banks (banks)	-
	2)	Maintenance of roadside hedge- and treerows on roadsides (road)	Maintenance
			New plantings wayside strips
	3)	Maintenance of moor areas (moors)	-
Czech Republic (CZ)	1)	Trees: urban space maintenance (tree-urban)	-
	2)	Trees: road side maintenance (tree-road)	-
	3)	Trees and grass: maintenance of riversides (river)	-
	4)	Grass: urban space maintenance (grass-urban)	-
	5)	Grass: road side maintenance (grass-road)	-

(3) Potential LCMW biomass consumers

Biomass demand is a key part to promote the use of LCMW biomass residues and the creation of opportunities around the change of work method and residue management when executing LCMW. No potential consumers imply a lack of opportunities to convert a residue into a by-product with certain value. Therefore, to know the profile of current and future biomass consumers is needed as a part of the status quo.

During the status quo assessment the main biomass consumers in the area were identified. When consisting in singular facilities, they were approached by project partners. For the unified description of the biomass consumers the template provided in Appendix 7.3 was utilised. It must be noted that the template also contains information on LCMW work, LCMW quality parameters and a table for the preliminary analysis of the compatibility of the LCMW biomass with the existing biomass consumers. The matching of the compatibility between LCMW biomass types and the existing potential consumers in the model regions, however, is not reported in the present document, but in the deliverable report D5.2.

(4) greenGain stakeholders and Local Working Groups (LWGs)

When greenGain was conceived, the greenGain partners were aware that greenGain coordination and support actions required the participation of multiple local players. Not all

of them could be part of an EU project consortium, but they would be vital. The promotion of the utilisation of LCMW biomass requires multiple actors to be aligned, to facilitate it. This is principally crucial when a residue has still no market (like is in general the case of LCMW biomass), since it is needed to raise awareness, activate the interest on the opportunities that LCMW biomass can bring, and involve local / regional actors in order to make the utilisation of biomass possible.

An important part of WP5 has consisted in aligning and engaging the relevant local stakeholders with greenGain. For this purpose an approach to them was carried out in all model regions. The main aim was to detect those stakeholders of relevance for LCMW biomass promotion and utilisation, and to build a relationship. The groups of relevant stakeholders were named as Local Working Groups (LWGs) supporting greenGain. These LWGs must be understood conceptually, and not necessarily as an actually exiting operative group. This is further explained in Appendix 7.4.1, where it is stated that it is not always possible or convenient to create a formal or legal group of multiple stakeholders. During the first year of the project the LWGs were officially announced to be in operation. Each country followed a different strategy to engage local stakeholders: small group meetings, bilateral contacts and local sectorial workshops are examples.

The LWGs stakeholders were classified into eight groups, according to the role they can play in the promotion of utilisation of LCMW biomass:

- Owners: those stakeholders, who own the land or the residue produced. Can be private (person, company, private body, private association) or public (council, government body). They may be also bound to the execution of works (e.g.: farmers whose fields are bordered with hedges and tree alignments, subject of maintenance work).
- LCMW service companies: companies able to execute the LCMWs (e.g.: forestry service companies, gardening companies, etc.)
- Logistic operator / conversion: any intermediary stakeholder dedicated to handle, treat and / or distribute biomass, and that could be interested in LCMW biomass. It includes biomass suppliers, residue dealers, but also power plants producing energy carriers like pyrolisis oil, torrified biomass, syngas, etc.
- Final consumer: energy consumer, which could be interested in the utilisation of LCMW biomass
- Permitting authorities: public body or service providing licenses, official certificates or documents granting authorization for execution of LCMWs
- Government bodies: public administration carrying out the political direction and control exercised over the actions of the members, citizens, or inhabitants of communities, societies, and states
- Social groups: relevant social groups which may neither be owners, nor actors of the value chain, but which live in the area and may be relevant: ecologist groups, entrepreneurs association, neighbours association, NGOs, associations for local or

rural development, etc.

- Other key actors: research centres, consultancy or engineering companies which may support or have influence, even though their relevance may depend on each region

The engagement and support obtained from local actors is crucial for the development of WP5 and for the diverse WPs bottom-up approach (as presented in section 1.1). A report for attracting stakeholders and engage them was produced in the beginning of the project. The summary and the methodology for the stakeholders assessment is presented in Appendix 7.4.

Stakeholder's relevance and involvement in greenGain LWGs and in the promotion of LCMW biomass has been analysed according to the scope and methodology presented in Appendix 7.4. As first step, stakeholders for each region were classified according to:

- their role as mentioned in the previous paragraph
- their relevance by LCMW type regarding if they were crucial, relevant, or not relevant (scores 0 to 3)
- their willingness or commitment with the project (scores 0 to 4)

Two diagrams have been prepared on the base of the information compiled and the scores assigned:

1. a spider net diagram, which depicts the readiness factor (RF – accounting the interest, proximity and capacity to contribute and participate in greenGain and to promote or facilitate the execution of future pilot experiences or new value chains)
2. a quadrant diagram, which depicts the contact value of the stakeholders together with the willingness to participate in greenGain (utilised to detect which relevant actors must be object of a strategic approach to activate their interest and get engaged with the project)

These graphs were useful to understand the status of the local stakeholders and to prioritise the contacts to be carried out by greenGain partners.

1.3. Value of the present document

The greenGain partners have carried out an identification of the LCMW sources and put it in the context of the pilot regions in order to describe their current status. The work is illustrated here, and may serve as a guide for exemplification and replication. The present document includes a series of templates that greenGain partners designed and utilised for the analysis of the status quo in the seven model regions. They may be of interest as a base methodology for future studies on the LCMW status in other regions.

2. Spain: regions, LCMW status quo, potential pathways and stakeholders

2.1. General description of the project regions Matarraña and Bajo Aragón

The general description of the regions is based on two strategic documents released by OMEZYMA in 2007 and 2013, namely:

- Leader Rural Development Program 2007-2013 for Bajo Aragón and Matarraña Counties (referred as OMEZYMA, 2007)
- Rural development strategy LEADER 2014-2020 (referred as OMEZYMA, 2013).

Bajo Aragón

Bajo Aragón is located in the north east of the Teruel province and has a total area of 130,400 ha (Figure 3). It is a strategic area situated 107 km southeast of Zaragoza (capital city of Aragon), 139 km west of Tarragona, 166 km northwest of Castellon and 234 km southwest of Barcelona. The three last cities are located at the Mediterranean coast. The region Aragon is located in the depression of the Ebro river valley at the East of Aragon. The region accounts 20 town councils. The chief town is Alcañiz (16,384 inhabitants) being the sixth biggest town of Aragon.

Figure 3: Location of the Spanish pilot region Bajo Aragón (source: OMEZYMA, 2007).

The region´s different areas present a climate with significant differences which leads to different types of landscapes therefore, we can find Mediterranean forests but also semi-arid zones and large areas with olives that spread throughout the region territory (Figure 4). Mediterranean continental climatic conditions with significant variations from summer (23-24°C of mean temperature) to winter (5-6°C of mean temperature) occur. The average annual precipitation is 400 mm. The region does not account with big mountains but in the south part of the region start the mountain of the Iberian System. The altitude is around 300-400 meters above the sea level in the depression rising up to 850-950 meters in mountains areas.

The main river is the Guadalope which merges into the Ebro River. But there are other minor rivers like el Guadalopillo, el Bergantes, el Mezquín and one small creek called the Regallo.
The region accounts with a curious natural formation called “las Saladas“, which are almost dried lagoons, where at the bottom dissolved mineral salts accumulate. The region also accounts with a certain number of ponds.
A 59 % of the territory is suitable for agricultural production with an easy topography. Another 39 % with a difficult topography (mountainous conditions) is used for forestry. Both can be intercalated originating a peculiar landscape (mosaic). Most arable land is used for growing cereals, vineyards, olive trees and fruit trees.

Figure 4: Landscape of Bajo Aragón: olive groves; and general landscape nearby Alcañiz (pictures: Joaquín Lorenzo. Grupo Bajo Aragón-Matarraña, OMEZYMA).

The total population in Bajo Aragón is 29,440 inhabitants, which results in a population density of 22.7 inhabitants / km^2. The population is concentrated in 23 villages. Only 4 villages have more than 1,000 residents, 4 reach from 400 up to 700 and the rest has less than 400 inhabitants. Alcañiz accounts more than 16,000 (55 %) habitants; the cities Alcañiz, Alcorisa and Calanda inhabit 79 % of the total population of the region. If Mas de las Matas is included the value rises to 84 %, and including Castelseras y Valdealgorfa 89% of the region total population is located in these municipalities. Therefore 90 % of the region population is located in one third of the region municipalities. Total employed population amounts 59.89 % of the region´s total population. The service sector concentrates more than 60 % of the workers. The agricultural sector has a 15.4 % of the workers, the industrial sector 13.3 % and the building company sector 10.7 %. Services are located at Alcañiz while in the small villages the agriculture is predominant.
In recent years the agro-business has raised: meat industry, canning industry and craft industry. Other activities as tourist trade or sport trials (motorland) are currently increasing

their importance. The agricultural activity and forestry occupies a high percentage of the population but it only generates 5.3 % of the gross added value (GAV), a lower percentage than the manufacturing company (9,9 %) or building company (16,4 %). The hotel and tourist trade contribute with more than 18 %, and the highest income comes from public administration, education and health (24 %).

Matarraña

The county Matarraña is located in the east of the Teruel province, which borders to the autonomous regions Catalonia and Valencia, in the eastern end of Aragon, and has a close connection with the Mediterranean area (Figure 5). The total area is 93,300 ha and the main town is Valderrobles. It is 179 km from Zaragoza away (regional capital city) but nearer to Tortosa (53 km) at the delta of the Ebro river, Tarragona (125 km) or Castellon (151 km). Barcelona is 222 km far away. It contains 18 town councils but only Valderrobles (2,310) and Calaceite (1,108) have more than 1 000 inhabitants.

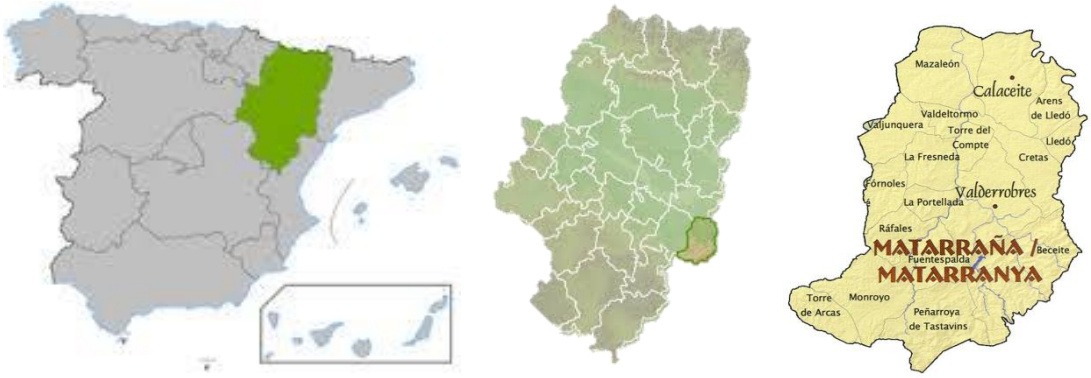


Figure 5: Location of the Spanish pilot region Matarraña (source: OMEZYMA, 2007).

The region has a continental Mediterranean climate. It is a small territory with a strong climatic contrast: in the north dry and hot, more fresh and wet in the mountainous areas (Figure 6). 43 % of its area is flat ground and is used as agricultural land. Another 56 % is forest land due to the mountainous conditions. The mountain range corresponds to the mountain massif of chalky character in which the vegetation has a high density noticing on the hilltops the larger pine forested areas (Pinus Sylvestris with Buxus sempervirens and Juniperus communis). The mountain range zone has a less abrupt geography with a forested mass of pine (Pinus nigra and Pinus halepensis). The region accounts several rivers, the Matarraña which merges into the Ebro River, the river Pena, river Ulldemó and river Tastavins.

In the past years there was an important timber industry and nowadays biomass industry. This landscape has originated more than 15,600 ha of Site of Community Importance (SCI) and 14,780 ha of special protection areas for birds (SPAs).

The more important crops are: olive trees (7,990 ha), fruit tree (7,940 ha), cereals (2,710 ha) and forage crops (910 ha).

Figure 6: Landscape of Matarraña (pictures: Joaquín Lorenzo. Grupo Bajo Aragón-Matarraña, OMEZYMA).

The total population of Matarraña counts 8,491 inhabitants which results in a population density of 9.1 inhabitants / km^2. Valdrerrobres (capital) and Calaceite account for 38 % of the total population of the region. The inhabitants live in 18 small villages, two of them with more than 1,000 inhabitants, five from 400 up to 700 and the rest less than 400. The population density is not very low comparing to other regions but as many others it has experienced an important negative demographic shift during the twentieth century (decrease of 15,000 habitants). People over 65 years old represents 27.5 % of the population (20.8 % in Aragon). The average age is 47.8 years (43.9 in Aragon). In recent years quality facilities for tourists have being developed in this area due to its nature and architectural value.

Total employed population amounts 59.89% of the region total population. The majority of the inhabitants and the highest percentage of gross added value (18 %) are related to crop-livestock farming and forestry. Only trade, hotel business and the services sector are higher (23 %). Building company sector contributes with 17 %. In recent years food and agriculture activities (meat industry, canning industry and craft industry) are increasing. Other activities, as nature and cultural tourist trade, are acquiring an increasing leadership. Forest resources and biomass is another important base-line of economic activity.

2.2. LCMW status quo in Bajo Aragón and Matarraña

The LCMWs identified initially in the Spanish greenGain regions are summarised as follows:

Table 2: Summary of the LCMWs for the greenGain Spanish project regions

LCMW	Short name	LCMW subtypes (if existing)
1)	Cleaning sides of agrarian and cattle tracks (track cleaning)	-
2)	Fire protection belts along local paths and tracks (fire belts)	Build new
		Maintenance
3)	Clearing vegetation along rivers and water courses (riverside cleaning)	Cleaning operations undertaken at an emergency level after a flood
		Reed removal
4)	Restoration of abandoned agricultural lands in valleys (restore agricultural land)	Restoring tracks and access
		Removal of former fruit, olive and vineyards
		Removal of natural vegetation
		Thinning and pruning of currently forested parcels
5)	Recreational forest and parks cleaning (recreational forest)	-

Each of the listed LCMW types and the biomass that can be obtained are described in the following chapters.

2.2.1. LCMW 1- Track cleaning

The short name “track cleaning” refers to maintenance works carried out in agrarian and cattle tracks to permit the circulation of vehicles of local inhabitants to public areas or to their own properties. Track should be considered as mainly gravel roads (non-paved road) allowing the circulation of vehicles. The work requires clearing the track sides from vegetation that has invaded or blocked it (Figure 7). The frequency of the work varies between 4-10 years in main tracks. The territory accounts with a large network of agrarian and cattle tracks, since an important part of Bajo Aragón and Matarraña is placed in hilly areas. Additionally the agrarian land ownership is quite fragmented, and it also influences in the extent of tracks.

Tracks in the present document do not include the walking path network, even though work is required in those paths located in shadow and more humid zones where the vegetation development spreads more quickly. It has been estimated the area is rather small, about 10 ha, and therefore not included as a target LCMW.

Natural vegetation along agrarian tracks is not as dense and fresh forests as in the mountain ranges in the very east of Matarraña (Beceite port), where *Pinus nigra* is prevailing. Along agrarian tracks at a lower height above sea level, the vegetation consists of Mediterranean forest land, ranging from dense forests of *Pinus halepensis* (aleppo pine) to very or disperse shrub vegetation. Forests are principally populated by *Pinus halepensis* and *Quercus ilex* (evergreen oak or holm oak). As forests become more disperse shrubb vegetation like *Quercus coccifera* (kermes oak) or *Pistacia lentiscus* (mastic) expand over the terrain. In shadow and fresh areas, or at the sides of agrarian tracks is also common to find *Rubus ulmifolius* (elmleaf blackberry or thornless blackberry).

The ownership is mainly private, as most of the vegetation is adjacent to agrarian land or in private forestry land. However the biomass produced by unit of track is rather small, and not considered of interest, practically not used. The municipalities mainly execute the clearing or maintenance work and sometimes private owners when the ownership of the path is private in which case an authorization is required.

Agrarian and cattle track maintenance works may include several types of operations, as described by the forestry brigade of the county Matarraña:

- Work carried out systematically work:
    - Removing damaged trees, dry trees, or trees invading the track
    - Pruning branches of trees and bushes
- Work carried out when fire prevention is also planned
    - Remove shrub vegetation in 3 meters distance on both sides of the track

The work is done in a combination of manual and mechanical technologies. It also depends on who is carrying out the work. Local inhabitants clearing parts of the track because of their own interest will use chainsaw, dispose the branches and keep the small firewood produced. Brigades from the councils, counties or Aragón Government use chainsaws to fell trees and crosscutting into firewood, and mowers (mounter on rear of a tractor) or grass trimmers for eliminating the small bushy vegetation. Residues are usually left on site, either shredded into small pieces (with a chipper fed manually) or they are simply loaded loose on a track for its disposal.

Figure 7: typical track side vegetation in Bajo Aragón and Matarraña. Above: dense Mediterranean forest (left) and sparse shrub vegetation (right). Below: natural vegetation along agrarian tracks adjacent to agrarian fields (pictures: Joaquín Lorenzo. Grupo Bajo Aragón-Matarraña, OMEZYMA).

Biomass from track cleaning is practically underutilised. It must be mentioned that in Bajo Aragón and Matarraña was quite a practice in former time to obtain firewood for self-consumption by the local inhabitants. Still part of the elder generation keep doing such type of work, even though is not usual. In contrast, part of the population still keeps the habit of consuming firewood, and therefore when road or forestry maintenance is being carried out, and the biomass obtained is not sufficient to be considered for commercial purposes, the local brigades leave firewood batches at the disposal of local inhabitants, who drive to the areas to gather the firewood produced.

It must be noted that the amounts of biomass can be substantial when the works executed are to restore former tracks being invaded by vegetation during several decades.

Figure 8: Before and after of the work for accessing to a private parcel being invaded by vegetation over more than 20 years (pictures: Olga Ric, Environmental technician of Matarraña County).

For the described LCMW-track cleaning in the Spanish model regions Bajo Aragón and Matarraña the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners. It has been stated that the limited amount of biomass per km of track would not allow neither the creation of intermediate stockpiles along the tracks, nor the utilisation of mechanised forest harvesters. Works rare therefore expected to be manually done, as manual felling, manual gathering of residues (to be mounted on a truck or to be chipped), and chipping with a small manual chipper mounted on a truck. Biomass should then be transported to a local storage centre (either a biomass supplier or a timber company) for treatment and distribution to local consumers as woodchips. In the tables below it is considered only the process of tree / large bush removal and pruning, not the mowing of shrub vegetation.

Table 3: Most promising logistical chain for LCMW 1-track cleaning in Spain

LCMW1-Track cleaning a) felling trees and large bush		
Felling	Felling with chainsaw	Felling with chainsaw Preparing short pieces
Treatment	Limbing of branches with chainsaw Stem / large branches crosscutting	Chipping of with small manual chipper to trailer
Loading	Manual load in 2 axis truck or agricultural trailer	-
Transport	2 Axis truck or tractor	2 Axis truck or tractor
Pre-treatment	Storage under shed Chipping with static chipper	Storage under shed
Combustion	According to woodchip quality. Public heating systems, farms / industry	According to woodchip quality. Farms / industry

Table 4: Most promising logistical chain for LCMW 1-track cleaning in Spain

LCMW1-Track cleaning b) pruning wood		
Felling	Pruning with chainsaw	Pruning with chainsaw
Treatment	-	Chipping of with small manual chipper to trailer
Loading	Load loose branches on 2 axis truck or agrarian trailer	-
Transport	2 Axis truck or tractor	2 Axis truck or tractor
Storage	Storage in open air	Storage under shed
Treatment	Chipping into woodchips	-
Combustion	According to woodchip quality. Public heating systems, farms / industry	

2.2.2. LCMW 2, Fire belt (firewall)

Fire belts (as a short name for "fire protection belts along local tracks") are a type of fire prevention work for natural areas consisting on clearing of the natural vegetation around the forest paths and roads (e.g. 20 or 50 m from each side of the path). It is a type of firewall, being a strategic element of the infrastructure against fires. These works are quite usual in the model regions of Bajo Aragón and Matarraña, as the principal firewall infrastructure is already built. Contrary to usual firewall this strategy allows a better accessibility for trucks and other means due to the use of the existing tracks. The existing agrarian and forestry tracks where the auxiliary belts are carried out become part of the fire risk prevention strategy (Figure 9).

Works on fire belts include:

- LMCW2a: built new (open new fire belts)
- LCMW2b: maintain the existing firebelts along tracks.

As can be observed the target infrastructure is same as for LCMW1-track cleaning. The difference is that LCMW1 targets the whole track network, whereas LCMW2 targets only the areas where fire belts are planned. Furthermore the treatment in fire belts is more intense in reducing the vegetation in a wide strip along the track, and does not only affect the very adjacent vegetation (as LCMW1 does).

Figure 9: Example of auxiliary belt opening in Zaragoza province: forest before and after opening fire belt in Villanueva de Gállego, July 2015 (Pictures: Daniel García – CIRCE).

Figure 10: Above: Residues in an auxiliary belt in Bajo Aragón and Matarraña boundary. Below (left) image of residues after being shredded; (pictures: Daniel García-CIRCE). Below (right): example of shredding operation with the Matarraña County shredder (pictures: Joaquín Lorenzo. Grupo Bajo Aragón-Matarraña, OMEZYMA).

For new auxiliary belts opening the main species that can be found are as the species mentioned for LCMW1: *Pinus halepensis*, *Quercus ilex*, *Pistacia lentiscus* and *Quercus coccifera*. The *Juniperus communis* (common juniper) and *Juniperus thurifera* (Spanish juniper) can also be found.

Fire belt LCMW concentrates in reducing the density of the vegetation, even though *Juniperus spp*. is usually maintained due to its indigenous character and to its high resistance to fire. It is not considered a vegetation cover which fuel model could involve a fire risk. In contrast other shrub vegetation like *Quercus coccifera* is regarded as a target species, as it contributes easily to fire propagation.

The property of forests in the Mataraña region is mainly Public (municipality) and in the region of Bajo Aragón is mainly private (individuals). This fact could affect the availability of biomass.

The LCMW is carried out by the environmental authority. If the authority does not have the means to carry out the work it will organize a public contest so that private companies will execute the work under their specifications. For maintenance work mainly the brigades of the Aragón Government carry out the work since no woody material will be extracted. The work is generally carried out by the brigades, instead of subcontractors.

Access is possible by using the existing tracks. Also, fire brigades work seasonally from April to October, and during summer they may be requested to participate in fire extinction works. In such cases the opening and management of firewalls and auxiliary belts are stopped. This limits the capacity of operation of external stakeholders willing to make use of the wood. The planning of such companies has to suddenly adapt to unavailability and delay in works carried out by the forest brigades. That can cause the supply to result un-economic: the plans and work execution changes, but the external stakeholder keeps the commitment of collecting the wood or residues according to specified schedules.

Regarding the LCMW biomass obtained, it is usually object of some utilisation. When new auxiliary fire belts are opened the brigades process stemwood and big branches into firewood. The local population still bases partially on firewood, and therefore the firewood produced is usually spontaneously consumed. The usual practice to provide the biomass is through permits provided by the local council to local neighbours. The biomass is regarded as a “right” of the neighbours, and they can collect only for own consumption (as firewood), not for commercialisation. Logs and big branches in form of small logs are transported by hand to the forest track side. Local neighbours do manual load and use their own pick-up or own tractor with trailer. In some areas this practice is not regulated, and the local council make a call to the neighbour to get the logs in a certain period, without any control of neighbours actually making use of it.

In forests with *Pinus halepensis* or *Pinus sylvestris* wood cannot be left for more than 15 days in the forest to avoid the propagation of a coleopteran pest. Therefore the wood should be either shredded or extracted and transported. This legal restriction affects logistics and economics. In some cases the Natural Protection guards take care of controlling the wood is removed, to ensure the firewood is not abandoned, which could be a source for pest nesting and propagation.

The residues (branches, small bushes) are usually gathered and placed in longitudinal piles. The residues remain several months on the forest until there is obtained a permit to be

burnt by forestry brigades, or until the Government of Aragón release funds for shredding to the soil (mulching) the forestry residues.

LCMW2a – Building new fire belts

The works are currently being done by government of Aragon fire brigades. These brigades are composed by persons ready to be involved in forest fire extinction operations. During the season from April till October these brigades are operative and in alert. The idle time they execute fire prevention works, like auxiliary belt opening. The teams are composed by personnel with limited skills in silviculture, able to basically utilise chainsaws, or carry manual operations. The fire prevention works are usually carried out by these brigades and therefore the limited capacity for improving the operations in terms of mechanisation. Works are only externalised when the dimension of the work (large areas) and the biomass obtained make the work object of a public bidding. Processes could be improved by enhancing the mechanising and radically changing the planning of the work. However the main barrier is the limited capacity of the fire brigades and the difficulties for including external subcontractors in small forestry work.

Currently a new strategy is being discussed in order to chip all the biomass for its use. It requires the combination of a private-public initiative. The works are to be executed by forestry brigades of the Aragón Government, who do not account with machinery like skidders, forest harvesters, truck-mounted chippers or forestry forwarders. The collaboration with private companies would allow obtaining the whole tree biomass to be chipped for local consumption or for exporting to other areas.

An alternative, if the forestry brigades continue doing the separation of branches and stemwood for firewood, would consist in leaving the firewood for neighbours (as usual), and to obtain the woodchips from branches with exiting shredders mounted at the rear of tractors, and through chips into an agricultural trailer. Such type of equipment is already being utilised for parks pruning wood and agricultural prunings, and can be an option for the mechanised harvest of residues.

Figure 11: Example of shredder able to obtain woodchips from longitudinal piles (Pictures: www.serrat.es).

For the described LCMW type auxiliary belt in the Spanish model regions Bajo Aragón and Matarraña the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 5 / 6: Most promising logistical chains for LCMW 2a-fire belt (building) in Spain

LCMW2-Fire belt a.1 separated harvest of biomass		
Felling	Manual felling with chainsaw [FB]	
Treatment	Limbing [FB]	
	Firewood	Forestry residues
Preparing	Crosscut in logs	-
haulage	Prepare small piles	Prepare longitudinal piles [FB]
Storage at forest stand	Storage in open air (short time to avoid pest propagation)	Storage in open air until residues are dry
Treatment	-	Harvest with shredder mounted on tractor (Figure 11) [LC]
Transport	Local inhabitants (gather firewood in their vehicles) [LI]	With agricultural trailer [LC]
Storage	Households, under cover [LI]	Intermediary storage under shed [LC]
Combustion	Households [LI]	According to woodchip quality. Farms / industry

[FB]: forestry brigades; [LC]: local company; [LI]: local inhabitants

LCMW2-Fire belt a.2 whole tree harvest	
Felling	Manual felling with chainsaw [FB]
Harvest	Forest forwarder with crane [LC]
Storage	Stockpile at track side [LC]
Chipping	Forestry chipper mounted on truck. Direct discharge on truck box or container [LC]
Transport	3 axis truck or multilift [LC]
Storage	Under shed [LC]
Combustion	According to woodchip quality. Farms / industry

[FB]: forestry brigades; [LC]: local company

LCMW2b – Maintaining fire belts

In the case of maintenance works, the residues are being mowed. Machinery utilised are grass trimmers operated by the forestry brigades, or mulchers, subcontracted to local companies. The existing vegetation is rather low in comparison to operations of fire belt opening, and thus the biomass obtained much lower. This is a critical point when planning the utilisation of the biomass.

Obtaining such residues may be feasible in areas where the bushy vegetation is rather large, or in areas where the maintenance has not been carried for more than 5 years. The potential way to obtain would require machinery as being researched in the LIFE+ project ENERBIOSCRUB (http://enerbioscrub.ciemat.es/). This project has developed two prototypes for harvesting shrub vegetation (Figure 12). In conversations with the Fire Prevention service of the Province of Teruel (where Bajo Aragón and Matarraña counties are circumscribed) the system was regarded as quite interesting, and a potential clever solution for forestry residues harvest, or for obtaining the shrub vegetation biomass. However the hilly and heterogeneous forestry land in Bajo Aragón and Matarraña may constraint quite the utilisation of such implements. Therefore no promising harvesting method has been proposed for the moment for obtaining the shrub vegetation of LCMW2-fire belt maintenance.

Figure 12: Example of novel implements utilised in the ENERBIOSCRUB project for collecting shrub biomass. Left: Papamato shredder; right: Anderson's Biobaler (pictures available at http://enerbioscrub.ciemat.es/).

2.2.3. LCMW 3, Riverside cleaning

With "riverside cleaning" we hereby refer to the operations of clearing / removing vegetation along rivers and water courses. At the start of the project 2 main maintenance operations were detected:

- LCMW3a: cleaning operations undertaken at an emergency level after a flood
- LCMW3b: reed removal

Among the woody species *Populus nigra* (black poplar) and *Fraxinus angustifolia* (narrow-leafed ash tree) are the most frequent. Among the shrub species *Rubus ulmifolius* (elmleaf blackberry or thornless blackberry) is by far the most extended and typical vegetation. Watercourses are habitats usually invaded by reeds like *Phragmites* spp (common reeds) or *Arundo donax* (giant cane, also known as Spanish cane).

The ownership is public (State) and private (Individual). The rivers and water courses runs along the territory crossing both private and public owned lands. Therefore adjacent land can be property of the regional government, the local councils, private companies, or physical persons.

The work requires usually authorization since these areas are included in a Nature network. Authorisation is also required by the permitting body, the Ebro River basin for any work of vegetation removal to be carried in the water course.

In riverside cleaning operations in the area there are significant technical difficulties, as the rivers basins are small and abrupt in general. Access is quite a constraint. Another limitation I the lack of companies interested in utilising the biomass. Forestry companies are uninterested in general, and gardening companies are still not prepared for undertaking biomass initiatives. Furthermore, mechanisation is not always feasible or existing.

The maintenance work is mainly done manually, by private owners (principally farmers). Burning the invasive species or folding them is a usual operation, not always being declared by farmers. Public prevention works from the councils and the river authority are usually lacking due to budget shortages. Therefore scarce maintenance is being carried out currently. Instead, the works concentrate in repairing damages after a flooding occurs. Then manual felling, gathering, and use of excavators are quit usual.

Additionally during the summer the biomass accumulation implies a fire risk: the works required will involve the clearing of this biomass. In some cases controlled fires are carried out to burn the material.

<u>LCMW3a-riverside cleaning (flood)</u>

In terms of LCMW3a, every 5-10 years biomass builds up in the river side which constitutes a risk in case of overflows and flooding causing clogging (see Figure 13 for small rivers) and may result in floods (see Figure 13 for Guadalope river, 2015). In contact with local stakeholders it was initially dimensioned the area can add up to 500 ha (under threat of flood damage).

After a flood cleaning operations are required to extract the biomass that accumulated and that could cause serious damage related to flooding if rainfalls occurred due to the river flow obstruction. The cleaning work may include: removal of whole trees that have fallen from which stem and branches will be obtained; remove branches and clear the paths along the river from which bushy and herbaceous biomass would be obtained; and dredging the river (no biomass is obtained). In some cases the bushy and herbaceous vegetation might be mixed with mud which will limit its use as an energy resource. In the case of maintenance

work carried out to prevent flooding the main species removed will be bushy and herbaceous.

The LCMW3a biomass is currently not used. An example is the flood episode of Guadalope river at Alcañiz in 2015 (see Figure 13). There a substantial amount of vegetation was damaged and object of removal. There were few contacts between local companies and local authorities. However, even in such appropriate conditions of access, nearness to a populated town and amounts of full tree biomass, the initiative did not proceed.

Figure 13: Above: riversides to be cleaned and maintained in the Spanish model regions (pictures: Joaquín Lorenzo. Grupo Bajo Aragón- Matarraña, OMEZYMA). Below: damages in Guadalope river after flood in winter 2015 (pictures: José Antonio Fras, citizen of Alcañiz).

Obtaining the biomass from flood damages would involve different operations depending of the access, dimension of flood and potential biomass in use. Describing a preferred supply concept for the LCMW3a would incur in a generalisation. In practical terms it was discussed with local actors that in the Spanish model regions Bajo Aragón and Matarraña the potential use of biomass would come from standing damaged trees and pruning. The biomass free of mud would be felled with chainsaw and then fed into a chipper mounted on a truck. However, the rest of biomass, quite contaminated with mud, could not be chipped, and would need a refine by grinding. Due to the very low quality it is probably only suitable for composting.

Table 7: Most promising logistical chain for LCMW 3a-riverside cleaning (flood) in Spain

LCMW3a-riverside cleaning (floods)	
Felling/pruning	Manual felling/pruning with chainsaw
Haulage	With forest forwarder or agricultural tractor to stockpile
Chipping	Forestry chipper mounted on truck. Direct discharge on truck box or container
Transport	3 axis truck, multilift or walking floor depending access.
Storage	Under shed
Combustion	According to woodchip quality. Farms / industry

[FB]: forestry brigades; [LC]: local company

LCMW3b-riverside cleaning (reeds)

In terms of LCMW3b, species like *Phragmites* spp (common reeds) or *Arundo donax* (giant cane, also known as Spanish cane) are quite extended along water courses. They may cause clogging of the rivers (see Figure 13) and reduce the running water, even though also they may have in some cases a protective function. Both reed types are considered invasive species, and it is quite usual individual actions, specially carried out by farmers, to reduce the water respiration and the competition for nutrients. This is a specific case for the *Arundo donax* reed, which is quite present in the agrarian lands, next to irrigation channels.

This biomass has been identified as a target of interest in the project since in bajo Aragón and Matarraña, as well as in Spain, *Arundo donax* reed, grow spontaneously an is usual object of eradication. Its use as biomass could bring a new chance for reed eradication and management practices. *Phragmites* spp (common reeds) or other bushy biomas like *Rubus ulmifolius* are not considered, even though it should be pointed out that the latter is subject of some use for agricultural purposes.

They are principally extended nearby cultivated areas with irrigation channels. There reeds have established since centuries. As a matter of fact Alcañiz name is assumed to derive from “Al-Qannis”, meaning “the reeds” in former Arab language. Some images can be seen in Figure 14.

Figure 14: Above: *Arundo donax* along water courses and agrarian land nearby Torrecilla de Alcañiz (pictures: Daniel García – CIRCE). Below: *Arundo donax* along green path route ("Via verde de la Vall de Zafán") nearby Alcañiz, and cane banks fallen after being bent by farmers (pictures: Joaquín Lorenzo. Grupo Bajo Aragón- Matarraña, OMEZYMA).

For the described LCMW3b type, it is still unclear the promising logistical chains. Therefore a pilot experience is planned in task 5.4. Beyond the pilot experience next details are to be considered:

- Reed banks can be accessible as they are near water courses, mostly in agrarian areas
- They cannot be harvested by circulating over them
- The moisture is very high, and the residue can degrade easily.

As regard of these facts, the *Arundo donax* could be harvested fresh for some uses like compost or biogas production. Under such scheme, machinery able to shred the bank and convey the material to a trailer would be ideal. For energy generation by combustion, the reeds should be left aside for drying. So a system of bundling like some forest processors do could also be applicable. The potential chain is described below.

Table 8: Most promising logistical chain for LCMW 3b-riverside cleaning (reeds)

LCMW3b-Riverside cleaning (reeds)		
Obtaining	Shredder / mulcher mounted on a tractor arm with conveying system to trailer (*)	Harvester / bundler mounted on tractor arm
Load	Directly on agrarian trailer	Directly on agrarian trailer
Transport	Tractor with agrarian trailer direct to plant	Tractor with agrarian trailer
Storage	-	Storage in open air until residues are dry
Treatment	-	Shredding with static or manual chipper / shredder
Transport	-	Depends on volume (agrarian trailer / dumper truck)
Final use	Composting / biogas	Combustion, according to quality. Farms / industry

2.2.4. LCMW 4, Restore agricultural land

Restoration of abandoned agricultural lands in valleys is the long name for LCMW4-restore agricultural land. These areas are abandoned cultivation areas that have not been cultivated for many years, therefore invasive crops have grown. The main species are *Pinus halepensis*, *Quercus ilex,* which can be used for firewood, and *Quercus coccifera* (Figure 15). The recovery for these areas will also have a function as firewall.

A pioneering initiative was started in 2011 by the Matarraña county through the Modeland INTERREG project. As the project describes, the target is to recover abandoned agrarian land which could also work as natural firebreaks areas.

The recovery and production of this abandoned land will be possible thanks to the initiative and collaboration Matarraña sheppers who have pledged to maintain production plots, for the exploitation of livestock. In such a way shepherds benefit of a larger area for grazing, and the former abandoned land is maintained under a productive use.

For such purpose it is necessary contacting, in the first instance, with potential users (shepherds) and in a second instance, with the owners of the plots, who are asked permission to act on the farms of their property. Once permission, the county brigades proceed to execute the restoration works.

With this pilot project about 15 hectares atomised in the valley bottom among hilly areas were restored in 2012. A second project named Bank of land (*"Banco de tierras"*) and

additional 41 hectares until 2015. The success of this first pilot experiences has demonstrated its feasibility.

greenGain aims to explore the chances to obtain the residual biomass obtained from the genuine works carried out by the Matarraña brigades, since it is expected a future increase of the agricultural area recovered contributing both to forest fire prevention and the recovery of agricultural landscape.

The total land available was subject of a previous study of the University of Zaragoza, through the agreement 'Chair' held with the County of Matarraña, on mapping of abandoned crops and priority parcels to recover depending on your landscape features and fire hazards (UNIZAR, 2011). In Matarraña it has been estimated areas potentially subject of ravine cleaning of about 1,265 ha and around 1,000 ha in Bajo Aragón. This area is distributed over all municipalities of the two regions but more specially concentrated in the following ones: Beceite, Monroyo, Peñarroya de tastavin and Valderrobres, since their location correspond to a mountain range.

The ownership of the land is mainly private but there are some cases of public (municipality) ownership.

The operations involved include (see also Figure 15):

- LCMW4a: restoring tracks and access (similarly to LCMW1-Track cleaning, see Figure 8 in section 2.2.1)
- LCMW4b: removal of former fruit, olive and vineyards
- LCMW4c: removal of natural vegetation on grass land (former arable land)
- LCMW4d: thinning and pruning of currently forested parcels

From the operations above, the LCMW concentrates in two of them: LCMW4b and LCMW4c, that is, the operations carried out in agricultural land, which has not been converted into forestry stands. LCMW4d is not considered since:

- Execution of forestry removal required explicit permit of INAGA, and cannot be executed easily, as it implies a land use change from forestry to agriculture. In contrast thinning and pruning required simple permits.
- Not being the main target of the action to carry out forestry works, but restoring agrarian land, these parcels can be object of a typical forestry thinning

A representation of the work carried out for LCMW4b and LCMW4c can be observed in Figure 15.

Figure 15: Above: restoring abandoned agrarian land. Left: original state; right: after (pictures: Olga Ric, Matarraña County). Middle: vegetation in abandoned agrarian land. Left: former field with almond trees; right: former arable land invaded by shrub vegetation. Below: work of Matarraña forestry brigades on October 2015. Left: biomass pile and workers with OMEZYMA personnel; right: mulcher shredding longitudinal piles of residues to soil (pictures: Daniel García-CIRCE).

The LCMW biomass is currently not used, except in some cases for fire wood. Owners are asked if they want to keep the firewood, and if owners are uninterested, it is withdrawn by the forestry brigades.

LCMW 4b, Restore agricultural land (vineyards, fruit and olive trees)

The harvest would be done manually by the brigades with the chainsaw. Felling of the trees and limbing, with manual separation of thin branches (to be object of mulching to be left as

soil amendment). Tree and branches crosscut into logs, and manual load into agrarian trailers to be used locally as firewood.
The alternative could be the utilisation of forestry chippers or shredders mounted on truck. However, this equipment is expensive. The fruit tree shape is furthermore inconvenient to most of chippers and shredders, and therefore this practice has not been considered as feasible.
The promising implementation on logistics would therefore look quite simple, as expressed in Table 9.

Table 9: Most promising logistical chain for LCMW4b-Restore agricultural land (vineyards, fruit and olive trees) in Spain

LCMW4b-Restore agricultural land (vineyards, fruit and olive trees)	
Felling	Manual felling with chainsaw
Preparing	Crosscutting of stems and branches into firewood
Residue disposal	Gathering branches into piles to be mulched to the soil
Load	Manually by the forestry brigades on agrarian trailer or 2 axis truck
Transport	Tractor with agrarian trailer or 2 axis truck
Storage	At households or at an intermediary shelter.
Combustion	Firewood at households

LCMW 4c, Restore agricultural land (natural vegetation in arable land)

The harvest should be done with mechanised implements as shown for LCMW2b (see Figure 12). Recovering the shrub vegetation cannot be considered feasible manually. Therefore, even not being proved, and being object of current developments by a Life+ project (ENERBIOSCRUB), the harvest cannot be declared as most promising, but as a potential alternative. In such case the logistic chain would look as presented in Table 10.

Table 10: Most promising logistical chain for LCMW4c-Restore agricultural land (natural vegetation in arable land) in Spain

LCMW 4c-Restore agricultural land (natural vegetation in arable land)		
Harvest	With shrub shredder	With shrub baler
Loading	Direct on trailer	Tractor with forklift on trailer
Transport	Agricultural trailer of 3 axis truck	Agricultural trailer of 3 axis truck
Storage	Intermediary storage under shed	Intermediary storage (open air)

Treatment	-	Chipping bales into woodchips with static chipper
Transport	3 axis dumper, walking floor depending volume of woodchips	3 axis dumper, walking floor depending volume of woodchips
Combustion	According to woodchip quality. Farms / industry	According to woodchip quality. Farms / industry

2.2.5. LCMW 5, Recreational forest cleaning

Work related to the maintenance of vegetation in parks, green areas an recreational forests is a potential source for residual biomass. Under the scope of greenGain the woody residues from such areas were initially considered as a residue that could be easily of interest in the region. Cleaning is required with frequency to maintain in condition such infrastructure for tourists and local inhabitants. LCMW residues include pruning wood from woody species and removal of damaged trees. Figure 16 shows two areas of interest, either recreational forest, or one of the multiple natural bathing zones in Matarraña.

Under a first consult with the local inventory of recreational forest and parks, it was statd that the area is rather small, adding up to 10 ha. There are recreational areas in both regions in each municipality; therefore the potential area can be represented as small spot disseminated. The reason is the small size of the local towns, and the onsideration of many of the forests of interest, as forest land, not as recreational park. These forests undergo a management based on the government of Aragón forestry planning department if the forests are declared of public intrest ("Montes de Utilidad Publica" –MUP). If not the management is directly in hands of the forest owners, either public (councils) or private. The result is that the recreational forests and parks represent only a small area.

The main woody species is *Pinus halepensis* (aleppo pine), and among the shrub species *Pistacia lentiscus* (mastic). Herbaceous grass includes the botanical families of *Brassicaceae* and *Poaceae*. *Rosmarinus officinalis* (rosemary) and *Thymus vulgaris* (thyme) can be found in recreational areas but they are not removed during the cleaning operations.

The areas for this LCMW type are owned by the public (municipalities) and the average surface is around 2,000-5,000 m^2. The biomass is currently not used, expect for fire wood. The work is done by hand and mechanically.

Figure 16: Recreational forests and areas in Matarraña and Bajo Aragón, which are object of maintenance (pictures: Joaquín Lorenzo. Grupo Bajo Aragón- Matarraña, OMEZYMA).

For the described LCMW type recreational forest cleaning in the Spanish model regions Bajo Aragón and Matarraña there is a low potential. Even though locally, the removal of some wood could be of punctual interest. The works would be rather basic, including felling / pruning with chainsaw, crosscut into wood logs and distribution locally for firewood.

Table 11: Most promising logistical chain for LCMW 5-recreational forest in Spain

LCMW5-Recreational forest	
Felling	Manual felling with chainsaw
Preparing	Crosscutting of stems and branches into firewood
Residue disposal	Gathering branches into piles to be mulched to the soil / disposed
Load	Manually by council workers / gardening company
Transport	Locally with van or pick-up
Storage	At households or at an intermediary shelter.
Combustion	Firewood at households

2.3. Promising pathways in the Spanish model regions

The biomass obtained from Bajo Aragón and Matarraña counties could be utilised in the existing or new-built biomass conversion facilities. The contact with the stakeholders of the Local Working Groups (LWG) has been the base to explore the chances for biomass utilisation. It has been observed that in the two counties the main existing uses are small and medium heating systems, either in households and buildings (public and private sector), or in farms and agro-industries. Table 12 summarises the main final biomass consumers that are present in the territory. As observed, the main biomass facilities are small. No single

large centralised plant, except a pelleting plant and the pig slurry treatment plants. No large conversion plants exist nearby, or in the neighbouring counties.

Table 12: Main potential LCMW biomass consumers in Bajo Aragón and Matarraña counties

Facility name	Technology type	Usual feedstock	Product obtained	Consumer type	Size [MW] or [t/yr]	Relevance in model region	Ever utilised LCMW?
Biomasa Matarraña	Pellet	Coniferous wood without bark	pellets	Domestic, community, farms	Small < 50 kW	Atomised; not unusual.	No
Peñarroya de Tastavin biogas plant	biogas	Pig slurry	electricity	Power plant (centralised)	500 kW (100,000 m3)	??	No
Municipalities council	Biomass boiler	Wood chips	Heat	Domestic	---	All city councils in the region	No
Chicken and pig farms	Biomass boiler	Wood chips	Heat	Domestic	---	---	No
Domestic boilers	Biomass boiler	Wood chips	Heat	Domestic	---	---	No
Hotels	Biomass boiler	Wood chips	Heat	Domestic	---	---	No
Valmuel Dehydration Plant	Biomass boiler	Herbaceous biomass	Heat	---	---	---	No
Valderobres and Alcañiz feed mills	Biomass boiler	Wood chips	Heat	---	---	---	No
Alcañiz Virgen de los Pueyos Cooperative	Maize dryer	Wood chips and agrarian residues	Dried maize grain	---	---	---	No
	Dehydration facility		Dehydrated alfalfa	---	---	---	No
Olive mills	Biomass boiler	Olive press cake	Heat	---	---	---	No
Valderobres biogas plant	biogas	Pig slurry	electricity	Power plant (centralised)	500 kW (120,000 m3)	Stopped	No

The only large facility that could adopt biomass is the Teruel coal power plant (1,050 MW of electrical power), sited in Andorra (Bajo Aragón). This facility is, however, not prepared for co-firing, even though in the past co-firing was being studied as an option for the power plant. The future for coal power plant is uncertain. Potential alternatives are the programmed shut-down in a near future, or a retrofitting, with might include any of next options: modernisation to a high efficient coal power plant, natural gas in a combined cycle, or retrofitting to alternative fuels (including biomass). Since the future is uncertain, the option of Teruel plant is not considered as a target in the short term.

The fact that facilities consuming biomass in the territory are mainly of small or medium size, it should be taken into account for defining the supply chain and treatments needed. In terms of the compatibility of the biomass from LCMW for these facilities, the Deliverable D5.2 report contains a first approach.

Biomass market has been object of a brief assessment. It has been stated that local pellet consumers acquire EN-PLUS bulk at 180-200 € / t, whereas pellet in bags and pellets rise over 200 € / t. Woodchips are being commercialised at prices from 50 to 70 € / t, depending

moisture and quality. It has been stated that there is a scarce use of biomass, and that the most of the woodchips produced by the local forestry companies is being exported to other provinces, or even to harbours in Valencia or Tarragona for being exported. According to this fact, LCMW biomass can be utilised to diversify, to contribute to km0 biomass and circular economies. However the region has a surplus of biomass generation. Promoting the use of biomass, is a key for local development, and for taking advantage of the positive social impacts that biomass brings with.

It must also be considered that most of the current facilities are not adapted to irregular woodchips. Therefore it should be explored which are actually compatible with biomass of similar characteristics to forestry residues.

2.4. Local working groups in the Spanish model regions

Building the LWGs and inauguration

The Local Action Group « Bajo Aragón - Matarraña » is named OMEZYMA - Organization for the development of the Mezquin regions: Matarraña and Bajo Aragón. It is a non-profit association which was established in 1996, in order to manage the European programme Leader II, at the initiative of the Association of Municipalities of the Mezquin regions. The members of the organization consist according to its statutes of a series of regional public bodies, associations (for tourism, economy, culture, women and youth), unions and the primary sector. Its 127 members cover a wide range of stakeholders relevant to this project from public administration, civil society, politics, industry and the primary sectors. OMEZYMA represents an example of an innovative formula which involves all the social and economic agents in the region in the decision making. OMEZYMA implements in 38 municipalities activities to overcome barriers to social and economic development, and is currently a key actor in the formation of associations and the awareness rising.

OMEZYMA is quite interconnected in the territory of Bajo Aragón and Matarraña, and therefore approaching the local stakeholders has resulted as one of its natural activities of the everyday. OMEZYMA has based principally on bilateral meetings to create interest with local stakeholders. Therefore councils, several LCMW service companies, few logistic operators and potential biomass consumers have easily been aligned with greenGain.

OMEZYMA and CIRCE have both established phone contacts and visits with the representatives of several departments of the government playing a role of LCMW planning and permitting. The department of Forest Management and Forest Fires Prevention of the Government of Aragón were visited by both in at least three months during the first 12 months of the project. The province services on the same areas have ben also approached several times, in order to obtain information for biomass assessment, clarify the permits for execution of some LCMW works and for preparing the pilot experiences (to be executed between M18 and M30). The Ebro Hydrographic Basin organism has also been visited, as they are crucial in governing and permitting works along water courses. As well the regional

office of irrigation of the Government of Aragón was contacted during the first months of the project.

The consolidation of the LWGs and the alignment of the local stakeholders with greenGain were publicly announced in press releases in October 2015. The visit that CIRCE paid to the territory to plan pilot experiences, and the meetings with the County administration and the local nature Protection Agent, were object of the press release were it was also announced the commitment of territorial stakeholders.

December 2015 the same message was launched in the framework of a local fair on entrepreneurship, where OMEZYMA held a presentation of greenGain.


BAJO ARAGÓN

Diario de Teruel

•GREENGAIN• INICIATIVA DE INVESTIGACIÓN Y DESARROLLO FINANCIADA POR LA COMISIÓN EUROPEA

Omezyma se incorpora a un proyecto para usar la biomasa como fuente de energía

Durante dos años, estudiará el volumen de la materia prima disponible y sus costes de gestión

•OBJETIVO•
Promover el uso energético de la biomasa

•••Los socios españoles de este proyecto europeo son Omezyma y la Fundación Circe ...

Figure 17: Left: press release describing greenGain and the establishment of greenGain LWG (October 2016); Right: presentation of greenGain by OMEZYMA manager and president in the framework of the Local Energy Fair of Fuentespalda (December 2015)

The results and analysis for the current status (June 2016, project halfway) of the LWGs in Bajo Aragón and Matarraña counties (Spain) are presented below, according to the methodology provided in Appendix 7.4.2, by the use of the spider net and the quadrant diagrams.

<u>Stakeholder analysis in Bajo Aragón County</u>

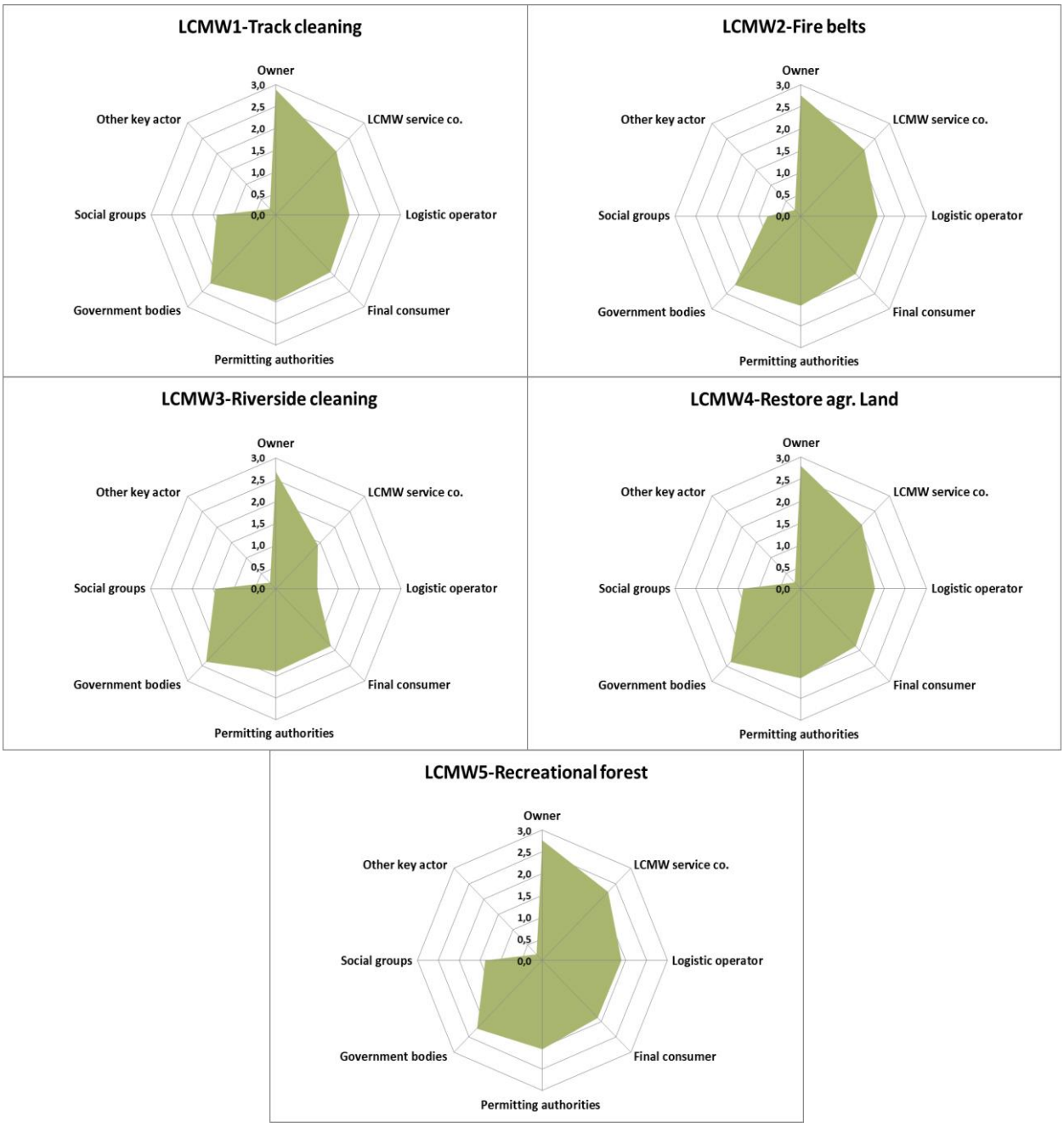


Figure 18: Spider net graphs for Bajo Aragón County (at Month 18, halfway through the project).

Figure 18 shows the radial distribution of stakeholders relevant for each specific LCMW for Bajo Aragón County. As can be seen, most of the stakeholder's profiles are fairly well covered. This indicates that in general, local stakeholders are well aligned with the project.
More in detail, owners have the highest RF placed between 2.7 and 3. The main reason is that owners are in many cases OMEZYMAs associates: several councils, forestry owners associations, and local cooperatives. They are followed by stakeholders of type LCWM service, logistic operator, final consumer, permitting authorities and government bodies, with a range from 1.8 up to 2.4 for all LCMW types, excepting LCWM 3-Riverside cleaning.

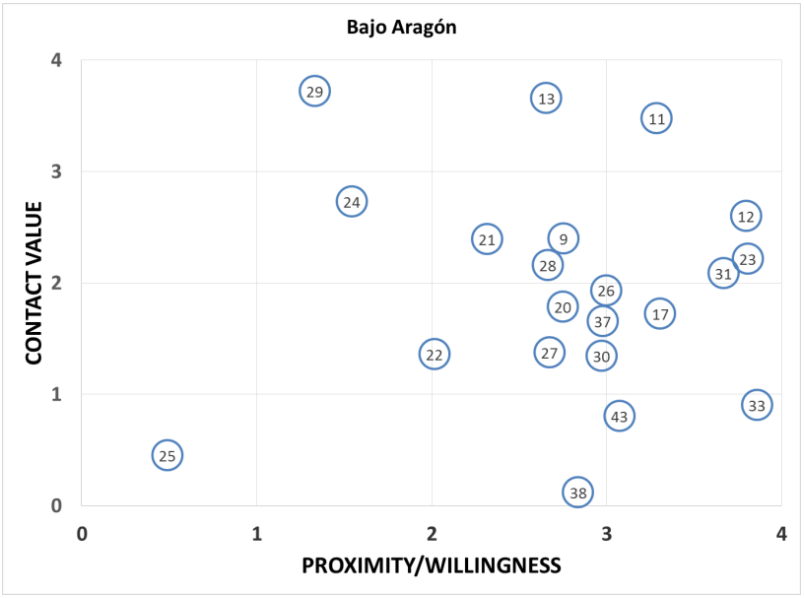
There are at least 3 companies executing forestry and conservation works in the area (Servimas, Monroyo industrial and Gil Forestal S.L.), which have been aligned with the project, and have also participated in May 2016 in a meeting with the greenGain project partners (during a one day visit to the Bajo Aragón and Matarraña counties to better know the territory and the LCMW types). These companies, also distribute biomass, even though other local companies (Alcoreco or Biomasa Matarraña) are also well positioned in the distribution of agrarian biomass. Final consumers potentially interested in LCMW biomass include several councils (almost every councils has installed either pellet or woodchip heating systems during the last years), multiple farms, and a couple of facilities of industrial heating (Grupo Arcoiris, Cooperativa del Mezquin, or Cooperativa del Matarraña).

For the LCWM 3 the stakeholders of type LCMW service and logistic operator have a lower RF, 1.4 and 1.0 respectively. This is related to the scarce previous experience in reed removal and use of this herbaceous feedstock for energy. There are in the area practically no companies with such experience, what could be a handicap for executing pilot experiences in task 5.4. A local association called “Amigos del Río y de los espacios Naturales de Alcañiz” (association of natural spaces and rivers in Alcañiz) has promoted several works on the utilisation of reeds. As well “Caña Selecta S.L.” is a company expert in collecting *Arundo donax* reed to produce commodities. Not being local stakeholders, their participation and support in local actions on LCMW3 may be quite strategic. Executing a pilot experience on reed removal and utilisation could be a key action to raise the local awareness on this complex LCMW biomass. The stakeholder type Social groups has lower RF 1.4-1.5 for all LCMW types, with exception of LCMW 2-Fire belts with 0.8.

In this respect, the graph may be misleading the reality, since as a matter of fact, OMEZYMA, the Local Action Group, and quite involved in the project and with other associations, is a greenGain partner. The issue is that OMEZYMA, being a greenGain partner, has not been placed in the diagram as a stakeholder. Finally, other key actors have a very small influence, with a 0.2 for all LCMW types.

Figure 19 shows the quadrant diagram for Bajo Aragón County. It is observed that in general stakeholders can be found inside the “engage quadrant” (quadrant where both willingness and contact value are more than 2). The main conclusion is that most stakeholders have an active interest in following or participating in greeGain (most of them interest > 2). Nevertheless, there are a few stakeholders with a willingness rate higher than 2 but a contact value lower than 2. Not being crucial for establishing close collaborations, or to get involved in pilot experiences, they are being object of information and communication strategies to keep their interest. In the zone of “contact value” > 2 (stakeholders with relevance to promote and participate in greenGain actions) it is found that stakeholder number 29 is not still in the quadrant of engagement at the mid-term of greenGain project lifetime. It refers to the departments on Forestry Management and Fire prevention works in the Teruel Province. Several contacts were done in past; they are being reported on pilot

experience planning, and it is expected the execution of the LCMW2 and LCMW4 pilot experiences will get them closer to the project.
In conclusion this region has a good network of stakeholders eager to involve themselves in pilot experience, and being at month 18 of the greeGain project no further urgent action is truly necessary to involve more actors in the LWGs (Local Working Groups).

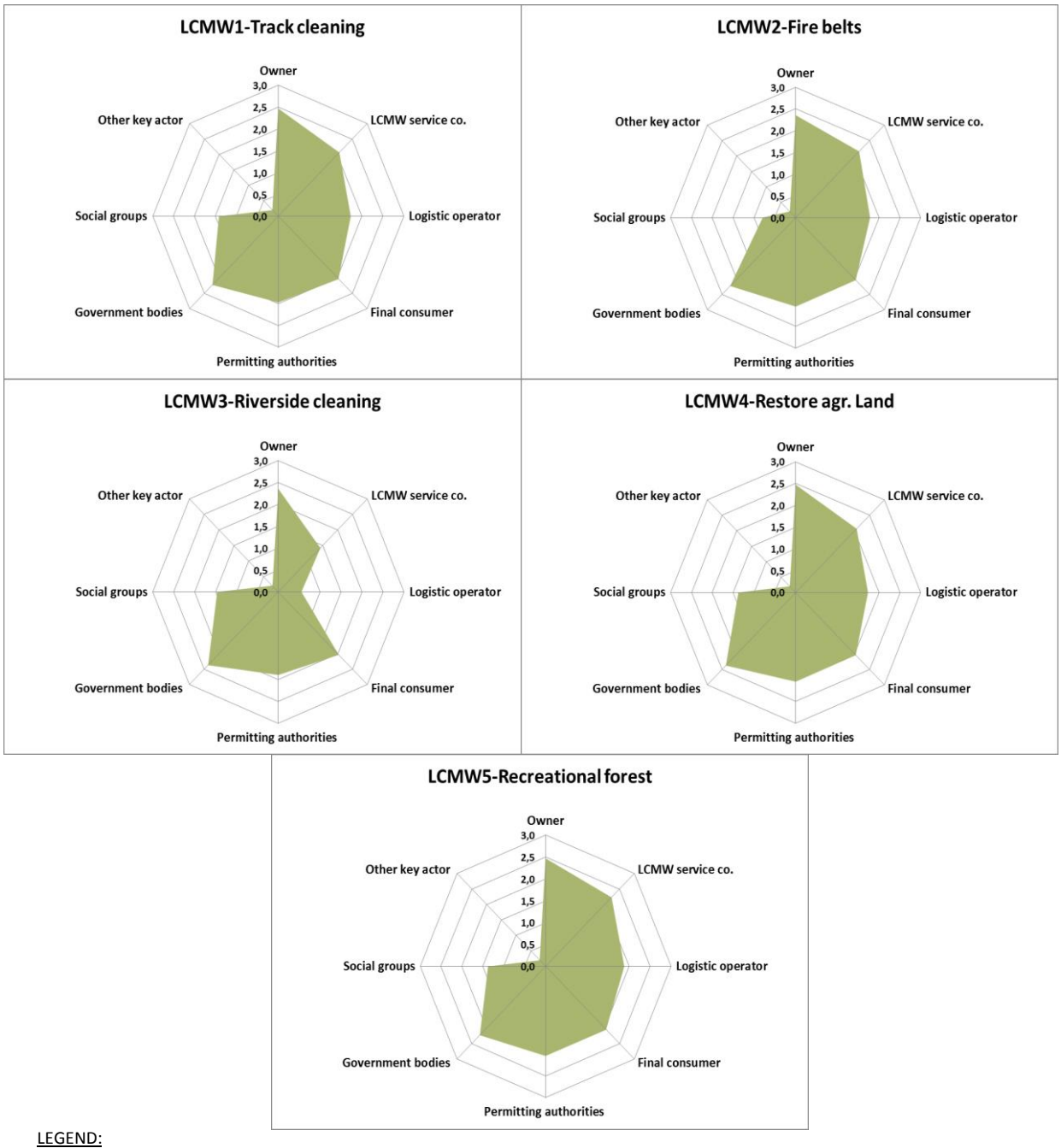


LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 19: Quadrant diagram for Bajo Aragón County (at Month 18, halfway through the project).

Stakeholder analysis in Matarraña County

Figure 20 shows the radial distribution of each LCMW for Matarraña County including the different stakeholders. Most of stakeholders relevant for Bajo Aragón, are also for Matarraña. Therefore LWGs (Local Working Groups) established there share an important part of the stakeholders. In general the distribution of the readiness factor (RF) is similar to the Bajo Aragón County presented in Figure 18. One difference that can be pointed out for this case is that owners have lower RF range, between 2.4 and 2.5, when compared to the Bajo Aragón County. The rest of RF distribution is very alike as the Bajo Aragón County case, and the same exceptions occur as well.



LEGEND:
Scores measure the readiness of stakeholders to get involved and support greenGain including, or to promote pilot actions or new utilisation of LCMW biomass: relevance, proximity and amount of stakeholders. High scores reveal that stakeholders have been contacted, the interest on greenGain has been activated, and they are collaborating fluently with greenGain partners.
Scores : 0: not relevant; 1: distant contact, low interest; 2: closer contact, interested in LCMW biomass; 3: very close contact, and high interest in greenGain and in LCMW biomass.

Figure 20: Spider net graphs for Matarraña County (at Month 18, halfway through the project).

Figure 21 shows the quadrant distribution for Matarraña County. Similar to what happens in Bajo Aragón County most stakeholders are placed in the engage quadrant, and a few need more information strategies, as for example sending newsletters. In conclusion, being at month 18 in the project, there are enough stakeholders who have assured their

commitment with the LWG (greenGain Local Working Groups) and therefore no further action is required

LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 21: Quadrant diagram for Matarraña County (at Month 18, halfway through the project).

3. Italy: regions, LCMW status quo, potential pathways and stakeholders

3.1. General description of the project region Trasimeno

The Mountain Community of Trasimeno is a territory of 13 municipalities in the Umbria Region with a total area of 114,156 ha. Its beautiful hilly landscape (altitude up to 250 meters above sea level) is more than 50 % under the Regional Landscape Protection Law and is composed of large areas of olive groves, vineyards, area devoted to grain production, rotation pastures, sunflower fields, grass meadows and coppice forests. The District of the Trasimeno Lake is characterized by agricultural production of high commercial value, such as olive oil (Protected Designations of Origin Umbria) and wine (Controlled designations of origin - DOC Colli del Trasimeno, Colli Perugini). In addition to agricultural production, tourism is a very important activity in economic terms (with the Trasimeno Lake, numerous cities of art, trails, bike paths, hiking trails, parks) and the farm, with over 150 active companies. The conservation and maintenance of the territory, in addition to the work of farmers, is in the hands of public institutions (Trasimeno, communes Park) and several farms or holdings that provide quality and value to the landscape (Figure 23). Agricultural products, residues of the landscape maintenance and conservation works of the many green areas, the roads and paths, besides conservation and cleaning works on rivers and lake basins finally offer a very high biomass potential allocable to the production of renewable energy, at low cost of production and with a low environmental impact.

Table 13: Climate in the Italian Trasimeno area (source: data from meteo station Castiglione del Lago – altitude 275 metres)

	Value	**Date**	**Time**
Max Temperature	38.6°C	06/07/2015	15:01
Min Temperature	-2.6°C	29/01/2015	03:10
Max Pressure	1,029.9 hPa	08/01/2015	10:30
Min Pressure	970.1 hPa	30/01/2015	12:50
Max Rain Quantity	29.4 mm	17/06/2015	n.d.
May Rain Quantity in 24 h	69.1 mm	26/03/2015	n.d.
Max Wind Velocity	54 km /h	05/03/2015	21:40

In the Italian project region the medium size per farm of the Total Farmland Area (TFA) is 15.30 ha and of the Utilised Agriculture Area 11.24 ha. Figure 22 shows the areas of the different agricultural products in the Trasimeno region.

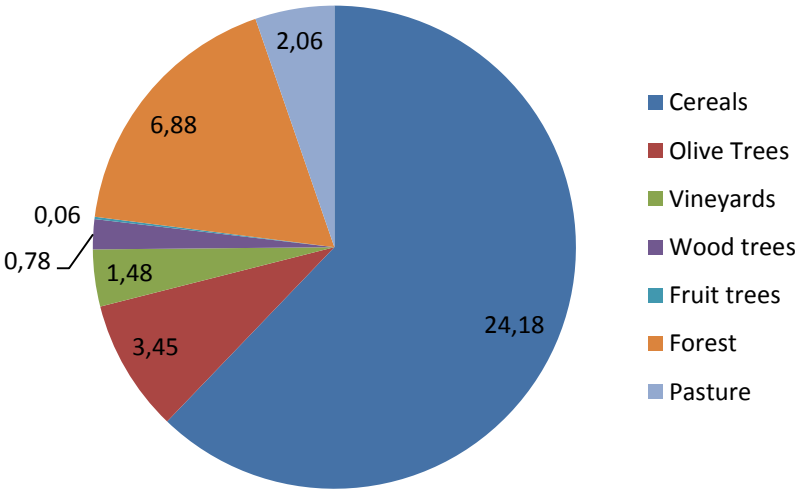


Figure 22: Amount of the different agricultural products in the Trasimeno area in ha (source: CM-ACT data, Agricultural Census 2010).

The Trasimeno Mountain Community is composed by 13 small municipalities which count with 3,500 to 15,000 inhabitants each, for a total of 116,000 inhabitants. The city of Perugia joins the Community through an historical agreement and ads further 160,000 inhabitants The predominant economic activities are agriculture, tourism and small industries.

Figure 23: Landscape of the Trasimeno area. Left: olive groves farm Monte Colognola Magione (PG); right: S. Arcangelo di Magione farm Morganti (pictures: Paolo Burini).

3.2. LCMW status quo in the Trasimeno region

The LCMWs identified initially in the Italian greenGain region are summarised as follows:

Table 14: Summary of the LCMWs for the Italian greenGain project region

LCMW	Short name	LCMW subtypes (if existing)
1)	Olive plantations	Maintained
		Restore abandoned
2)	Vineyards	No subtypes
3)	Parks and Gardens	Woody biomass
		Herbaceous biomass
4)	Roadside Maintenance	Woody biomass
		Herbaceous biomass
5)	Waterways Maintenance	No subtypes

Each of the listed LCMW types and the biomass that can be obtained are described in the following chapters.

3.2.1. LCMW 1 and LCMW 2, Olive groves and Vineyards

The woody and herbaceous biomass is gained from branches and leaves produced during the pruning of plants for the purpose of improved production of olives and grapes/wine (Figure 24). This intervention has a high value in terms of landscape and maintenance of rural traditions besides being effective for production. This type of LCMW is mainly done in house by private individuals and the farms are quite small and handled individually or by small companies. The biomass is currently not used.

The setting up of an energy supply chain might have a function of environment protection and encourage the maintenance of the landscape, as the cultivation of olive one of the distinctive features of the landscape. Additionally, olive processing residues (Nocciolino) are used for energy production. However, it is important to underline that in Umbria there is a strong opposition to the presence of energy biomass plants for the potential risks of improper use and spreading of pollutants.

Also, the use of pruning for energy production could encounter difficulties due to the continuous increase of abandoned land. This “natural” transformation is widespread in Umbria and is determined mainly by the individual characteristics of the terrains, of orientation and high steepness which is very common. Olive groves are very small (<5 ha),

just like the size of companies. These elements have resulted in large part to the abandonment of these crops for the use of other crops which are more profitable.
The used harvesting technologies are a mix of manual and mechanical techniques. The branches are cut and then chopped and buried or burnt on site, so currently no transport, storage or pre-treatment take place. Currently the weakness is that there is no economic use for the branches. The soil improvement through burial of the wood can have a positive effect, combined with the avoided problem of landscape spoiling by abandoned branches. Regarding vineyards, burial can create phytosanitation problems from the spreading of pests in the soil. Regarding the technical constraints the need of dedicated sites for energy use of biomasses must be carefully assessed. Logistics and transportation of biomasses could be critical in this environment.
Finally, the prohibition for burning the crop residues was removed by a ruling by the Court of Cassation under Law no. 116/2014. Therefore, burning of small piles of branches in agricultural areas is admitted.

Figure 24: Vineyards and olive groves are one of the LCMW types in the Italian project region Trasimeno. Left: abandoned olive groves; right: collection and chipping of olive pruning (pictures: Paolo Burini, www.cbrnet.it).

For the described LCMW type “olive groves and vineyards” in the model region Trasimeno the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Tables 15 / 16: Most promising logistical chains for LCMW 1 in Italy

Olive groves	
Biomass	Woody little branches from maintained and abandoned fields
Felling	Cutting of little branches (D<2 cm)
Storage	In the field: binding and placing on the ground
Extraction	With tractor and trailer to farm storage
Transport	With truck or tractor to power plant

Vineyards	
Biomass	Woody little branches
Felling	Cutting of little branches (D<2 cm)
Storage	In the field: binding and placing on the ground
Extraction	With tractor and trailer to farm storage
Transport	With truck or tractor to power plant / boiler

3.2.2. LCMW 3, Parks and Gardens maintenance

In the focus area there is a widespread presence of areas assigned to use as parks or garden, both in private and public property (Figure 25). There are also several subjects engaged in maintenance works for biomasses, and this constitutes a good opportunity for energy production.

The produced material derives from weeds, shrubs and trees typical in parks and / or gardens: the set of flora and vegetation and architectural characteristics of the different areas of intervention (pruning, mowing, etc.) determine a varied production of biomass. The areas in which LCMW are conducted are usually public property. They can be either municipal (green areas, primary schools, urban parks), provincial, but also private (condominiums and private gardens). Monitoring and analysis of the organization of biomass collection resulting from LCMW in public areas is easier for public properties. In private areas traceability is more difficult because specialized companies must be involved and therefore data collection results more difficult. In the urban areas, biomass coming from private areas must be considered and treated as a waste, while the national regulation is changing about the biomass from public areas, which, according to a recent communication by the Ministry of Environment, can be considered as a sub-product if it complies with certain characteristics.

The use of the currently not used biomass has a potential benefit in the creation of an energetic supply chain which could work as safeguard for environmental conservation and

for an effective maintenance of green areas: it is important to plan the periodic activation of maintenance interventions in order to have an appropriate landscape conservation. In some cases parks are in areas restricted with limited possibilities of interventions due to landscape conservation regulations (i.e. Conservation parks, Site of Community Importance, Special Protection Areas, forests) and must be treated taking into consideration the limitations. Additionally, in urban parks there are minor problems of abandoned land which is in transformation towards a natural status and the positioning of new power plants and the logistics for transportation of biomass must be accurately planned because these activities are new for the region.

There is a national law which defines the framework of interventions to be incentivized in LCMW, but most of all are the municipal regulations which define the framework of possible interventions and practices on this topic, obviously within the national regulatory framework. Under the organizational and financial point of view, the municipalities determine annually the economic commitment for the LCMW.

The used harvesting technologies are a mix of manual and mechanical techniques. The material is normally finely ground and left on site, not collected because it is not reused. Any material of greater size is stacked on the sidelines of the working area and carried off by the company carrying out the work and is usually delivered to a landfill. The wet fraction serves potentially for the production of compost. A weakness of the utilization of this LCMW type is the costs, because there is no economic advantage in treating the biomass. A strength is that a high level of mechanization is available and it could support the operations of collection, storage and transportation to the energy plant.

Figure 25: LCMW in gardens and parks produces biomass in the Italian project region: public Park Pian di Massiano, Perugia (picture: Paolo Burini).

For the described LCMW type garden and park biomass in the model region Trasimeno the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 17/ 18: Most promising logistical chains for LCMW 3 in Italy

Parks and gardens a)	
Biomass	Prunings
Felling	Felling/ Cutting of different sized branches
Storage	In the field: binding and placing on the ground
Extraction	With tractor and trailer to farm storage
Chipping	Pre-treatment with agents (cellulosolitici)
Transport	With truck or tractor to power plant

Parks and gardens b)	
Biomass	Prunings
Felling	Cutting of herbs,
Chipping	Drying and burning (when not used) otherwise fermentation like silage
Storage	Stockpile in nearer areas

3.2.3. LCMW 4, Roadside cleaning and maintenance

Maintenance and cleaning of public roads of various kinds (national, regional, provincial and municipal), electric lines and rail networks is an activity managed in Italy by the organizations which are responsible for the territory (i.e. municipalities), or from agencies especially created for the purpose (e.g.: Anas – National Roads Authority for National highways) (Figure 26). Maintenance activities on roads are carried out in-house or by specialized companies mainly in spring and summer. In the case of electric lines and railway lines, such maintenance is carried out all over the year.

The produced biomass is a mix of herbs, shrubs and trees which interfere with normal traffic. In some cases for electric lines and railways, drying products are used (type gliphosate) therefore it is difficult to use the biomass. The ownership of the roads is mostly public, except the rural roads, which are private. For electric lines and railways, usually they are entrusted to specific management agencies (Anas, Enel (National Electricity Body), FF.SS-National Railways, FCU - Regional Authority for Mobility in Umbria, others).

The creation of an energy supply chain might have a function of protection and of incentive for the maintenance of roads, electric and railway lines, where this biomass is currently unused. However, it must also be specified that in Umbria there is a strong opposition of the people for the presence of biomass plants because of the potential dangers of an improper use and production of pollutants.

The used harvesting technologies are a mix of manual and mechanical techniques. The herbaceous material is mostly chopped and left on the ground, trees and logs are accumulated in specifically reserved areas. No transport, storage and pre-treatment of the material are done. In some cases the infrastructures – especially for electric lines and railways – are not easily accessible. Regarding the valorisation of the biomass, the location for sites dedicated to the use of biomass for energy production is not at present defined because there was no need so far to determine them. The location of new power plants must be identified as well and designed according to the logistic and the possibility of transportation of residual products.

Figure 26: Maintenance work along roadsides in the Italian Trasimeno region (picture: www.comune.valdagno.vi.it).

For the described LCMW type maintenance of roadside and technical infrastructures in the model region Trasimeno the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 19/ 20: Most promising logistical chains for LCMW 4 in Italy

Roadsides a)	
Biomass	Prunings
Felling	Felling/ Cutting of different sized branches
Storage	In the field: binding and placing on the ground
Extraction	With tractor and trailer to farm storage

Chipping	Pre-treatment with agents (cellulosolitici)
Transport	With truck or tractor to power plant

Roadsides b)	
Biomass	Herbaceous
Felling	Cutting of herbs
Treatment	drying and burning (when not used) otherwise fermentation like silage
Storage	Stockpile in nearer areas

3.2.4. LCMW 5, Waterways cleaning and maintenance

At this LCMW spontaneous vegetation growing in ditches (artificial waterways) and other waterways is periodically cut for flood safety reasons (Figure 27). Artificial ditches are constructed for irrigation and for flood management reasons. The produced biomass ranges from logs, weeds, shrubs and trees typical of wetlands and ditches with a strong presence of poplar, acacia, reeds, bushes, and typical plants of wetland habitat.
The areas are owned by the public and the competence is dependent on the type of hydraulic network. The minor ditches (capofossi e scoline) fall normally in privately owned land and the mayor ditches and other waterways are often state-owned. Usually, the management responsibility of the state-owned waterways is either at the municipality, the Consorzio di Bonifica ("Land Improvement Consortium", which is a consortium of farmers and residents and provides irrigation and removal of water in excess) or of the region, according to the dimension. If this kind of biomass would be used, as currently it is not, an energy supply chain with function of flood safety and an incentive for the proper ditch network maintenance could be created. It is important to plan a periodical activation of maintenance works which are fundamental for the cleaning of the waterways thus an appropriate water flow regulation. However, it has to be kept in mind that in some cases there is a habitat protection for important natural and wildlife features.

The biomass transportation and delivery for energy production is not very common currently in Umbria. Therefore, the location of energy plants must be carefully planned with a deepened study of logistics aspects for LCMW biomass. Laws of reference are the Royal Decree n °. 523/1904 and regional law n °. 30/2004, as well as the funding for agricultural enterprises Decree 102/204 and 82/2008. The maintenance work must be done outside of the bird breeding period. The Superintendence (State Body) issued a binding opinion that often determines an extension of the bureaucratic procedures. There are many parties

entitled to issue opinions about the authorization to conduct LCMW. Often one of the biggest problems is caused by the lack of financial resources. Periodically these are made available through specific regulatory measures after floods (non-preventive answer).
The used harvesting technologies are a mix of manual and mechanical techniques. Grinded plant material of small size is left on site while the larger parts are stored in the vicinity and are withdrawn from neighbouring properties. No transport and pre-treatment are done.

Figure 27: Vegetation growing in ditches has to be removed regularly in the Italian project region, here the Caina Magione Torrent, - Corciano (pictures: Paolo Burini).

For the described LCMW type waterways in the model region Trasimeno the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 21 / 22: Most promising logistical chains for LCMW 2 in Italy

Waterways a)	
Biomass	Woody
Felling	Felling/ cutting of different sized branches
Storage	In the field: binding and placing on the ground
Extraction	With tractor and trailer to farm storage
Transport	With truck or tractor to power plant

Waterways b)	
Biomass	Herbaceous
Felling	Cutting of herbs
Treatment	Drying and burning (when not used) otherwise pre-fermentation like silage
Storage	Stockpile in nearer areas

3.3. Promising pathways in the Italian model regions

In order to produce energy from the biomass that can be obtained from typical LCMW described above for Trasimeno region, it is necessary to explore the existing current biomass consumption and markets, and to also foresee the potential future uses. An inventory of existing and prevailing biomass use in the region has been carried out by SOGESCA and CM-ACT in collaboration with local stakeholders.

Biogas production is quite usual, both in 30 small facilities (30 to 600 kW CHP) and in 13 medium-sized facilities (up to 2 MW CHPs). These facilities are fed usually with straw, pig slurry, manure, silage and other organic by-products or dedicated products.

In respect the solid biomass, up to 26 facilities for farm heating have also been reported (20 to 200 kW). In the public sector only 2 facilities for building heating have been reported (about 100-200 kW each). All of them consume woodchips. In contrast the domestic sector consumes both pellets and woodchips, in small facilities of less than 20 kW of thermal power.

It has been observed that there is no single large biomass plant, or no advanced conversion systems like gasification in operation in the area. Table 23 summarises the main final biomass consumers that are present in the territory.

Table 23: Main potential LCMW biomass consumers in Trasimeno region

Facility name	Technology type	Usual feedstock	Product obtained	Consumer type	Size	Relevance in model region	Ever utilised LCMW?
13 medium / small Biogas Plants (no ERDF Contribution)	biogas CHP	Straw, slurry, manure, silage, sub products	Power, Heat	Heat partially used for the digester and the farm. Power to the electric grid	6→100 kW 2→300kW 1→500kW 1→600 kW 2→1 MW 1→2MW	To be assessed whether new plants are being built. Feed-in tariff is not so good anymore.	No, but they are available to try.
30 small / micro Biogas plants (with ERDF contribution)	biogas CHP	Straw, slurry, manure, silage, sub products	Power, Heat	Heat partially used for the digester and the farm. Power to the electric grid	2→30kW 17→50kW 8→100kW 2→300 kW 1→600 kW	To be assessed according to the new regional policy for 2014-2020	No
26 Biomass combustion Plants (Farms)	Comb Boiler fixed/moveable grill	Log wood, wood chips	Heat (few power)	Self-consumption	1→20kW 16→50kW 4→90-100kW 2→150-200kW	To be assessed according to the new regional policy for 2014-2020	No, but they are available to try.
(1) Municipalities council/Schools	Comb Boiler fixed grill	Wood chips	Heat	Domestic	200-300kW		No
(2) Municipalities council/Schools	Comb Boiler moveable grill	Wood chips	Heat	Domestic	200-300kW	tbd	No
Domestic boilers	Biomass boiler	Wood chips	Heat	Domestic	<20 kW	tbd	No
Companies/Farms	Biomass boiler	Wood Chips/ Pellet	Heat	---	tbd	tbd	No
tbd: to be determined							

In only Trasimeno and Perugino Areas there are about 50 biogas plants built with EU contribute (through rural development programs - PSR), especially in farms with cattle breedings or generally medium and large farms.
The market research has revealed that for biogas CHP, the typical purchase price depend on the biomass type. Some figures are for triticale is 30 € / t, maize 40-55 € / t and cooperatives pay silage triticale 25 and maize 30 € / t if self-produced. Whereas any formally quality certification/standard is requested, it is recommended that the feedstock "diet" must be well determined and for mayors changes authorization must be requested to the competent authority. In the case of combustion and biomass boilers, the purchase prices varies from 80 € / t (log wood and chips) to 250 € / t (domestic pellets)
Since the most of the existing facilities are not centralised, future supply schemes and logistics may require an organisation able to provide LCMW biomass to multiple users, or to an existing biomass operator.

3.4. Local working groups in the Italian model regions

Building the LWGs and inauguration

Trasimeno stakeholders were contacted by reason of many years of extension services and technical support provided by CM-ACT to over 900 farmers, only in Trasimeno and Perugino Areas. The consistent inclusion of farmers in the LWG is due to the importance of vineyards and olive groves appropriate maintenance for an optimal landscape conservation. Their principal needs are the reduction of costs of cultivation and breeding, with the goal of environment protection.
The link of CM-ACT with other institutions such as the Region, the Province (currently in a dismissal phase) and the municipalities is deeply in the nature of CM-ACT and is included in its ordinary activities. In fact CM-ACT is a representative of the municipalities and provides many services to the territory: agriculture services, agritourism, water management (irrigation and marshland reclamation), fire prevention, forest management and nature conservation. Therefore, the bondage with the institutions is very strong.

Figure 28: The Tevere River (left) and an example of olive groves (right) (Picture Paolo Burini).

LWG involvement

In these last years the good maintenance of the territory has reached an equal importance as the one of agriculture production. Landscape is a fundamental resource for the touristic activities in the area, and in terms of safety, in Umbria region, every year there are a lot of damages for natural disasters (strong winds, intense and continuous rains, hail, floods). As a consequence, an appropriate maintenance of river sides and the good management of lands (hydraulic works) is the principal theme connected to climate changes.

CMT has a daily contact with farmers much interested to recycling and use of green biomass, with two goals: cleaning of lands and rivers and production of renewable energies.

In the same time, European financial contributes to build energy plants are moving many farmers to the production of biogas, electric energy, heat from specific energetic crops (silage), breeding residues and wood residues of forests and trees (green areas and roads). Therefore, the stakeholder´s involvement and the LWG formation has been a natural process since the beginning of the project.

To strengthen the information in the area, a greenGain YouTube channel was started:

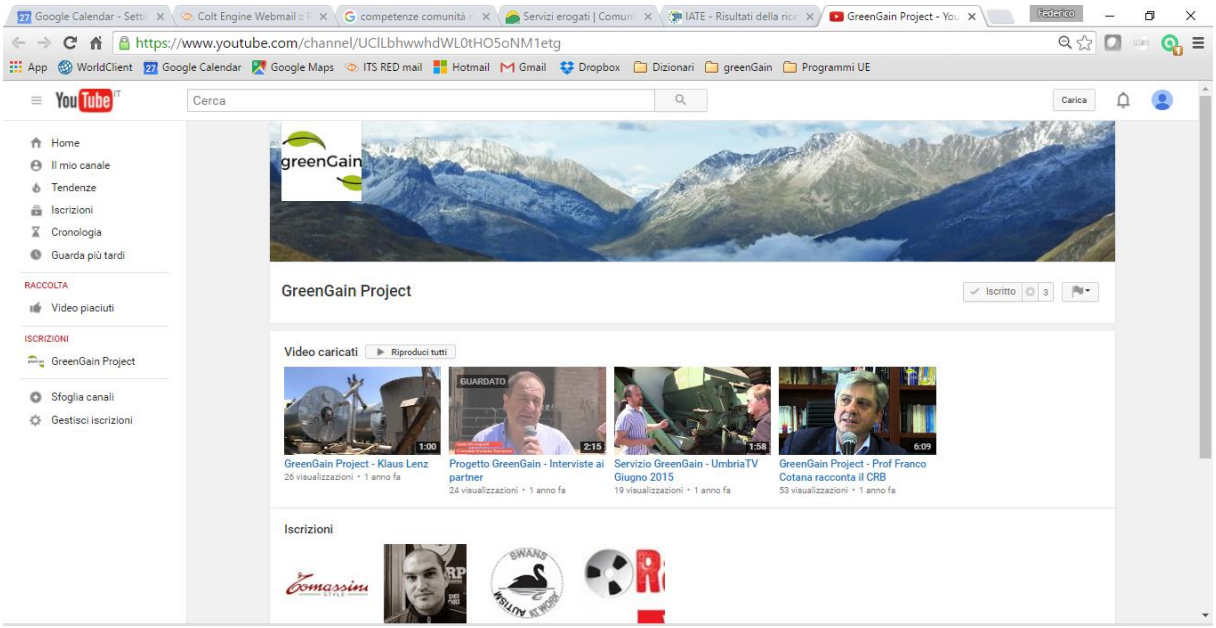


Figure 29: Screenshot of the greenGain Youtube channel (https://www.youtube.com/channel/UClLbhwwhdWL0tHO5oNM1etg).

Interviews in English and in Italian were conducted and published:

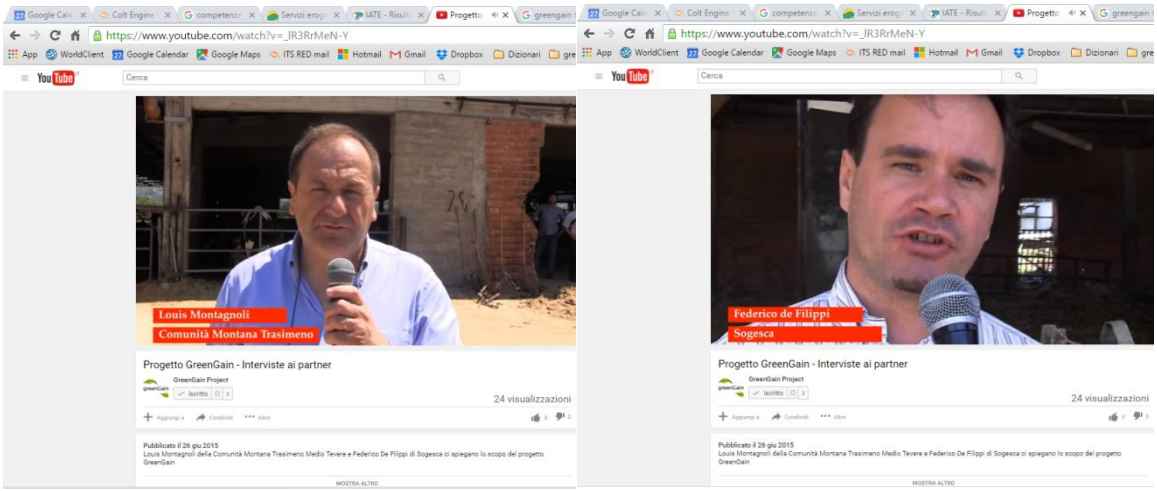


Figure 30: interviews to Louis Montagnoli (CM-ACT) and Federico De Filippi (SOGESCA) (https://www.youtube.com/watch?v=_lR3RrMeN-Y).

Several communications were launched for raising further awareness in the local stakeholders, especially following the management meeting and the visits conducted in June 2015:

Figure 31: screenshot of the publication on PerugiaToday (http://www.perugiatoday.it/economia/trasimeno-progetto-green-gain.html).

Figure 32: screenshot of the publication on Umbria24 (http://www.umbria24.it/energia-da-biomasse-via-al-progetto-green-gain-umbria-allavanguardia/360199.html).

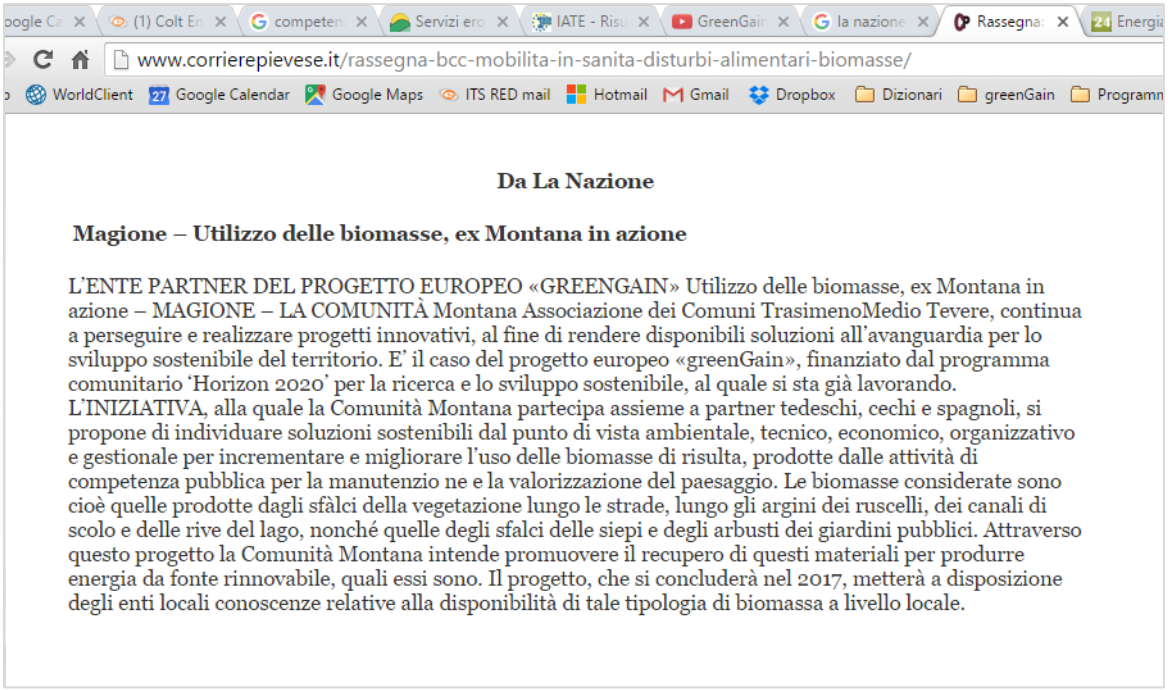


Figure 33: screenshot of the publication on Corrierepiavese (9 March 2016, http://www.corrierepievese.it/rassegna-bcc-mobilita-in-sanita-disturbi-alimentari-biomasse/).

In the middle of April 2016 CM-ACT and SOGESCA conducted a series of visits/round tables with LWG members, namely:

- ARPA Umbria (Regional Agency for Environmental Protection) Perugia – Interview To dott.ssa Grillo

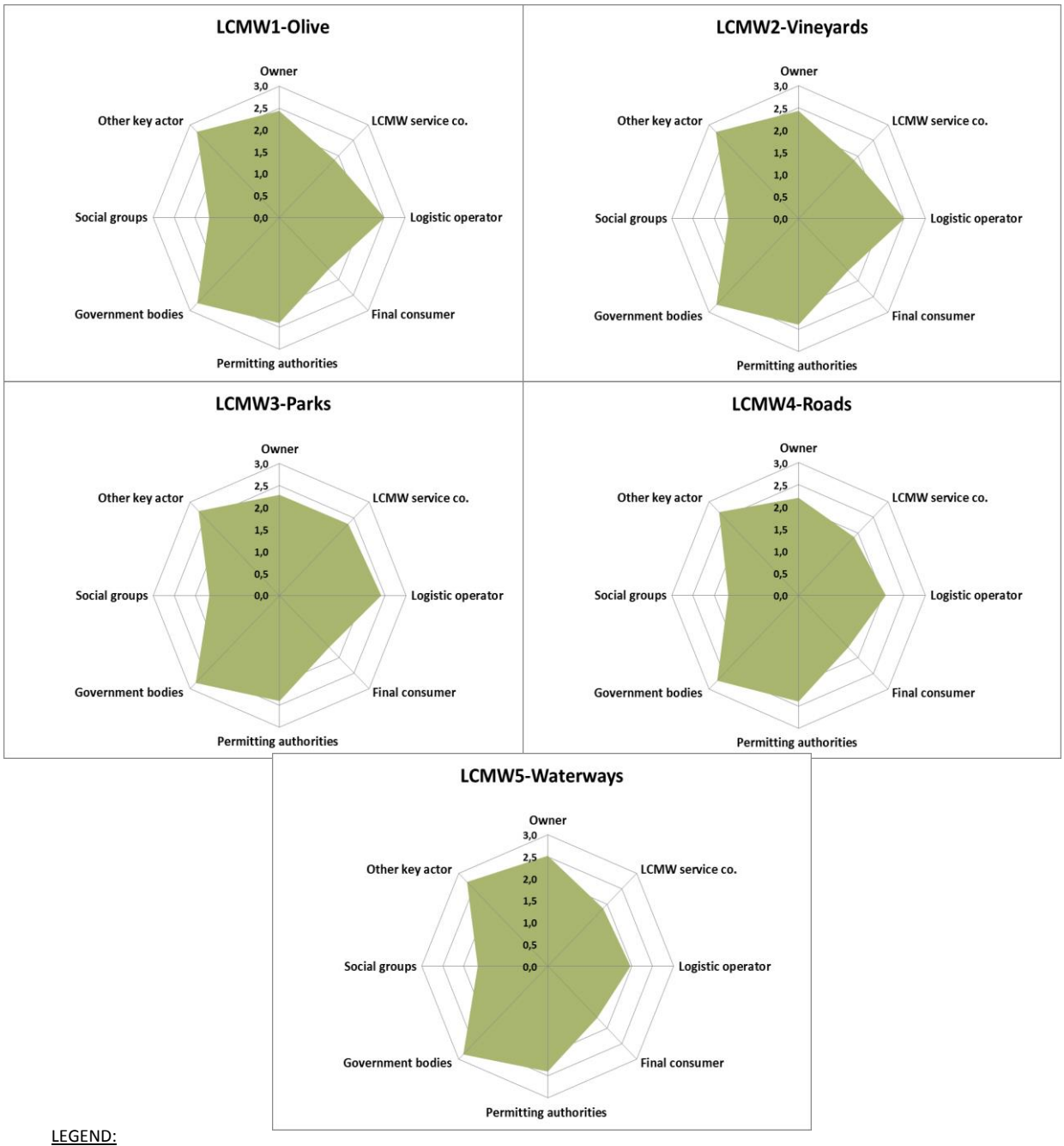
- Umbria Region (Office for energy and waste management) Dr. Andrea Monsignori, director
- Umbria Region (Forest And Mountain Economy sector) Dr. Francesco Grohmann
- Mayors of Magione, Castiglione del Lago, Panicale together with the President of Umbria Agricolture Confederation (CIA)

In fact, these rounds of interviews and discussions with local and regional authorities and stakeholders is to be considered the kick-off activity of the LWG, and it has enabled greenGain partners to confirm the validity of the LCMW biomass selection and to identify few strategic lines which will be pursued during the project, i.e.: recovery of abandoned olive groves, the assessment of the feasibility of a logistic platform for biomass storage, selection and pre-treatment and the importance of conducting LCMW with the objective of increasing the safety of the area in terms of floods and fire prevention.
This mobilisation is integrated with the continuous contact with companies of the area to which CM-ACT provides extension services. This contact has enabled CM-ACT to identify a series of small companies located in the area and interested in participating in different ways to the supply chain development process.

The results and analysis for the current status (June 2016, project halfway) of the LWGs in Trasimeno Region (Italy) are presented below, according to the methodology provided in Appendix 7.4.2, by the use of the spider net and the quadrant diagrams.

Stakeholder analysis in the Trasimeno Region

Stakeholders' relevance and involvement in greeGain LWGs (Local Working Groups) and in the promotion of LCMW biomass has been analysed according to the scope and methodology presented in Appendix 7.4. The diagram provides the readiness factor (RF), which measures the interest, proximity and capacity to contribute and participate in greenGain and to promote or facilitate the execution of future pilot experiences or new value chains.



LEGEND:
Scores measure the readiness of stakeholders to get involved and support greenGain including, or to promote pilot actions or new utilisation of LCMW biomass: relevance, proximity and amount of stakeholders. High scores reveal that stakeholders have been contacted, the interest on greenGain has been activated, and they are collaborating fluently with greenGain partners.
Scores : 0: not relevant; 1: distant contact, low interest; 2: closer contact, interested in LCMW biomass; 3: very close contact, and high interest in greenGain and in LCMW biomass.

Figure 34: Spider net graphs for Trasimeno region (at Month 18, halfway through the project).

Figure 34 shows the radial distribution of each LCMW for the Trasimeno Area including the different stakeholders. In general the readiness factor (RF) distribution is relatively high for each stakeholder category. Stakeholders of type government bodies and other key actors present the highest RF values, between 2.7 and 2.8 for all LCMW types.

Below we resume the principal technical stakeholders contacted in Trasimeno and Perugino Areas, in detail.

Permitting authorities have the same RF value for all LCMW types with a RF of 2.4
As stated above, greenGain partners have been informing the Regional competent offices (Energy and Waste sector, Forest Economy Sector), the Regional environmental Agency and the municipalities of the Area about the project, have shared some ideas and collected observations and proposals on their side. The Region is the permitting authority for biogas and biomass plants above 50 kW (external) and 200 kW (inside buildings). Currently the Region has delegated the provinces which are being dismissed. The municipalities are responsible for the authorization of smaller plants and for the quality of the air, so they can rule the use of heating plants and f fire.

Final consumers and social groups have both a RF of 1.7. CM-ACT in the framework of its institutional tasks (i.e. the support to access and management of European rural development funds) has continuous relations with final biomass consumers, especially big biomass and biogas plants. Following here are some examples:

- AGRICOLA PECCIA - Biogas Plant- PERUGIA: Mr. Pietro Peccia is one of the beneficiaries of European financial contribution from the Rural development fund (PSR) to build biogas plant in Perugino area. He uses silage and breeds residues to feed the plant with 50 Kwh power. He is interested to use other herbaceous material coming from works of cleanig and land maintenance, in a ray of 20 km around his structure (over all products similar to herbs silage, like Lolium Multiflorum)
- MOLINO NUOVO SRL - Biomass Plant- MAGIONE: Mr. Jacopo Granturchelli is a owner of a little cogenation plant in Magione, using wood cheaps coming from works of land maintenance in Trasimeno area. The plant power is 50 Kwh, with production of electricity and heat. He is interested to use of every kind of wood material cutted in the zone, tree branches with a minimum diameter of 5 cm. Very intereting is his cohoperation with Mr. Antonio Salaris, owner of a chipper moving machine (see below). The particular central area and his contacts with many other farmers could allow the involvement of many actors in the future exploitation of LCMW biomass for the production of electric energy for the town of Magione.
- IRACI BORGIA ALESSANDRO – Biogas plant – BETTONA: one of the most important utilizer of olive oil residues in Perugino Area, with a consortium plant that would use in the future olive prunings too. Built in 2008 – 2009; Plant Power 999 kW; daily electric energy production about 22,5 MWh, annual, about 8.200 MWh; daily heat production about 12,5 MWh
- CONESTABILE DELLA STAFFA ALESSIO - Biogas Plant - MAGIONE: is one of the beneficiaries of European financial contribute (PSR) to build biogas plant in Perugino area. He uses silage and slurry to feed the plant with 100 Kwh power. He is interested

to use other herbaceous material coming from works of cleanig and land maintenance, in a ray of 30 km around his structure (over all products similar to herbs silage, like Lolium Multiflorum and other spontaneous herbs)

- AGRICOLA CIRI - Biogas Consortium Plant Owner – SPOLETO: actually it's using dedicated crops like mail silage; but its potential (power 250 Kw) needs of a continuos daily feeding with green material easy to ferment. The use of this plant could cover an LCMW area with a ray of 50 km.

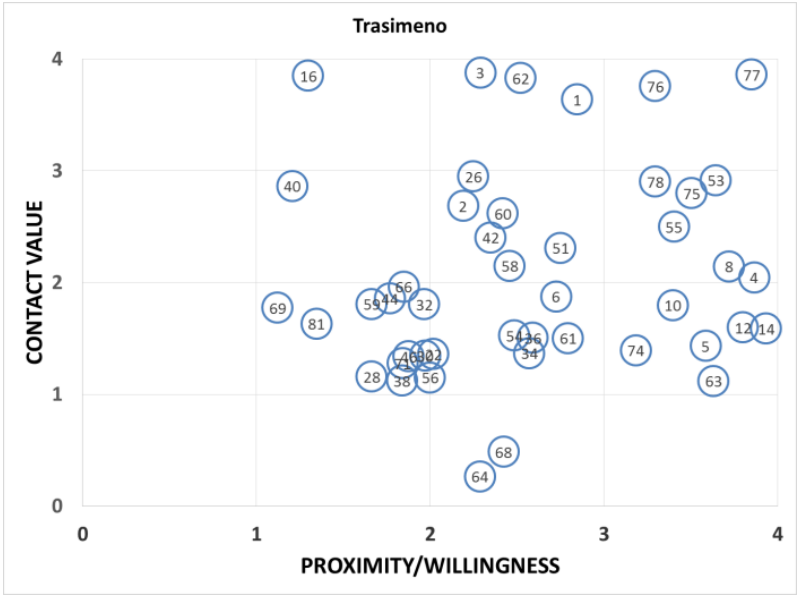
For logistic operator the RF varies within the LCMW type, being higher for LCMW1-Olive, LCMW2-Vineyards and LCMW3-parks (range 2.4-2.5) than for the rest of LCMW types (range 2.0-2.1). Trasimeno Servizi Ambientali is in fact a Waste management company. Its interests could be related to the fact that LCMW biomass coming from private sources (olive, vineyards and private parks) could be considered as a waste and therefore require special permissions to collect and manage it and the registration to waste management and transportation national registers. Other logistic operators are surely working in the area but were not yet identified.

Stakeholders of type owner have RF range values of 2.2-2.5 Biomass owners are: municipalities for the roadsides, parks and gardens. They usually have their LCMW management services but are curious to see what benefits the project can bring. Farmers are owners for the Olive Groves and vineyards – and the main associations were already contacted and are very interested in the development of the supply chain, but in fact they are counted under "Other key actors".
Finally, stakeholder of type LCMW service has a RF value of 1.9 for all LCMW types, with the exception of LCMW3-Parks, RF value of 2.3.
CM-ACT had the possibility to contact many LCMW operators, below there is a brief report of their interests:

- SALARIS ANTONIO - Maintenance And Land Cleaning - CITTA' DELLA PIEVE: Mr. Salaris is one of the biggest private operator in the maintenance of Trasimeno Area, over all the rivers sides cleaning and public green areas cleaning. He is interested to have a role of opinion leader in restoration of LCMW for production of heat destined to public buildings (school, hospitals, public offices). Now he is in contact with Città della Pieve Municipality to build a district heating town network.
- PELLICCIA GIANFRANCO – He is a big private operator in Perugino Area, for many rural works, over all crop harvesting and land moving. Directly interested to works of river sides cleaning and to restoration of wood residues for the production of renewable resources.
- RINALDUCCI ss - GUALDO CATTANEO (PG): he has the same characteriscs and interest to use, restoration and development of LCMW in Trasimeno and Perugino Area. He worked to river Caina sides cleaning;

- ISOLA COOP - PRIVATE GARDENS CLEANING – PANICALE: works of cleanig of private gardens and green areas, cutting of trees, prunings of olive trees and of many other gardens trees. Its location in Trasimeno area is a very interesting reference for the introduction of Local Public Private Agreements for the land maintenance (Patti Territoriali Di Collaborazione, for more details see Deliverable D6.3 "Implementation plans for legal, finance, governance as well as public participation measures developed to be implemented in model regions")
- COOP SOPRA IL MURO - ASSISI: it has the same role of ISOLA COOP.
- AFOR: THE MOST IMPORTANT PUBLIC AREAS CLEANING OPERATOR- 160 hectars ,aimtained only in Perugia (PARKS AND GREEN AREAS): its daily work of land maintenance is a very important reference to build a correct „net", leaving from tree and herbs cutting, first treatment, breaking and wood cheaping. Realization of a specific area, where all the people can bring wood residues, otherwise destined to tips.

Figure 35 shows the quadrant distribution for Trasimeno County. As can be pointed out there are quite number of stakeholders placed inside the engage quadrant (quadrant where both willingness and contact value are more than 2).



LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 35: Quadrant diagram for Trasimeno region (at Month 18, halfway through the project).

This means, that important stakeholders that can contribute significantly to the project have a relatively high interest in participating. Surely municipalities, LCMW operators and

farmers' associations will be the most pro-active allies in the implementation of the project strategies.

Stakeholders number 16 (Province of Perugia Soil Defense and Water Management) and 40 (Comune di Piegaro) present a very high contact values, but low willingness factor. In the former case, it is because the Province is in a dismissal phase and it is not clear which public body (municipalities, region or others) will take in charge the waterways maintenance. In the latter case, it can be explained though lack of resources for improving the service of roadsides and park/gardens cleaning. Communication strategies should be carried out in order to increase their interest in participating. This can result in a great benefit as their contribution factor could be very important.

In conclusion we can state that the Trasimeno Region a good network of stakeholders who are willing to get involved in the value chain development, either for business or institutional (read: safety and cost reduction) reasons. The willingness will be tested during the pilot experience and the development of the business models, but we can state that no further urgent action is truly necessary to involve more actors in the LWGs (Local Working Groups)".

4. Germany: regions, LCMW status quo, potential pathways and stakeholders

4.1. General description of the project regions Rotenburg (Wümme) and Friesland

Friesland

The county Friesland (FIR) lies in the North-West of Germany, 130 km west of Hamburg and belongs to the metropolian region of Bremen and Oldenburg. In the north the county borders to the Wadden Sea of the North Sea and in the east to the Jade Bay with the city Wilhelsmhaven lying in-between. It has a total area of 60,785 ha (Figure 36). [1]

Figure 36: Municipalities and location of the county Friesland (right) in Germany (upper left) and the state Lower Saxony (lower left) (adapted from http://bit.ly/1Ywup81).

In total 96,937 inhabitants live in the county FIR in eight municipalities, which results in a population density of 159.5 people per km^2. The majority of the population lives in the cities Varel (~ 23,550) Schortens (~ 20,200) and Jever (~ 13,800). The smallest municipality, the island Wangerooge, has only about 1,290 inhabitants. [2]

[1] https://de.wikipedia.org/wiki/Landkreis_Friesland

[2] https://www.friesland.de/unser-landkreis/zahlen-daten-fakten/

The predominat landscape type is the „Marsch“ (alluvial land), followed by Geest (slightly raised landscape with sandy soil) and moor (Figure 37). Hedgerows on banks are widely spread and are part of Friesland´s cultural landscape. Mostly there is agricultural area, however tourism plays economically an important role due to the direct contact to the North Sea with the Wadden Sea (Wattenmeer) and the island Wangerooge.[3]

Figure 37: Typical landscape in the region of the county Friesland: Marsch (left) and moor areas (right) (pictures: Nora Kretzschmar)

About 28 % of the population (26,935 people) is employed, whereby the biggest part works in the service sectors (Figure 38). In 2012 a gross domestic product of 21,882 € per inhabitant was produced. [4]

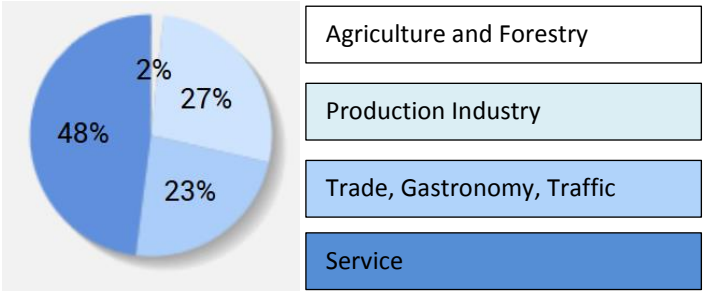


Figure 38: Share of employees in the main economic sectors in the German project region Friesland (adapted from http://bit.ly/1rtgOB0)

Rotenburg (Wümme)

The county lies between the Hanseatic cities Hamburg and Bremen and has close proximity to Hannover, the capital city of Lower Saxony. It is one of the biggest counties in Germany (Figure 39).

[3] https://de.wikipedia.org/wiki/Landkreis_Friesland

[4] https://www.friesland.de/unser-landkreis/zahlen-daten-fakten/

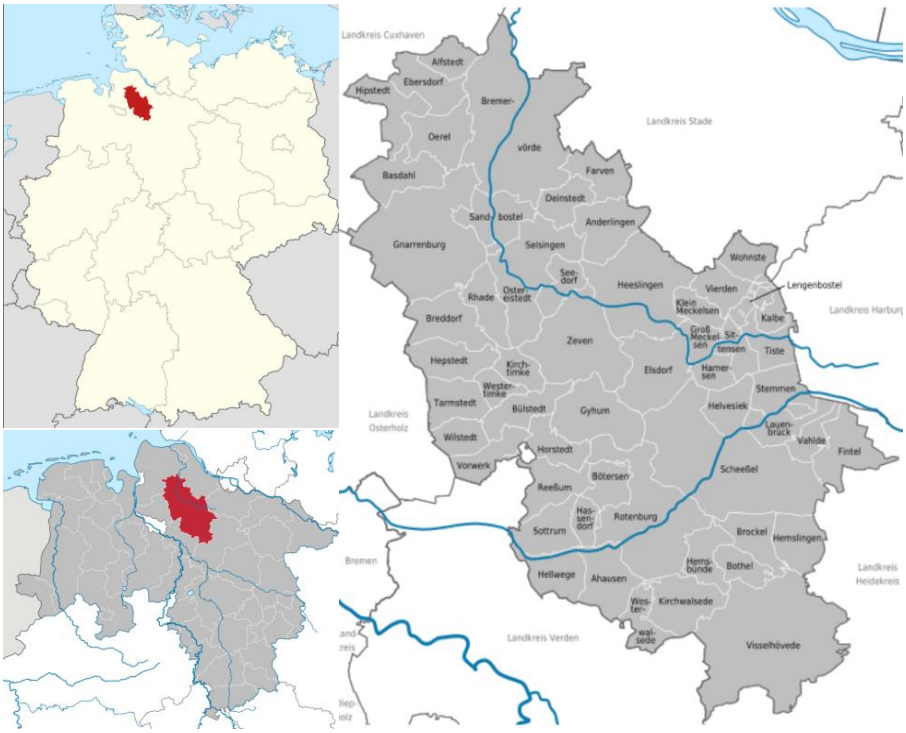


Figure 39: Municipalities and location of the county Rotenburg (Wümme) (right) in Germany (upper left) and the state Lower Saxony (lower left) (adapted from http://bit.ly/1UAa0x5)

In total about 163,000 inhabitants live in the county Rotenburg (Wümme) (ROW) in 57 municipalities[5] (see Figure 39), which results in a population density of 78 person per km^2. 52 of the municipalities are small (<5,000 inhabitants) and only five have bigger dimensions (9,000-21,000 inhabitants).

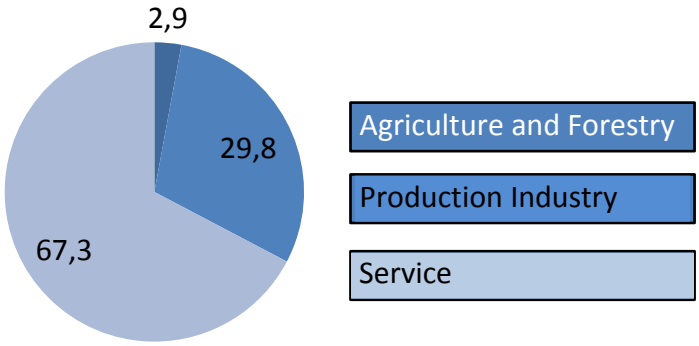


Figure 40: Share of employees (%) in the main economic sectors in the German project region Rotenburg (Wümme) (source: http://bit.ly/1V15CDd)

[5] http://bit.ly/1Ug1Jju

In ROW one can find regions of Geest (slightly raised landscape with sandy soil), lowlands created through formerly cultivation of moors or still intact moor systems (Figure 41). The rivers Wümme and Oste flow through the county and create important natural habitats and an attractive landscape. Besides agricultural areas the county has a rural landscape with forests, moors, rivers and some heathland regions.

Figure 41: Typical landscape in the county Rotenburg (Wümme): heathland in Lüneburg (left) and extended moor areas (right) (pictures: Nora Kretzschmar, Aline Clalüna)

4.2. LCMW status quo in the counties Rotenburg (Wümme) and Friesland

The LCMWs identified initially in the German greenGain regions are summarised as follows:

Table 24: Summary of LCMWs for the German greenGain project regions

LCMW	Short name	LCMW subtypes (if existing)
1)	Maintenance of hedge- and treerows on banks	-
2)	Maintenance of roadside hedge- and treerows	Maintenance
		New plantings wayside strips
3)	Maintenance of moor areas	-

Each of the listed LCMW types and the biomass that can be obtained are described in the following chapters.

4.2.1. LCMW 1, Maintenance of hedge- and treerows on banks

The first LCMW type in the project region FRI looks at vegetation standing on earthen mounds/banks (mix of trees and shrubs), which where build in historical land use to fence agricultural fields (Figure 42). Over time the hedge- and treerows lost their function and they

were not taken car off anymore. Because of that, many were highly damaged, wrongly maintained or are now even scarcely stocked [LK FRI (a)].
Today the Federal Law of Nature protection protects these historical landscape elements and regulates their maintenance. Cutting/felling is allowed only from October to February and should not be done more frequently than every seven years. Additionally, the structures have to be protected against grazing through a fence. The new building or widening of passages through the banks is allowed, however, they should not be wider than 12 m and per management intervention maximum two are to be worked at. The work on passages has to be reported to the Nature Conservation Agency at least a month beforehand [Ambrosy 2014].

Usually, the hedge-and treerows on banks are owned privately, mostly by farmers. The maintenance and conservation is supported with two legal programs, one on the regional and the other on the state level [Ambrosy 2014; Brand 2015]. From both (participation only in one possible) the owners receive financial support for the LCMW and in turn make sure, that the typical character of the hedgerows on banks (from ecological to historical aspects) is preserved.
Every year on Easter so called “Easter Fires” take place at which people burn residues from their gardens and fields, and with that also the biomass from the LCMW of hedge- and treerows on banks. These fires have a long historical tradition, however, a new regulation from April 2014 demands that every single fire is registered and needs a permit from the nature protection agency. With that the bigger fires organised by municipalities can still take place, the smaller ones on the other hand, can be better controlled, surveyed and if necessary be forbidden [LK FRI (b)]. With that the disposal of residues from this LCMW type is now more strongly controlled.
The used harvesting technologies are a mix of manual and mechanical techniques, but are often more adapted for vegetation control and not for harvesting. The felling is done with felling scissors (pinching) or a cutting aggregate on an excavator, larger dimensions and trees are cut by chainsaw. Often there are logistical problems with big chippers, the biomass is chipped too finely or the vegetation, which should sprout again after the LCMW, damaged by pinching machines (cutter should be preferred). The transportation is done by trucks or tractors with trailer. Is the biomass not utilised it is chipped directly on site. If it is further used, the material is often dried as fuel wood or woodchips in open air or in sheds.
It has to be kept in mind that the LCMW on hedge- and treerows on banks can raise high public awareness. Also the work is often considered as secondary job during the winter months which leads to problems with meeting the legal deadlines.

Figure 42: Hedge- and treerows on banks in the German pilot region Friesland (pictures: Alexander Rosenberg).

For the described LCMW type hedge- and treerows on banks in the model region Friesland the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 25: Most promising logistical chain for LCMW 1 in the German pilot region Friesland

Hedge- and treerows on banks	
Felling	Felling scissors (pinching) or cutting aggregate on excavator, larger dimensions and trees with chainsaw
Storage 1	Short storage and bundling on roadside
Chipping	Chipper (mounted on trailer)
Loading	From chipper blown on tractor with trailer/ truck
Transport	Tractor with trailer/ truck
Pre-treatment	Depending on combustion technology: sieving or drying
Storage 2	Chips piled under shed
Combustion	Sell to burn, burned by company or hedgerow owner

4.2.2. LCMW 2, Maintenance of roadside hedge- and treerows

The LCMW along roadsides ensures traffic safety on the county roads in the pilot regions FRI and ROW (Figure 43). The work is managed by specialised roadside maintenance agencies of the county (Straßenmeistereien)[6], which closely cooperate with further companies to secure the performance. During the LCMW the flowing traffic has to be considered and often there

[6] http://bit.ly/1UdkXkD

is just limited space for temporary storage on site, thus the biomass usually has to be removed immediately. Today about 90 % of this material is already used for energetic purposes[7].

According to Nature Conservation Law, cutting and felling of the vegetation along the county roads is only allowed from October to February. With that this type of LCMW represents a seasonal biomass source. Also it has to be considered that the roadside maintenance agencies often have other short term responsibilities (e.g. accidents, construction sites, winter service) which make planning of the LCMW more difficult.

The used harvesting technologies are a mix of manual and mechanical techniques. Felling is usually performed with a feller (clipper)-buncher, larger dimensions are cut with chainsaws. Trucks and tractors with trailers remove the material from the roadsides and a stationary chipper at the work yard of the roadside maintenance agency further processes the biomass. Depending on the used combustion technology, sieving for quality improvement is necessary. When the biomass is unused, it is directly chipped to the site.

Additionally to the maintenance of county roads, the situation of wayside strips of the municipal roads in the county ROW is considered. Many of these wayside strips are currently falsely ploughed by farmers when they work on their adjacent fields. With that not only foreign land is ploughed, but also the development of valuable habitats for plants and animals prevented. In collaboration with the affected farmers these wayside strips are to be returned to their intended shape by planting herbaceous and/or woody vegetation. These measures will lead to an increased occurrence of vegetation, which in the future has to be maintained similar as the one along county roads.

Figure 43: Hedge- and treerows along the county roads in Friesland and Rotenburg (Wümme) have to be maintained regularly (left and middle). Falsely ploughed wayside strips in Rotenburg (Wümme) need to be recovered (right) (pictures: Alexander Rosenberg).

[7] Statement roadside maintenance agency Bremervörde, Mr. Ralf Ratajczak, June 2016

For the described LCMW type maintenance of roadside hedge- and treerows the following steps for the most promising logistical chains were defined in cooperation with the technical and regional project partners.

Table 26/ 27: Most promising logistical chains for LCMW 3 in the German pilot regions

Roadside hedge- and treerows a), remove immediately	
Felling	Felling with feller (clipper)- buncher, larger dimensions with chainsaw
Loading	Whole biomass on tractor with trailer/ truck
Transport 1	Tractor with trailer/ truck to near work yard
Chipping	Big, stationary chipper
Transport 2	Tractor with trailer/ truck to user
Pre-treatment	Depending on combustion technology: sieving or drying
Storage	Chips piled under shed
Combustion	Sell to burn, burned by maintenance company

Roadside hedge- and treerows b), chipping on site	
Felling	Felling with feller (clipper)- buncher larger dimensions with chainsaw
Chipping	Chipper (mounted on trailer)
Loading	From chipper on tractor with trailer/ truck
Transport	Tractor with trailer/ truck to user
Pre-treatment	Depending on combustion technology: sieving or drying
Storage	Chips piled under shed
Combustion	Sell to burn, burned by maintenance company

4.2.3. LCMW 3, Maintenance of moor areas

The LCMW type moor areas is worked with in both German project regions. The interest lies on moorland, which can also be under nature protection or/and be a Natura 2000 area. The moors are partly covered with forests and the LCMW is necessary to minmize internal drainage effects through trees (Figure 44). Predominant species are Birches (*Betula*), Scots pine (*Pinus sylvestris*), Rowans (*Sorbus*) and Oaks (*Quercus*). In the project regions the moors

are partly owned by the federal state of Lower Saxony, partly by the counties and by private owners.

The areas are usually accessible only under very favourite weather conditions and only to a very limited extent by machines, often even with handtools the access is difficult due to high water levels and old peat digging places.

The used harvesting technologies are a mix of manual and mechanical techniques, where the cross-cutting is done with chainsaws and splitting with an axe or hydraulic splitter. However, mostly the available technology is not sufficiently adapted to the difficult sites.

As far as property of the state, there is a separate administration with labour and special equipment, who can perform maintenance to a very limited extent (Moorverwaltung, only in case of the county FRI)[8]. The work is per part also done by sheep herds, however, these often have to be supported by "regular" LCMW. It has to be considered that public awareness of large-scale removal might lead to strong criticisms in the population.

Figure 44: The removal of trees and bushes (Entkusselung) on moor areas in the counties Friesland and Rotenburg (Wümme) prevents water removal trough the vegetation (pictures: Alexander Rosenberg).

For the described LCMW type protected moor areas in the model regions FRI and ROW the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 28: Most promising logistical chain for LCMW 2 in Germany

Protected moor areas	
Felling	Chainsaw, per part also with adapted machines (depending on site)
Extraction	Moor caterpillar
Storage 1	Short storage and bundling on roadside
Chipping	Chipper (mounted on trailer)
loading	From chipper blown on tractor with trailer/ truck

[8] http://bit.ly/1S98r3k

Transport	Tractor with trailer/ truck
Pre-treatment	Depending on combustion technology: sieving or drying
Storage 2	Chips piled under shed
Combustion	Sell to burn, burned by company or hedgerow owner

4.3. Promising pathways in the German model regions

Biomass resources from LCMWs identified in the counties FRI and ROW consist principally of woody biomass, similar to forestry wood (stem wood and whole tree biomass) and forestry residues (branches from tree prunings). In order to produce energy from these biomass types the potential final consumers have been identified in both counties in collaboration with local stakeholders.

Table 29 summarises the main final biomass consumers that are present in the territory. As observed the main consumption is based on wood logs (mainly in small stoves and domestic heat), small pellet boilers, and woodchips. The relevance in the territory has been stated by considering the number of existing stoves (annual fireplace counting). As observed the predominant wood use is in small wood log stoves and boilers in both counties. The strategy for LCMW biomass procurement will therefore have to base on these small facilities, or in few medium-sized units.

Large biomass consumers are present in ROW, which use residue wood from sawmills. However, previous contact made by the county administration showed that these facilities are fully covered with woody fuel and have no interest to adapt their energy management to incorporate other types of material. Accordingly, these consumers have not been considered to be potential users of the LCMW woody biomass. In Friesland there are no large biomass plants (> 1 MW thermal power).

Biogas plants are also quite present in both counties. The promotion of biogas through feed-in tariffs and other supporting mechanisms has led to an expansion of biogas plants in the area fed with herbaceous crops or with maize. The current situation is not much favourable as it was for energy crops, and these biogas plants are in a transition period to diversificate and re-tune their feedstock strategy. The LCMW biomass could be an alternative whenever compatible with the biogas production process.

Table 29: Main potential LCMW biomass consumers in Friesland and Rotenburg (Wümme)

Facility name	Technology type	Usual feedstock	Product obtained	Consumer type	Size	Relevance in the region (nr.)		Ever utilised LCMW?
						Friesland	Rotenburg (Wümme)	
log wood single furnace	Combustion	Wood logs	Heat	Atomised	Micro	15,827 (90 %)	31,640 (95 %)	p.p. Yes
log wood central furnace < 15 kW	Combustion	Wood logs	Heat	Atomised	Micro	104 (<1 %)	524 (1,6 %)	p.p. Yes
log wood central furnace > 15 kW	Combustion	Wood logs	Heat	Atomised-Cluster	Micro	1,427 (8,1%)	755 (2,3%)	p.p. Yes
pellet single furnace	Combustion	Pellets	Heat	Atomised	Micro	119 (< 1%)	152 (< 1%)	p.p. Yes
pellet central furnace < 15 kW	Combustion	Pellets	Heat	Atomised	Micro	53 (< 1%)	69 (< 1%)	p.p. Yes
pellet central furnace > 15 kW	Combustion	Pellets	Heat	Atomised-Cluster	Micro	18 (< 1%)	161 (< 1%)	p.p. Yes
woodchips central furnace < 50 kW	Combustion	Wood chips	Heat	Atomised	Micro	12 (< 1%)	75 (< 1%)	p.p. Yes
woodchips central furnace > 50 kW	Combustion	Wood chips	Heat	Atomised-Cluster	Micro Mini	3 (< 1%)	51 (< 1%)	p.p. Yes
woodfueld power plant	Combustion	Wood from Sawmill	Heat	Centralised	>1MW	---	Not relevant	No
woodfueld power plant	Combustion	Wood from Sawmill	Heat	centralised	>1MW	---	Not relevant	No
Biogas	Biogas	Energy crops	biogas	Atomised-clusters	Micro small	479	233 (high relevance)	No

Note that inventory of boilers and fireplaces has been obtained from the fireplace counting annually done by 3N (competence centre for renewable resources) for whole Lower Saxony (http://3-n.info/).
p.p. Yes = per part Yes: most of these furnaces are owned by private people, depending on where they obtain their wood fuel (e.g. super market or local farmer) it originates from LCMW in the region or not.

In FRI and ROW the prices of biomass purchase varies from wood logs at 30-40 € / m^3 [LWK 2016], then wood chips 80-130 € / t [C.A.R.M.E.N. (a) 2016] and pellets costing 210-240 € / t [C.A.R.M.E.N. (b) 2016]. Both wood logs and wood chips do not need previous treated stages, as they come from regular forestry works. In the case of biogas facilities, only energy crops or herbaceous material are used.

Biomass emissions requirements depend on the power of the used boiler / facility, as seen in (Table 30). This can be a constraint in small units, where biomass of low quality may be incompatible with the air emissions regulation.

Table 30: Emission requirements for wood furnaces in Germany (adapted from Brüggemann 2014)

Biomass	Power kW	Dust[1] g/m^3	CO[1] g/m^3	Dust[2] g/m^3	CO[2] g/m^3
logs, chips	4-500	0,1	1	0,02	0,4
logs, chips	> 500	0,1	0,5	0,02	0,4
Pellets DIN	4-500	0,06	0,8	0,02	0,4
Pellets DIN	> 500	0,06	0,5	0,02	0,4

[1] *Minimum requirements for existing installations. After a certain transitional period, depending on the type, existing furnaces have to fulfil the limits of this first level*

[2] *Minimum requirements for wood chips- and pellet-furnaces installed after 1/2015 and for wood log-furnaces installed after 1/2017.*

Standards of the fuel (moist, ash, particle distribution) depend on the furnace in use.

4.4. Local working groups in the German model regions

Building the LWGs and inauguration

For the establishment of the local working groups (LWGs) COALS could profit from existing contacts to relevant stakeholder in the project region Rotenburg (Wümme) (ROW), derived from a previous cooperation in the project "Bioenergy Promotion" (biogas and woody biomass). In the case of the second region Friesland (FRI) such a group emerged with strong support from the county administration and the farmers´ associations. To get first personal contact with these actors in FRI, an inauguration meeting took place in Bockhorn-Grabstede (FRI, 10.03.2015) with six key stakeholders. Here the representatives of the counties administration and the local farmers´ association were introduced into the project greenGain and already discussed the relevance of the biomass production from LCMW on hedge- and treerows on banks.

A month later a joint meeting in Varel-Obenstrohe (FRI, 27.04.2015) with participants from both project regions was organised. During this event, 15 stakeholders from administration, LCMW service companies, farmers´ association, forestry operators and project members (COALS, SYNCOM, FNR) discussed and confirmed the potentials of bioenergy from LCMW biomass in the German regions. Additionally, a site visit took place were the results of a LCMW on a hedge- and treerow on bank and the used chipping technology were presented (Figure 45).

Figure 45: Memebers of the LWGs from the two German project regions meeting the first time in Friesland (left), visiting the results of an implemented LCMW on a hedge- and treerow on bank (middle) and observing the LCMW biomass being processed (right) (pictures: Alexander Rosenberg).

Until June 2016 several bilateral meetings, site visits and phone calls between the already involved stakeholders, new key players and COALS took place. The inauguration events and the work of the LWGs in greenGain was additionally described and promoted in the magazine "Land & Forst" and on the homepages of COALS[9] and the county ROW[10]. This led

[9] https://www.lwk-niedersachsen.de/index.cfm/portal/forstwirtschaft/nav/1967.html, Access: June 2016

to new stakeholders joining the LWGs, which were in each case inaugurated via e-mail and by telephone.

The results and analysis for the current status (June 2016, project halfway) of the LWGs in the German counties FRI and ROW are presented below, according to the methodology provided in 7.4.2, by the use of the spider net and the quadrant diagrams.

Stakeholder analysis in the county Friesland

Figure 46 shows the radial distribution of each LCMW for the county FRI including the different stakeholders. As can be seen, social groups, in this case being the "Ammerländer Landvolkverband" and the "Kreislandvolkverband Friesland e.V.", have a very high readiness factor (RF), 2.8, for the category LCMW1-Banks. These farmers´ associations gather many owners of hedge- and treerows on banks and are in close contact with the local LCMW service providers. Through them a big number of actors can be effectively reached. These contacts are of great relevance in regard of the planned pilot experience for this LCMW type (Task 5.3). For the other LCMW categories, social groups have a middle RF value of 1.8.

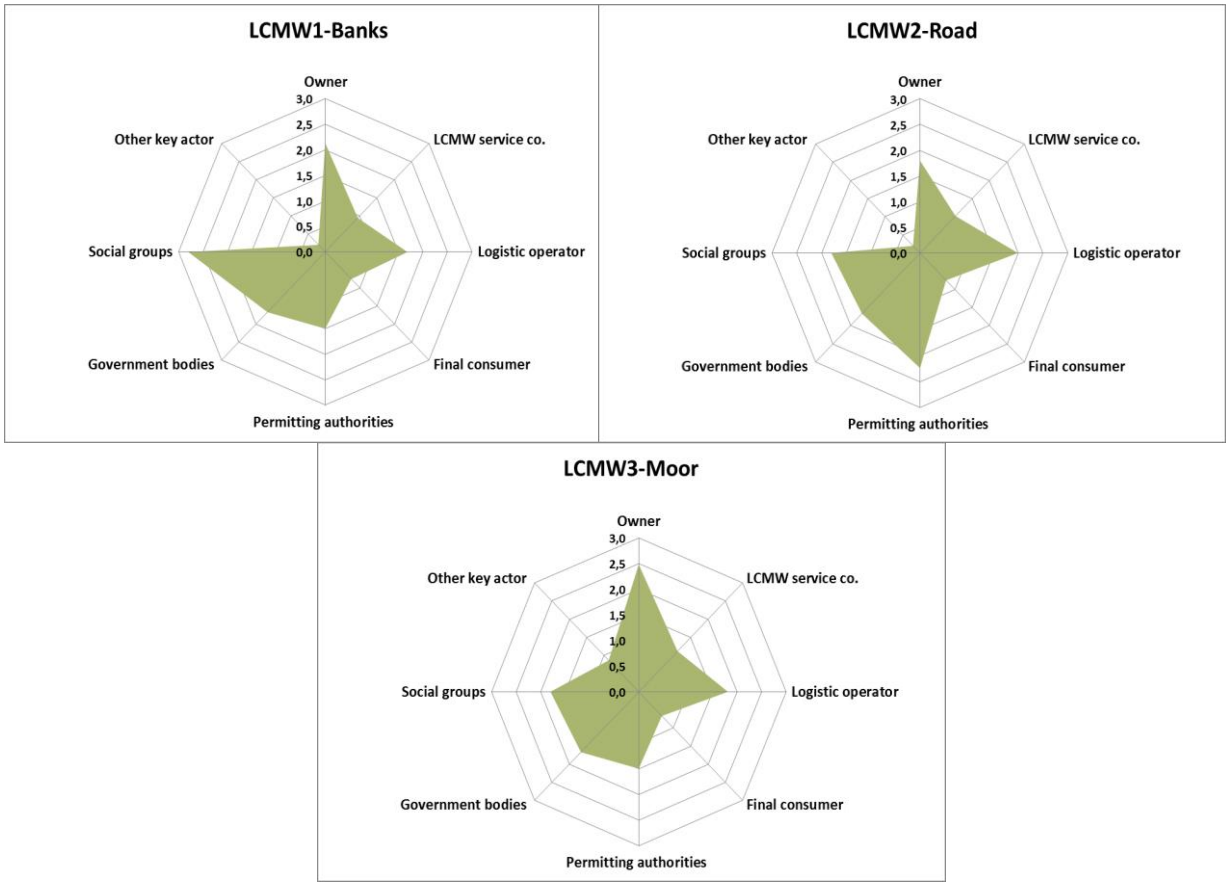
Owners have relatively high RF around 2.2 and 2.5, except for the type LCMW2-Road with a lower RF of 1.8. The higher values can be explained through the high organisation level of the above described farmers´ associations in the case of LCMW1-Banks and the personal engagement of a specific owner of a moor area (LCMW3-Moor). As owner of the county roads the county administration is involved in the project work with a regular intensity, however does not show especially high activity.

Stakeholders of type logistics operator and government bodies have a similar range from 1.7 up to 2.0 in each LCMW type. Permitting authorities have a RF value of 1.5, with the exception for the LCMW2-Road type. For LCMW2, permitting authorities are the highest RF value, 2.2. For all three LCMW types the county administration is a crucial permitting authority. However, for LCMW2-Roads the regional roadside maintenance agencies have permitting functions as well, which leads to a higher value in this evaluation.

Final consumers have an equal RF value of 0.8 for all the LCMW types. In FRI most consumers are private persons with small to middle sized stoves (see section 4.3), thus their involvement into the project work is difficult. However, a close contact could be established with the Power Plan Rieste of the Bayernfornds BestEnergy 1 GmbH & Co. KG (situated in in a county south of FRI), which is a final consumer utilizing wood from LCMW coming from up to 100 km distance.

Finally, for other key actors the readiness factor varies within the LCMW type, being 0.9 for LCWM3-Moor and 0.2 for the others.

[10] http://bit.ly/297pcSf, Access: June 2016



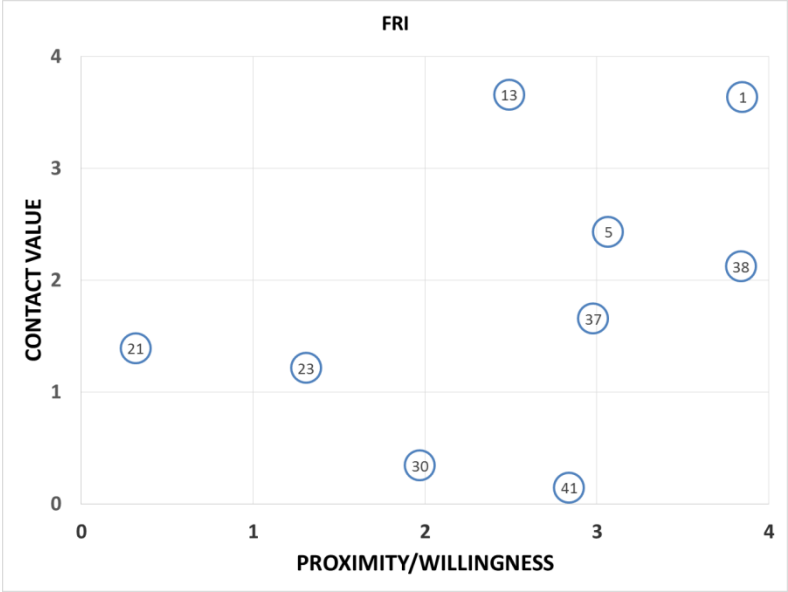
LEGEND:
Scores measure the readiness of stakeholders to get involved and support greenGain including, or to promote pilot actions or new utilisation of LCMW biomass: relevance, proximity and amount of stakeholders. High scores reveal that stakeholders have been contacted, the interest on greenGain has been activated, and they are collaborating fluently with greenGain partners.
Scores : 0: not relevant; 1: distant contact, low interest; 2: closer contact, interested in LCMW biomass; 3: very close contact, and high interest in greenGain and in LCMW biomass.

Figure 46: Spider net graphs for the county Friesland (at Month 18, halfway through the project).

Figure 47 shows the quadrant diagram for the county FRI. As can be pointed out, there are four stakeholders placed in the engage quadrant (quadrant where both willingness and contact value are more than 2), including the county´s administration, the described farmers´ associations and roadside maintenance agency. The position of the latter is derived from its multiple function as permitting authority, LCMW service provider and logistic operator. Three stakeholders are placed with a willingness factor higher than 2 but a contact value factor below 2. Their contribution is limited at the time being. A first contact was established with all and their interest in greenGain and its results is activated. However, the cooperation with them will be of more interest when the implementation of project results (biomass assessment, pilot experiences) is going to be initiated during the second half of the project time.

The displayed graph of the pilot region FRI is not strongly populated, which is based on the structure of the incorporated stakeholders. Groups as the farmers´ associations combine multiple stakeholders of the same type but are here shown as a single actor. The same is the case for single stakeholders, who fulfil multiple functions (e.g. county FRI being owner of

county roads as well as permitting authority). In many cases issues could be managed by COALS in cooperation with one contact and simply no further stakeholder commitment was needed until this point of the project.



LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 47: Quadrant diagram for the county Friesland (at Month 18, halfway through the project).

In conclusion, this region has a sufficient network of stakeholders eager to involve themselves in the project work and the up-coming pilot experiences. Depending on further steps of the project work single contacts may be intensified. No further urgent action is necessary to involve more actors in the LWGs.

Stakeholder analysis in the county Rotenburg (Wümme)

Figure 48 shows the radial distribution of each LCMW for the county ROW, including the different stakeholders. It can be pointed out that owners have a relatively low readiness factor (RF), 1.2 for both LCMW types. In the case of the type LCMW2-Road this can be explained by the inclusion of wayside strips along municipal roads. The relevant issues for greenGain in this regard lay in the hand of administrative bodies and thus a close contact and involvement with the single municipalities, which are the owners of the wayside strips, is not necessary. Regarding LCMW3-Moor, the contact with the foundation Nature Protection County ROW showed that for the areas in possession of this group, no great interest on LCMW is present.

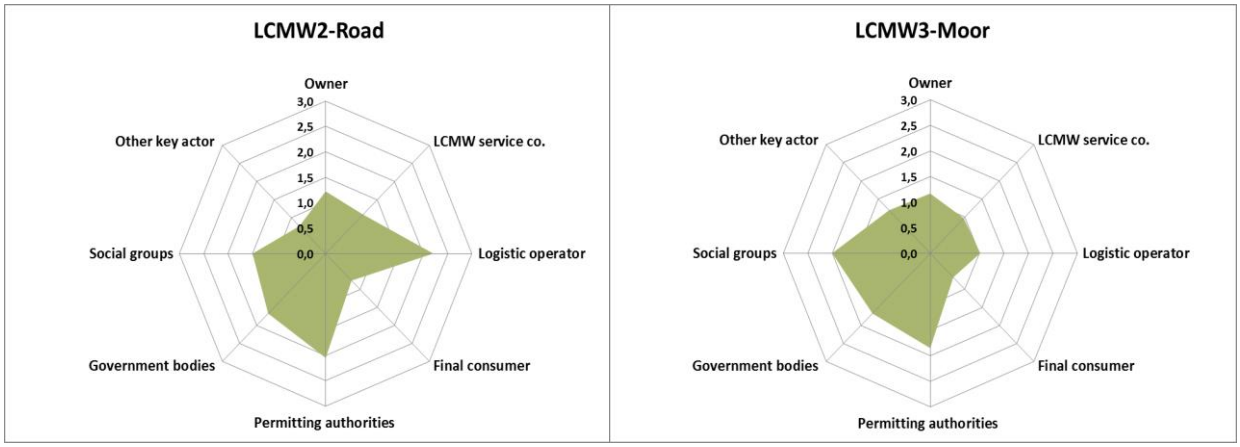
Stakeholders of type final consumers have also a low RF, 0.7. Like in the other German project region FRI, most consumers in ROW are private persons with small to middle sized

stoves (see section 4.3), thus their involvement into the project work is difficult. The close contact with the Power Plan Rieste of the Bayernfornds BestEnergy 1 GmbH & Co. KG as described in the previous section on FRI is also relevant for ROW.

Further, LCMW service, permitting authorities and government bodies are similar for both LCMW types and have RF values between 1-1.1, 1.9-2.1 and 1.7, respectively. Because for both types pilot experiences are planned (Task 5.3) the contact with the involved stakeholders is stable. For LCMW2-Roads the cooperation with the roadside maintenance agency Bremervörde is close because it fulfils functions as permitting authority, provides LCMW services and is logistic operator. In the case of LCMW3-Moor COALS as government body has a big interest in analysing the utilization of biomass from moor areas more closely in the course of a greenGain pilot experience. For this, close contact with the local forestry operation Nordheide-Heidemark (LCMW service and permitting authority) and the county´s nature protection administration (permitting authority) is maintained.

Other evidence that stands out is the stakeholder of type logistic operator, the logistic operator has the highest RF, 2.2, for LCMW2-Road, while for LCMW3-Moor, is 1. As described above, this can be based for LCMW2 on the close contact with the roadside maintenance agency in ROW which fulfils functions as logistic operator. Additionally, the company Raiffeisen Agil in Leese, one of the biggest providers of energy wood in northern Germany, is a possibly relevant actor fulfilling this type of action for both LCMW types. Comparing the two LCMW types it has also to be considered that the utilisation chain for the biomass from roadsides is already set up but has still to be developed for the material from moor areas.

Finally, social groups and other key actors have higher RF values for LCMW3-Moor, presenting the highest RF of 2.0 for this LCMW category. As important social group the association “Forst Consulting Hohe Heide” is included in this analysis. It clusters the local forestry associations and organises the selling of the wood (for energy or industrial) on the market. As the utilisation chain for biomass from LCMW3-Moor is not yet established the cooperation with this association is close and of great importance.



LEGEND:
Scores measure the readiness of stakeholders to get involved and support greenGain including, or to promote pilot actions or new utilisation of LCMW biomass: relevance, proximity and amount of stakeholders. High scores reveal that stakeholders have been contacted, the interest on greenGain has been activated, and they are collaborating fluently with greenGain partners.
Scores : 0: not relevant; 1: distant contact, low interest; 2: closer contact, interested in LCMW biomass; 3: very close contact, and high interest in greenGain and in LCMW biomass.

Figure 48: Spider net graphs for the county Rotenburg (Wümme) (at Month 18, halfway through the project).

Figure 49 presents the quadrant diagram for the county ROW. As can be noted, most stakeholders have a willingness factor higher than 2. The diagram is more populated than in the case of FRI. Even though in ROW only two LCMW types are analysed (compared to three in FRI) the circumstance that two pilot projects are planned in the region makes a higher number of stakeholders necessary.

There are four stakeholders placed inside the engage quadrant (quadrant where both contact value and willingness are higher than 2). These are important stakeholders contributing to the implementation of the pilot experiences in ROW. In general the cooperation with the county´s administration is of great importance for all actions regarding LCMW. Regarding the single LCMW types, especially the roadside maintenance agency Bremervörder (LCMW2-Road), the forestry operation Nordheide-Heidemark and the association “Forst Consulting Hohe Heide” (both LCMW3-Moor) contribute significantly to the fulfilment of greenGain´s project aims.

For the others stakeholders, presenting both, contact value and willingness factor less than 2, communication and information strategies should be carried out, as their contribution is limited and is only important for mutual feedback. Stakeholder number 25 has a very low willingness factor and contact value, and thus, no action is required as its contribution is not relevant for project.

LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 49: Quadrant diagram for the county Rotenburg (Wümme) (at Month 18, halfway through the project).

In conclusion, this region has a good network of stakeholders eager to involve themselves in the project work and the up-coming pilot experiences. Stakeholder with less proximity to the project will be informed more regularly on the results gained during the pilot experiences and other works in greenGain. No further urgent action is necessary to involve more actors in the LWGs.

5. Czech Republic: regions, LCMW status quo, potential pathways and stakeholders

5.1. General description of the project regions Obec Kněžice and Mikroregion Vltavotýnsko

Obec Kněžice

The municipality is situated in Central Bohemia, approximately 70 km east of Prague. Kněžice[11] is a small village and municipality in Nymburk District in the Central Bohemian Region of the Czech Republic (Figure 50). It is located 22 km east of Nymburk and 67 km east of Prague capital. The municipality established the company "Energetika Kněžice" which operates bioenergy centre and is commonly referred as "energy independent village". Kněžice is also active in the local action group (LAG) Mezilesí[12] which consists of 25 municipalities in the region. The cooperation with greenGain on LCMW biomass can be therefore to some extent also useful to other municipalities in the region.

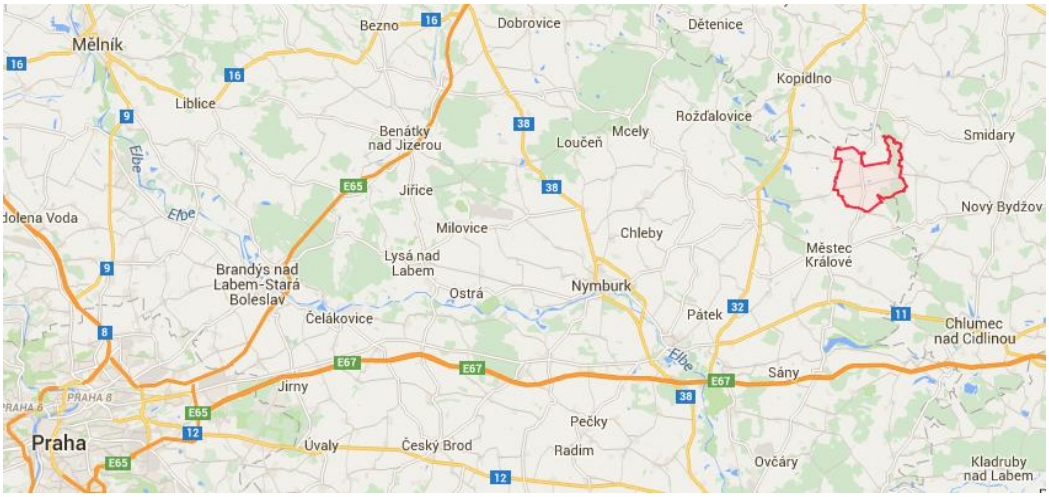


Figure 50: Location of the Czech pilot region Obec Kněžice near Prague (source: http://www.uir.cz/mapa/537292/Obec-Kněžice).

The model region has a plain landscape (Figure 51), lays about 220 meters above sea level and has a total area of 1,958 ha. Due to a high share of arable land, it has an intensive agricultural activity. In the region Poděbrady about 4.7 % of the area is used for agriculture, forestry and fishing; 12.8% for industry and 14.1 % for construction. Commerce, hotel services and gastronomy take up about 28.2 % of the regions´ area. In 2014 Kněžice counted 512 inhabitants. The population in the Mezilesí region is generally distributed over a large number of small villages (average 400 inhabitants) with a couple of larger towns.

[11] http://www.obec-knezice.cz/

[12] http://www.masmezilesi.cz/

Figure 51: Landscape in the region Obec Kněžice (pictures: Obec Kněžice).

Mikroregion Vltavotýnsko (PRO-ODPAD)

The region of Týn nad Vltavou (in DoA referred to as PRO-ODPAD) is located in South Bohemia approximately 100 km south from the Prague capital. The administrative center is Týn nad Vltavou which is situated about 30 km from České Budějovice (centre of the South Bohemia Region) (Figure 52). The vegetation period starts in April and lasts more then 210 days. A central European (transitional) type of climate is predominant in the region. The landscape of PRO-ODPAD is influenced by the Vltava river and Lužnice river. The 26,243 ha big area has an altitude range from 343 to 626 meters above sea level (Figure 53). From the total area 60.8 % is agricultural land, 28.1 % forests, 1.3 % build-up area and 9.8 % other structures.

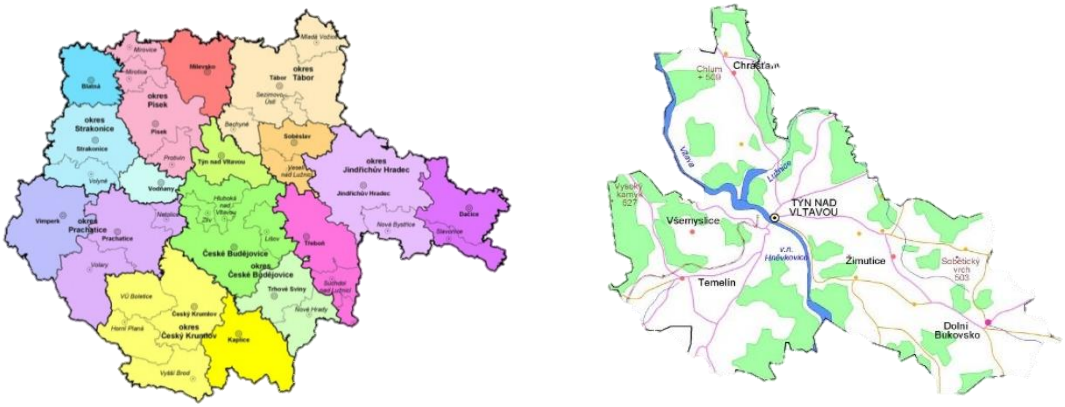


Figure 52: Location of the Czech region of Týn nad Vltavou (PRO-ODPAD) (right) in the Jihoceský region (left) (source: Czech Statistical Office).

In the year 2013 PRO-ODPAD was populated by 14,104 inhabitants, whereby 8,089 live in the main city of Týn nad Vltavou. The economic activity is dominated by the sectors commerce, hotel industry and food (22.1 %), followed by construction (16.6 %) and industry (13.7 %). Finally, agriculture, forestry and fishing make up for 7.2 % of the regions´ economy.

Figure 53: Typical landscape of the Czech project region Týn nad Vltavou (picture: Miroslav Herout).

5.2. LCMW status quo in the municipality Obec Kněžice and Vltavotýnsko Mikroregion

The LCMWs identified initially in the Czech greenGain regions are summarised as follows:

Table 31: Summary of LCMWs for the Czech greenGain project regions

LCMW	Short name	LCMW subtypes (if existing)
1)	Trees: urban areas	
2)	Trees: roadside maintenance	-
3)	Riverside cleaning	-
4)	Grass: urban areas	-
5)	Grass: roadside maintenance	Maintenance (existing roadsides)
		Newly redesigned/widened roadsides (anticipating use of LCMW feedstock)

Each of the listed LCMW types and the biomass that can be obtained are described in the following chapters.

5.2.1. LCMW 1, Trees: urban space maintenance

Generally, the LCMW feedstock in urban areas (Figure 54) is more likely to be utilized due to the higher priority for maintenance (social, safety, economic factors) then in remote areas.

In Kněžice the biomass of this LCMW type is used in combustion for energy production. In Týn nad Vltavou (PRO-ODPAD) on the other hand it is partially utilized for the production of wood chips (used directly for combustion and also in the composting plant as a mixture. In both regions the regular LCMW takes place from April until October (public parks). Cutting and pruning of the trees is usually done in spring and autumn, in some cases during winter. Usually, the maintenance is complex and done on some concrete and limited area with production of larger amounts of woody feedstock.

Figure 54: Trees in urban spaces are regularely maintained in the Czech pilot regions (pictures: Obec Kněžice)

For the described LCMW type trees from urban space maintenance in the Czech model regions the same steps for the most promising logistical chains as for the third LCMW type could be defined in cooperation with the technical and regional project partners (Table 32 / 33).

5.2.2. LCMW 2, Trees: roadside maintenance

This LCMW type includes the maintenance of trees along local roads and roads with the category II and III (Figure 55). As in the case for the grass along roadsides (LCMW 5) the local roads are maintained by the local municipality, the other categories by the regional authority. Currently, bigger branches and stems, which are produced during the LCMW, are picked up; smaller branches are left in the place and not used. They occur in small amounts and it is not very economical to collect them for energetic use. The harvesting is done fully mechanised. In Kněžice stems from trees are just picked up and divided among the people in the maintenance company.

Figure 55: LCMW on trees along roadsides in the Czech pilot regions is done regularly (pictures: Miroslav Herout, Jan Doležal)

For the described LCMW type trees from roadside maintenance in the Czech model regions the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 32/ 33: Most promising logistical chains for LCMW 1 and 2 in the Czech pilot regions

Trees: roadside maintenance (Kněžice)	
Felling or trimming	Felling or trimming with chainsaw
(Storage)	Possible short period of storage at the spot
Chipping	Mobile chipper (mounted on trailer)
Transport	Loading and transportation with a tractor with trailer or a truck
Storage	Storage at the Energetika Kněžice s.r.o. premises
Combustion	Combustion of the wood chips in the combustion plant of Energetika Kněžice s.r.o. (winter period)
Heat	Central heating distribution system (winter period)

Trees: roadside maintenance (Týn nad Vltavou)	
Felling or trimming	Felling or trimming with chainsaw
(Storage)	Possible short period of storage at the spot
Chipping	Mobile chipper (mounted on trailer)
Transport	Loading and transportation with a tractor with trailer or a truck
Storage	Storage at the local roads maintenance operator

#1 Selling the woodchips	Marketing the wood chips
# 2 Composting	Composting the wood chips in composting plant Kompostárna Jarošovice, s.r.o.

5.2.3. LCMW 3, Riverside cleaning

The LCMW type riverside cleaning in the Czech project region (PRO-ODPAD) is done on an area in close proximity to the Vltava River (Figure 56). More priority is given to areas in urban centres (similar to LCMW1 and LCMW4). The work produces a mix of woody and herbaceous biomass from grasses, trees, shrubs, branches and natural regeneration. Compared to other sources of biomass this feedstock is relatively minor (in terms of volumes). The river is "owned" by the state, but the LCMW lays in the responsibility of local or regional actors. It is maintained by the local authority (and subcontractors) if the river is in an urban space (land register of Týn nad Vltavou town) and by a national authority (and their subcontractors) if the river is located outside of urban space. Certain volumes of this biomass are utilised in a composting plant (herbaceous feedstock in urban spaces).


Figure 56: LCMW along rivers is an important prevention measure in the Czech project regions (pictures: Miroslav Herout).

For the described LCMW type riverside cleaning in the Czech model region PRO-ODPAD the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 34 / 35: Most promising logistical chains for LCMW 3 in the Czech pilot regions

Riverside cleaning (woody biomass)	
Felling or trimming	Felling or trimming with chainsaw
(Storage)	Possible short period of storage at the spot

Chipping	Mobile chipper (mounted on trailer)
Transport	Loading and transportation with a tractor with trailer or a truck
Storage	Storage at the local roads maintenance operator
#1 Selling the woodchips	Marketing the wood chips
# 2 Composting	Composting the wood chips in composting plant Kompostárna Jarošovice, s.r.o.

Riverside cleaning (herbaceous biomass)	
Cutting	Mowing machine (special needed for the road side maintenance)
(Storage)	Possible short period of storage at the spot (in urban areas), otherwise preference is to directly utilise the feedstock
Transport	Tractor with a trailer or a truck
(Storage)	Possible short period of storage before entering the anaerobic digestion process
Composting	Utilization in composting plant Kompostárna Jarošovice, s.r.o.
Compost	Selling of compost

5.2.4. LCMW 4, Grass: urban areas maintenance

The fourth LCMW type in the Czech greenGain project regions describes the work done on grassy biomass on public green spaces within the municipality (in the Kněžice municipality land register or in the Týn nad Vltavou land register) (Figure 57).
In the region Kněžice the material is already used in a biogas plant for energy production. In Týn nad Vltavou (PRO-ODPAD) it is used in a composting plant (material use). Generally, the feedstock in urban areas is more likely to be utilized because there is a higher priority for maintenance (social, economic factors) then in remote areas. In this region the regular LCMW takes place from April until October. The number of fellings depends on the locality (highly frequented areas like e.g. squares or main recreational parks are maintained more regularly). Facilities for sport and leisure (swimming pools, athletic, football and other stadiums, etc.) have the highest frequency of cutting and maintenance. There is a general lack of awareness among certain segments of the general public about the many benefits of the utilisation of grass from urban space maintenance. For this LCMW type it also applies that the responsible actors in the region of Kněžice have insufficient equipment for effective

collecting of the grassy material and for its treatment (collect and transport before processing in the local biogas plant).

Figure 57: Maintenance of grass areas in urban spaces in the Czech project regions (pictures: Miroslav Herout).

For the described LCMW type grass from urban space maintenance in the Czech model regions the same steps for the most promising logistical chains as for the fifth LCMW type could be defined in cooperation with the technical and regional project partners (Table 36).

5.2.5. LCMW 5, Grass: roadsides maintenance

In the Czech greenGain project regions the fifth LCMW type looks at the grassy biomass along local roads and roads with the category II and III (Figure 58). The local roads are maintained by the local municipality, the other categories by the regional authority. In the Kněžice municipality the herbaceous biomass is partially utilized in a biogas plant and partially left on site as mulch. In this region funds for proper treatment of biomass are missing and the responsible stakeholders are currently looking for a support to get the necessary equipment.

The LCMW on roads categories, which are maintained by a national authority, is not performed as often as would be ideal for keeping good visibility for drivers. It would be better if they would be maintained by a local company for further energetic utilization, because then they would have a motivation to cut it more often.

In the pilot region Týn nad Vltavou (PRO-ODPAD) there is still a general lack of awareness among certain segments of general public about the many benefits of biomass feedstock utilisation. Sometimes the whole potential of LCMW biomass feedstock, or rather renewable energy in general, is not understood and therefore not utilised.

The responsible actors in the Kněžice municipality have insufficient equipment for effective collecting of the biomass and for treatment of grass (extract and chop before processing in the local biogas plant). Grass has to be collected shortly after the cutting, otherwise there is danger of the lowering the energetic gain of biomass. Additionally, the roadsides are filled with various non-biodegradable wastes and they need to be cleaned manually before the cutting in spring. If the grassy is used, it is, when possible, not stored on site but transported directly to the biogas plant.

In the Kněžice municipality parts of the roadsides under the municipal maintenance are being redesigned (widened) with the grass feedstock maintenance taken into account. The needs of existing biogas plans in the municipality (supply of feedstock) are consciously taken into account.


Figure 58: LCMW on grassy areas along the roadsides in the Czech project regions (pictures: Miroslav Herout, Milan Kazda).

For the described LCMW type grass from roadside maintenance in the Czech model regions the following steps for the most promising logistical chains could be defined in cooperation with the technical and regional project partners.

Table 36/ 37/ 38: Most promising logistical chains for LCMW 4 and 5 in the Czech pilot regions

Grass: roadside maintenance (Kněžice)	
Cutting	Mowing machine (special needed for the road side maintenance)
(Storage)	Possible short period of storage at the spot (in urban areas), otherwise preference is to directly utilise the feedstock
Transport	Tractor with a trailer or a truck
(Storage)	Possible short period of storage before entering the anaerobic digestion process
Anaerobic digestion	Utilization in biogas plant Energetika Kněžice, s.r.o.
Electricity and heat	Electricity grid + central heating distribution system

Grass: roadside maintenance (Týn nad Vltavou)	
Cutting	Mowing machine (special needed for the road side maintenance)
(Storage)	Possible short period of storage at the spot (in urban areas), otherwise preference is to directly utilise the feedstock
Transport	Tractor with a trailer or a truck
(Storage)	Possible short period of storage before entering the anaerobic digestion process
Anaerobic digestion	Utilization in the biogas plant in Jarošovice
Electricity	Electricity grid

This pathway is currently not deployed, according to the local partners the preference is given to composting with the following production pathway:

Grass: roadside maintenance (Týn nad Vltavou, composting)	
Cutting	Mowing machine (special needed for the road side maintenance)
(Storage)	Possible short period of storage at the spot (in urban areas), otherwise preference is to directly utilise the feedstock
Transport	Tractor with a trailer or a truck
(Storage)	Possible short period of storage before entering the anaerobic digestion process
Composting	Utilization in composting plant Kompostárna Jarošovice, s.r.o.
Compost	Selling of compost

5.3. Promising pathways in the Czech model regions

The LCMW potential biomass consumers existing in Kněžice municipality and Vlatavotynsko Mikroregion are summarised in Table 39. They have been directly contacted for the assessment of the consumption side and their interest in LCMW biomass. As observed, in both areas the composting and the consumption in small furnaces is an option for the LCMW biomass. In Vlatavotynsko Mikroregion there are neither medium to large biomass plants, nor biogas plants. On the contrary Kněžice municipality includes two commercial CHP plant, based on woodchips and biogas.

Table 39: Main potential LCMW biomass consumers in Kněžice (Kněž) municipality and Vlatavotynsko (Vlat) Mikroregion

Area	Facility name	Technology type	Usual feedstock	Product obtained	Consumer type	Size	Relevance in the region	Ever utilised LCMW?
Kněž	ESO Kněžice (2,500MWhe)	biogas	grass	electricity, heat	community (district heating), local SMEs	30 kW	yes	Mixed with other biomass
	ESO Kněžice (2,500MWhe)	comb	wood chips	electricity, heat	community (district heating), local SMEs	30 kW	yes	Mixed with other biomass
	Proagragro Nymburk composting plant (29,000 t) Composting plant Městec Králové	composting	grass, wood chips	compost (Organic)	private companies	---	yes	Mixed with other biomass
	Households	comb	fire-wood	heat	households	---	yes	yes
Vlat	Kompostárna Jarošovice (Composting Plant in Jarošovice) Proagragro Nymburk composting plant (29,000 t) Composting plant Městec Králové	Composting, selling wood chip	Grass, leaves, wood chips	compost	community	Several tons of compost/yr	no	yes
	Citizens	Comb(in family houses)	Wood chips	heat	households	25 kW, one caldron for one house	no	yes

The market prices for the biomass feedstock produced in LCMW works have been explored in Kněžice municipality and Týn nad Vltavou region. For the ESO Kněžice plant, the wood chips purchase price is 30 - 40 € / t and for grass only the cost of maintenance and transport. This type of grass must fulfil the Czech law, with a denomination of "N" (product: fertilizer). Except for households, it is required the biomass to be national material (any foreign material is avoided).

In Týn nad Vltavou region it has been obtained from Kompostárna Jarošovice (Composting plant in Jarošovice) they acquire grass at a price about 5 € / t for their compost production (at 60 % moisture). Woodchips are being purchased at 5 to 10 € / m^3 (equivalent to 15 to 30 € / t, at 20 % moisture).

5.4. Local working groups in the Czech model regions

Building the LWGs and inauguration

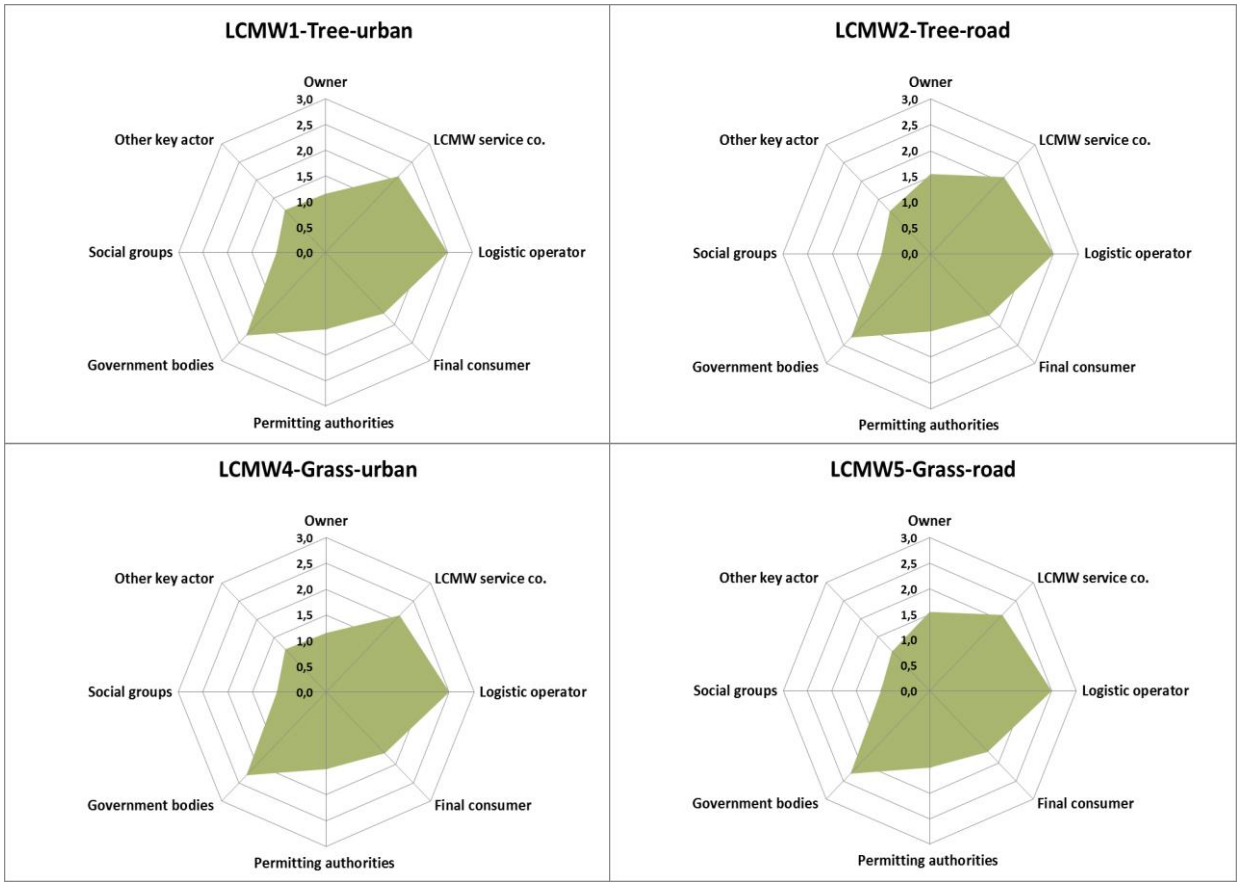
CZ BIOM took advantage of the existing contacts with Energetika Kněžice and PRO-ODPAD due to the fact that both institutions are member organisations of CZ BIOM – Czech Biomass Association and provide necessary presence in the model regions. Energetika Kněžice is a unique project of energy independent (sovereign) municipality; not only within Czech Republic, but also within the EU as a whole. Cooperation with such an interesting project

seems as a natural fit to the broader aim of the greenGain project to support local bioenergy initiatives through market uptake and energy utilization of biomass from LCMW.
Similarly, to complement the example of Kněžice (as a smaller municipality), already established contacts with the NGO PRO-ODPAD help the greenGain project to build presence in the South Bohemia Region. PRO-ODPAD is a member of CZ BIOM and operator of composting plant (Kompostárna Jarošovice) in Týn nad Vltavou region, namely in Jarošovice village. The advantage of the second region is its larger area and also ability to analyse stakeholder's views on the possible utilization pathways, economics and related trade-offs among different technologies (anaerobic digestion or combustion vs. composting).
The LWG in the Kněžice municipality (Energetika Kněžice according to the DoA) has been established in January 2016 via e-mail communication (12.01.2016) with seven key players in the field of maintenance of public green areas or utilization of the biomass from landscape conservation and maintenance work (both energetic and material). There were also bilateral meetings among representatives of Energetika Kněžice and the key players in the model region during autumn 2015. The actors were also invited to the greenGain national workshop in November 2015 (25.11.2015) in the Czech Republic and are advised to subscribe to the greenGain newsletter. CZ BIOM cooperates more closely with the Kněžice municipality and Energetika Kněžice to take advantage of the knowledge of other local stakeholders in the field of LCMW maintenance and waste management. The LWG serves as a platform to facilitate other tasks within the greenGain project, especially the biomass assessment and potential identification of pilot experiences. The aim for future is to broaden scope of the working group not only to Kněžice (as a relatively small municipality; although very significant due to its local bioenergy project) but also to other municipalities in the region (Nymburk district).

The LWG in the region of Týn nad Vltavou (PRO-ODPAD according to the DoA) has been established during November and December 2015 by a series of bilateral meetings between representatives of association PRO-ODPAD and key players involved in maintenance of public green areas in the region and utilization of the feedstock. The actors were also invited to the greenGain national workshop in November 2015 (25.11.2015) in the Czech Republic and are advised to subscribe to the greenGain newsletter. The LWG has been formally established in February via email communication with the key players in the region. In April 2016 there was a meeting organised with the representatives of Týn nad Vltavou municipality and key players involved in LCMW biomass maintenance and utilization.
CZ BIOM cooperates with the local NGO PRO-ODPAD who is a major stakeholder in the region advocating for improvements in the management of biodegradable material. The LWG serves as a platform to facilitate other tasks within the greenGain project, especially the biomass assessment and potential identification of pilot experiences.

The results and analysis for the current status (June 2016, project halfway) of the LWGs in Kněžice municipality and Týn nad Vltavou region (Czech Republic) are presented below, according to the methodology provided in Appendix 7.4.2, by the use of the spider net and the quadrant diagrams.

Stakeholder analysis in Kněžice municipality



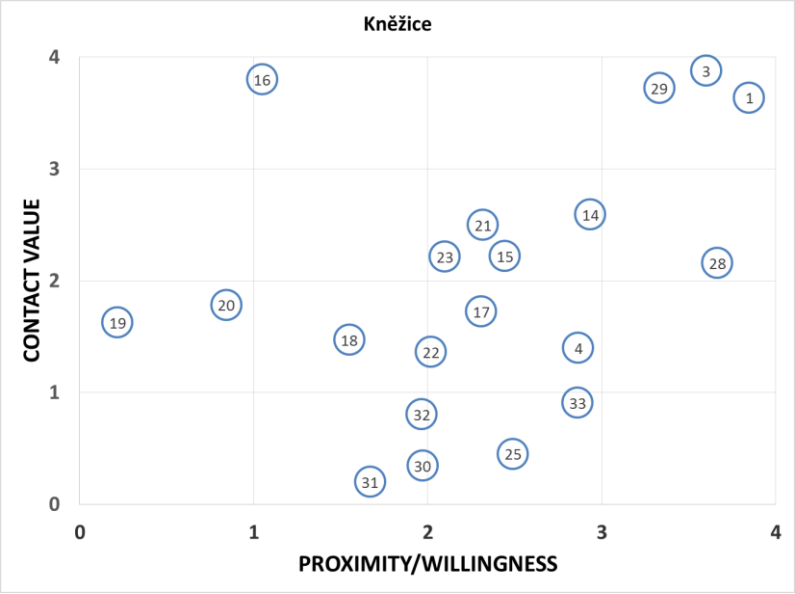
LEGEND:
Scores measure the readiness of stakeholders to get involved and support greenGain including, or to promote pilot actions or new utilisation of LCMW biomass: relevance, proximity and amount of stakeholders. High scores reveal that stakeholders have been contacted, the interest on greenGain has been activated, and they are collaborating fluently with greenGain partners.
Scores : 0: not relevant; 1: distant contact, low interest; 2: closer contact, interested in LCMW biomass; 3: very close contact, and high interest in greenGain and in LCMW biomass.

Figure 59: Spider net graphs for Kněžice County (at Month 18, halfway through the project).

Figure 59 shows the radial distribution of each LCMW for *Kněžice municipality* including the different stakeholders. As can be perceived there are no big differences in the readiness factor (RF) distribution between the LCMW types as the types chosen in Czechia are quite homogenous and involve similar actors. Stakeholder types of logistic operator and government bodies present the highest RF values, 2.5 and 2.3 respectively. They are followed by stakeholders of type LCMW service, permitting authorities, other key factors and social groups, with a RF value of 2.1, 1.5, 1.1 and 1.0 respectively. The relatively low values can be explained by the fact that the subject, Kněžice municipality even with the

neighbouring municipalities, represents a relatively small area. Among the LCMWs the only difference in the diagrams is in the stakeholder owner type, where the RF is 1.2 for LCMW1-Tree urban and LCMW4-Grass urban and 1.6 for the others types.

Figure 60 presents quadrant diagram for Kněžice municipality. As can be seen there are many stakeholders in the engage quadrant (quadrant where both willingness and contact value factor are higher than 2). The most important stakeholder in the region is Energetika Kněžice, s.r.o. due to the fact that the LCMW biomass is identified as an interesting additional feedstock for its biogas plant and biomass heating plant. Stakeholder number 16 (Technické služby města Nymburk) has a very high contact value but a still is scarcely aligned with greenGain actions. Its contribution might be very significant for the project but its collaboration is not yet assured. Therefore, communication and information actions, as for example more contacts to be done, must be carried out in order to involve them in future pilot experiences. The rest of stakeholders are mostly concentrated in the region with a of willingness value between 1.8 and 2.8, but with a contact value lower than 2. Even though their contribution is limited, more information and communication should be done in order to obtain mutual feedback.

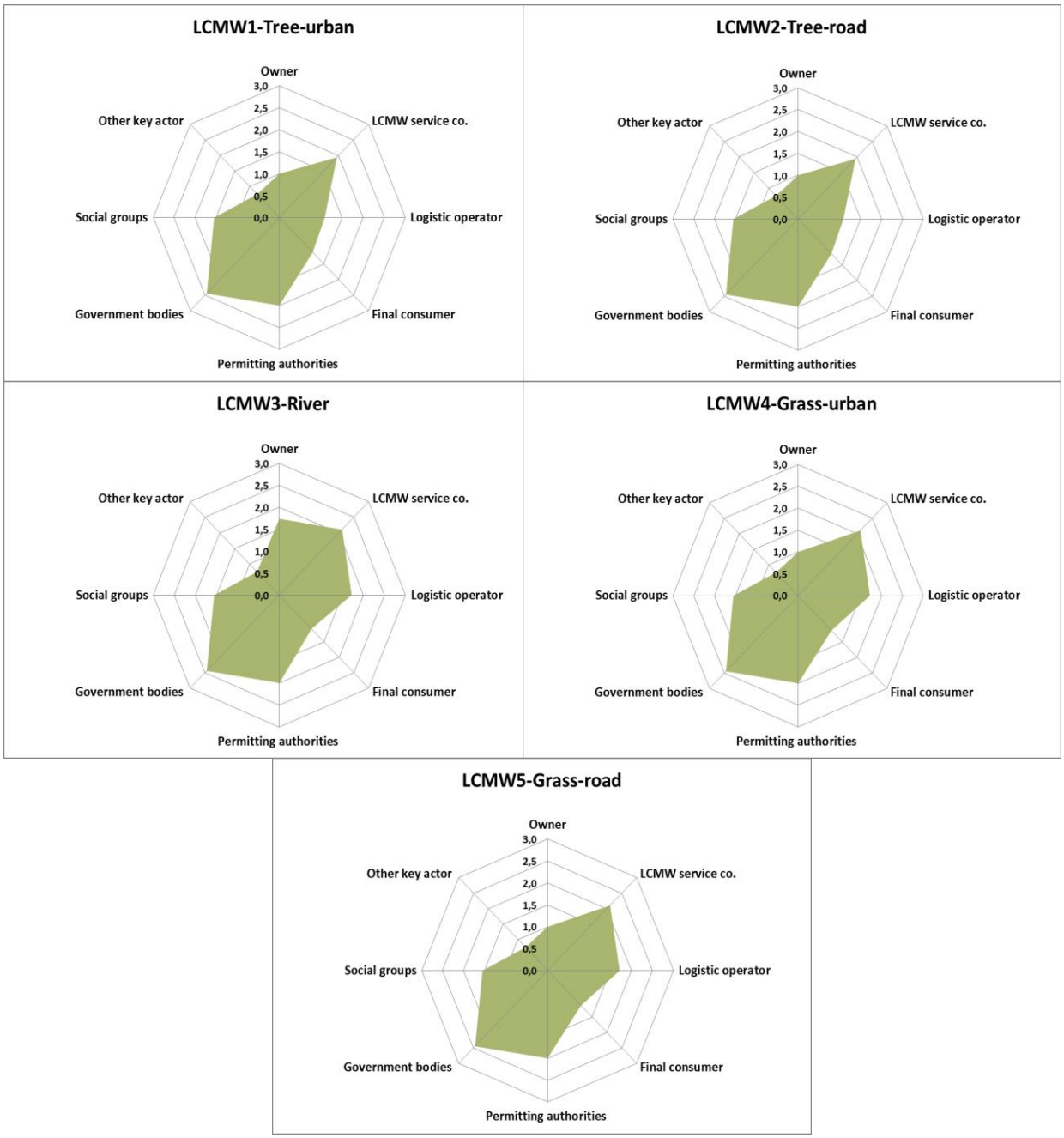


LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 60: Quadrant diagram for municipality of Kněžice (at Month 18, halfway through the project).

In conclusion the Kněžice municipality has a good network of stakeholders eager to involve themselves in pilot experience, and being at month 18 of the greenGain project no further urgent action is necessary to involve more actors in the LWGs (Local Working Groups)".

Stakeholder analysis in Týn nad Vltavou region



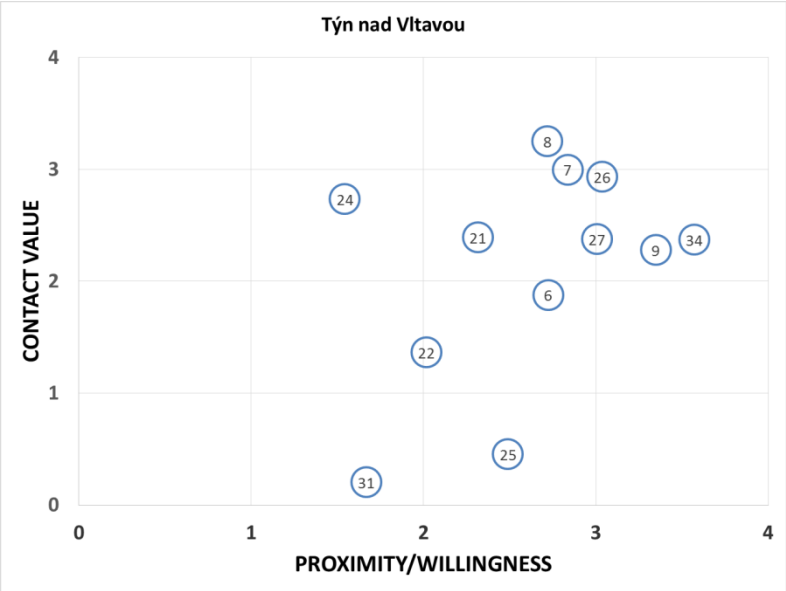
LEGEND:
Scores measure the readiness of stakeholders to get involved and support greenGain including, or to promote pilot actions or new utilisation of LCMW biomass: relevance, proximity and amount of stakeholders. High scores reveal that stakeholders have been contacted, the interest on greenGain has been activated, and they are collaborating fluently with greenGain partners.
Scores : 0: not relevant; 1: distant contact, low interest; 2: closer contact, interested in LCMW biomass; 3: very close contact, and high interest in greenGain and in LCMW biomass.

Figure 61: Spider net graphs for Týn nad Vltavou region (at Month 18, halfway through the project).

Figure 61 shows the radial distribution of each LCMW for Týn nad Vltavou region including the different stakeholders. It is observed that stakeholders of type government bodies responsible for LCMW and waste management present the highest readiness factor (RF)

value, 2.4, for all LCWM types. They are followed by permitting authorities, social groups, final consumers and other key factors, with RF value of 2.0, 1.6, 1.1 and 0.8 respectively. The key challenge is to find arguments and viable model for LCMW utilization which will bring benefits and does not increase costs of the maintenance. One difference that stands out is at the owner type, with RF = 1.7 for LCMW3-River and RF=1.0 for the rest of LCMW types. LCMW service also have a small difference between the LCMW types, being 1.9 for LCMW1-Tree urban and LCMW2-Tree road and 2.1 for the rest LCMW types. Finally, stakeholder of type logistic operator presents RF values of 1.1 for the LCMW1-Tree urban and LCMW2-Tree-road, and 1.7 for the rest of types.

Figure 62 presents quadrant diagram for Týn nad Vltavou County. As can be seen most of skateholders can be found in the engage (quadrant where both willingness and contact value factor are higher than 2). The key stakeholder the cooperation depends on is PRO-ODPAD as an operator of composting plant and biogas plant in Jarošovice. PRO-ODPAD partner organisation is already involved in LCMW service works, the composting plant is already a major final consumer of LCMW feedstock in the region (mainly from urban areas). PRO-ODPAD as a major stakeholder closely cooperates with the local municipality with respect to biodegradable waste. Stakeholders number 22, 25 and 31 need further information actions in order to obtain mutual feedback. Stakeholder number 24 (South Bohemia Region Office) has a considerable important contact value but a willingness factor less than 2, and thus, it is important a communication action in order to increase their proximity and willingness to participate and collaborate in future projects or pilot experiences. Nevertheless, being at month 18 of the greenGain project, Týn nad Vltavou region presents a good stakeholders commitment in the LWGs, and therefore it is not necessary further actions. Still, future work should focus on closer cooperation with the local government and the river maintenance administration body.



LEGEND
Contact value scores: 0 to 1: non relevant; 1 to 2: scarce relevance; 2 to 3: relevant; 3 to 4: crucial
Proximity / Willingness scores: 0 to 1: not aware of greenGain; 1 to 2: knows the project, no interest; 2 to 3: interested to follow project; 3 to 4: interested to collaborate.

Figure 62: Quadrant diagram for municipality of Týn nad Vltavou region (at Month 18, halfway through the project).

In conclusion the Týn nad Vltavou region has a good network of stakeholders eager to involve themselves in pilot experience, and being at month 18 of the greenGain project no further urgent action is necessary to involve more actors in the LWGs (Local Working Groups)".

6. References

ADB, 2001. Handbook on stakeholder consultation and participation in ADB operations. African Development Bank. Available at: www.afdb.org

Ambrosy, 2014. Landrat Landkreis Friesland, „Öffentliche Bekanntmachung der Eintragung von Wallhecken in das Verzeichnis gemäß § 14 Absatz 9 des Niedersächsischen Ausführungsgesetzes zum Bundesnaturschutzgesetz vom 19.02.2010 (Nds. GVBI. S. 104“. Available at: https://www.friesland.de/buergerservice/dienstleistungen/wallhecken-901001656-20800.html?myMedium=1, Access: June 2016

Brand J., 2015. „Wallhecken im Oldenburger Land – Informationen zum Förderprogamm,“ Oldenburg. Available at: http://www.nlwkn.niedersachsen.de/startseite/naturschutz/wallheckenprogramm_oldenburger_land/das-wallhecken-programm-oldenburger-land-118365.html, Access: June 2016

Brüggemann C., 2014. „Schärfere Grenzwerte ab 2015“, Magazin LAND & Forst Nr. 42, 16. Oktober 2014, page 9.

C.A.R.M.E.N. (a), Centrales Agrar-Rohstoff Marketing- und Energie-Netzwerk e.v., 2016. „Preisentwicklung bei Waldhackschnitzeln – Der Energieholz-Index“. Available at: https://www.carmen-ev.de/infothek/preisindizes/hackschnitzel, Access: June 2016

C.A.R.M.E.N. (b), Centrales Agrar-Rohstoff Marketing- und Energie-Netzwerk e.v., 2016. „Preisentwicklung bei Holzpellets – Der Holzpellet-Preis-Index“. Available at: https://www.carmen-ev.de/infothek/preisindizes/holzpellets, Access: June 2016

LWK (Landwirtschaftskammer Niedersachsen) 2016, „Aktuelle Holzpreise im Privatwald Niedersachsen – Juni 2016“, Brennholz Eiche / Buche, 22.06.2016, Hannover. Available at: http://www.lwk-niedersachsen.de/index.cfm/portal/forstwirtschaft.html, Access: June 2016

LK FRI 1 (Landkreis Friesland), Wallheckenbroschüre, 2010. Available at: https://www.friesland.de/medien/dokumente/wallheckenbroschuere[1].pdf?20150311090321 , Access: June 2016

LK FRI 2 (Landkreis Friesland), „Osterfeuer oder Verbrennung von Gartenabfällen?“. Available at: https://www.friesland.de/portal/meldungen/detail-901001774-20800.html, Access: June 2016

Morris, J. & Baddache, F. 2012. Back to Basics: How to Make Stakeholder Engagement Meaningful for Your Company. Available at: www.bsr.org, Access: June 2016

OMEZYMA, 2007. Programa de desarrollo rural LEADER 20072013 para las Comarcas del Bajo Aragón y Matarraña (OMEZYMA). Leader Rural Development Program 2007-2013 for Bajo Aragón and Matarraña Counties. Available at: http://www.omezyma.es/descargas.php, Access: June 2016

OMEZYMA, 2013. Rural development strategy LEADER 2014-2020. Estrategia de Desarrollo Local LEADER 20142020. Grupo Bajo Aragón Matarraña (OMEZYMA). Available at: http://aragonrural.org/leader/estrategias-leader-2014-2020/, Access: June 2016

UNIZAR, 2011. Cartografía de cultivos abandonados y selección de areas prioritarias de recuperación en la comarca del Matarraña/Matarranya. Department of Geography and Regional Planning of the University of Zaragoza, Mastergeo, S.L. and Geoter, S.C.

7. Appendices

7.1. Appendix 1: Template for the model regions description

Short name	Long name / description
Model region total area (ha)	
Brief description of the location	North, east, west or south, distance to the main cities that could be useful as reference Include a map
Type of landscape	Mountainous, plain pasture, hilly / dry or humid /climatic region (general features of the climate in the region)/ forest or agriculture area mainly? PICTURES (1 or 2 representative pictures)
Type of population	Population density and distribution. Large cities? Small villages?
Economic activity	Importance in the region of the agriculture and forestry sector, Some idea of its relevance (% of the total surface occupied by this sectors, or % in the gross domestic product, e.g.)
Types of LCMW biomass in the region	List PICTURES (1 or 2 representative pictures per LCMW)
Relevance of LCMW biomass types	Describe the relevance of each type of LCMW shortly: • homogenous distribution across the region or concentrated in a specific or small zone of the region? • approximate % of the region area • interest for the region • Currently used? (Note that part of this can be obtained from Status Quo questionnaires)

7.2. Appendix 2: Status quo questionnaires produced for the model regions

Please describe only one type of LCMW biomass per questionnaire!

LCMW denomination (overwrite!)

GENERAL INFORMATION

Technical partner: Choose

Demoregion I: Choose **Demoregion II:** Choose

MAIN PROPERTIES OF LCMW FEEDSTOCK

Main purpose of source area: Choose

Sub-categories, if Technical Infrastructure: Choose

Describe in detail:TEXT

Describe the territorial character ot the source area TEXT

LCMW subtypes identification: Please describe in the following section all possibly occurring subtypes of your LCMW (see the following table for an example on what is meant with subtype). Do also mention subtypes and their according biomass types for which you already know that they cannot be used for energetic purposes (e.g. LCMW type: Riverside Cleaning; Subtype: cleaning after flood event; Biomass: muddy branches and shrubs). This will serve as basis to show that all possible LCMW types where considered and contributes to the completeness of the Status-quo assessment. The following table shows with the example of the LCMW type Firewalls how the description should possibly be done.

Use for your own LCMW type the following table and adapt it if necessary.

LCMW type	LCMW subtype	Biomass types
Riverside cleaning	Cleaning operations undertaken at an emergency level after a flood	Trees (stem and branches) shrubs herbaceous biomass mixed with mud other
	Maintenance	shrubs and branches herbaceous other

Biological property: Choose

Describe in detail: TEXT

Predominant shape of the LCMW-resource within source area category: Choose.

OWNERSHIP

Ownership: Choose

Describe in detail: TEXT

CONSTRAINTS, OBLIGATIONS, BENEFITS AND INCENTIVES

Is the LCMW biomass currently used? ☐Yes ☐no

If yes, for what purpose? TEXT

Existing framework conditions for energetic use:

Social constraints/obligation/benefits: ☐ **Describe in detail:** TEXT

Natural constraints/benefits: ☐ **Describe in detail:** TEXT

Technical constraints: ☐ **Describe in detail:** TEXT

Legal restrictions/obligations public law: ☐

Legal restrictions/obligations private law: ☐

Legal restrictions – describe in detail): TEXT

Existing incentives for energetic use:

Public Incentives: ☐ **Private incentives (e.g. foundations):** ☐

Incentives – describe in detail): TEXT

TECHNOLOGIES FOR FEEDSTOCK TREATMENT CURRENTLY IN USE

Harvesting technology: Choose

Describe in detail: TEXT

Transport: Describe: TEXT

Storage: Describe: TEXT

Other pre- treatment: Describe: TEXT

Strengths/weaknesses of currently used technologies: TEXT

FURTHER INFORMATION

ADDITIONAL COMMENTS: TEXT

☐ PICTURES/DOCUMENTS ADDED

7.3. Appendix 3: Pre-identification of pathways

Document for model region: _____

LCMW types

LCMW	Short name	LCMW subtypes (if existing)
1		1a) 1b)
2		2a) 2b)
3		3a) 3b)
4		4a) 4b)
5		5a) 5b)

NOTE: we would like you place here the current main biomass consumers:

a) **Single facilities**
b) **A sector of market (when there are many facilities)**

IMPORTANT: any type of facility potentially able to use LCMW, even if currently they have never tried it, or even if they have never consider the use of LCMW

CURRENT EXISTING BIOMASS CONSUMERS IN THE MODEL REGION

PLEASE, first identify main biomass consumers in the region

MAIN FINAL CONSUMERS							
Facility name	**Technology type**	**Usual feedstock**	**Product obtained**	**Consumer type**	**Size (MW, t/yr of biomass)**	**Relevance in model region**	**Ever utilised LCMW?**

Facility name: write a very short facility name.

Also you can build-up abbreviations, like those shown below. In such case we need a table with full name and the coreesponding short name

- Biogas plant in Perugia: Bgas_Perug
- Multiple small household consumers for heating: House_H
- Pelletizer plant in Friesland: Pellet_Fries
- Etc.

Technology types: combustion (comb), gasification (gasif), pyrolysis (pyr), hydrothermal conversion (HTC), pelleting* (pellet), torrefaction* (torr), drying* (dry), treating & sorting* (t&s), biogas production (biogas), 2nd generation bioethanol (bioethanol), 2nd generation biodiesel (biodiesel); biorefinery (bioref)

(* = intermediates, information on consumer type refers not to these intermediates but to the final consumer of the product.)

Usual feedstock: straw bales, forestry wood chips, etc.

Products: heat, electricity, cooling, CHP. CCHP, energy carrier (quote energy carrier); biogas, biomethane, bioethanol, biodiesel, material (quote material), fraction (quote main fractions obtained)

Consumer type: particular households (atomised), community (clusters: district hating, institutional buildings), industry (centralised), power plant (centralised)

Typical size: of each consumer.

Micro: <50 kWt; Mini: <500 kWt; Small: <2MWt; Medium: <5 MWt; Large: <20 MWt; Central: > 20MWt

Micro: ≈5 t/y; Mini: ≈50 t/y; Small: ≈500-1000 t/y; Medium: ≈4 kt/y; Large: ≈20-50kt/y; Central: > ≈100 kt/y

Relevance in the region: e.g. if you describe small household heating device as final consumer, the facilities are very small. But it may happen that it is quite common the use of biomass in houses. Then, even the size of household boilers is small, it should be described in "relevance" that is a predominant use in the region.
Ever used LCMW? Describe if these facilities (or market sector) has ever utilised.

Describe if necessary further details

Write here

Fill it in if you have already data available. If you do any guessing or estimations specify with PINK highlight.

REQUIREMENTS								
Facility name	**Technology used**	**Usual feedstock**	**Purchase price (€/t)**	**Quality certification / standard**	**% moist**	**% ash**	**Shape/ particle distribution**	**Other requirements**
Note that for a single facility type several requirements can be included. E.g.: for combustion, it can be included specifications for small household combustion and for several large power plants.								

Describe if necessary further details

Write here

COMPATIBILITY OF LCMW with EXISTING BIOMASS CONSUMERS

LCMW AND FINAL CONSUMER COMPATIBILITY							
	Facility name 1	**Facility name 2**	**Facility name 3**	**Facility name 4**	**Facility name 5**	**Facility name 6**	**…**
LCMW1a							
LCMW1b							
LCMW2a							
LCMW2b							
LCMW3a							
LCMW3b							
LCMW4a							
LCMW4b							
LCMW5a							
LCMW5b							
N.C.: not compatible; **UNk:** uncertain / unknown; **Feasib:** priori feasible, no experiences back-up this statement; **Conv:** feasible previous conversion; **Possible:** possible according to existing experiences							

Here you should match which final uses are "a priori" compatible with each LCMW

Describe if necessary further details

Write here

MOST PROMISING CHAINS according to the technical and regional partners

Among the different options that you have mentioned in Section 2 (compatibility of LCMW with current users) show your vision about which could be the preferred / logical pathways for each LCMW type or sub-type in your model regions.

Example of a logistic chain for a firewall opening

Felling	Felling with chainsaw Branches are removed from stem
Extraction	Skidder
Chipping	Chipper (mounted on trailer)
loading	Chips loaded with shovel
Transport	Box truck (e.g. 60 m3)
Storage	Chips Piled under cover

For each one of the LCMWs proceed:

a) Describe the steps of the chain (similar to the one shown in the table). Add any other relevant information about the chain if available.
b) Explain the reasons why do you conclude that these chain (or chains) are the most promising (that might have to do with some socio-economic circumstances of the model region)

LCMW1a

LCMW1b:

LCMW2a:

LCMW2b:

etc.

7.4. Appendix 4: Templates utilised for preparing status quo and LCMW identification

7.4.1. greenGain and local stakeholders in model regions

Involving local stakeholders into greenGain activities requires convincing them regarding the benefits they will derive from becoming involved in the project and then giving them a meaningful way to contribute.

For that purpose it is crucial to assess what would make an individual person, either as personal or as organisational decision, to be motivated to participate. This largely determines the individual's extent of interest and compromise to a project.

It is therefore crucial to understand the potential value of the project prior a contact for consultancy or for involvement in specific activities.

STAKEHOLDER TYPES

Stakeholders' relation with the LCMW and new chains creation are divided into three categories:

- Primary stakeholders: those directly involved in aspects of LCMW management include owners of land where the LCMW biomass is obtained, LCMWs service co., Logistic operators, etc.
- Secondary stakeholders: are those who influence the development of LCMW works, like Permitting authorities and Government bodies, Conversion facilities, final consumers, etc.
- Tertiary stakeholders: those which indirectly influence the performance of LCMW works, but that might positively or negatively affect both, primary and secondary stakeholders. They may provide tools for its improvement, or may constraint or boost widespread of these practices. Here we include Research / environmental Centres, Social groups (as voice of civil society) and Other key actors.

Next table summarises the description of local stakeholders, and its categories.

Table 40: Summary of stakeholder types relevant for WP5.

Cat	Type of stakeholder	Description
1	**Owner**	Can be private or public. Person, company, private institution or public body belonging the land subject of treatment., or having some legal bound for the execution of works (e.g.: farmers which fields are limiting with hedges and tree alignment subject of maintenance works)
1	**LCMW service co.**	Companies able to execute the LCMWs, e.g: forestry service companies.

1	**Logistic operator/ Conversion**	Any stakeholder dedicated to handle, treat and/or distribute biomass, and that could be interested in LCMW biomass.
		Plants producing energy carriers like pyrolysis oil, torrified biomass, syngas, etc.
2	**Final consumer**	Energy consumer, which could be interested in the utilisation of LCMW biomass.
2	**Permitting authorities**	Public body or service providing licenses, official certificates or documents granting authorization for execution of LCMWs.
2	**Government bodies**	Public administration carrying out the political direction and control exercised over the actions of the members, citizens, or inhabitants of communities, societies, and states;
3	**Social groups**	Relevant social groups which may neither be owners, nor actors of the value chain, but which live in the area and may have some opinion. The idea is to see which social groups are near to our greenGain partners: neighbour association, NGOs, ecologist groups, associations for local development, etc.
3	**Other key actor/ Research / environmental Centres**	Other not mentioned: consultancy companies, etc.
		Research and technology centres which may be of support because of their knowledge on ecosystems, forestry management, or biomass supply and conversion

LEVEL OF INVOLMENT OF SKATEHOLDERS IN GREEGAIN WP5 ACTIVITIES

greenGain foresees the interaction and participation with local stakeholders in two levels, following the descriptions and methodology provided by ADB, 2001:

- LEVEL 1 - Consultation level: specially for data collection and to obtain a realistic feedback regarding the LCMW utilisation. These types of activities are carried out in greenGain in different WPs (WP2, 3, 4, 5, 6). In WP5, it refers to specific data collection which will allow to characterise and describe LCMW, and to obtain information relevant for the biomass, economic and sustainability assessments. Level 1 interaction with stakeholders involves actions like information-sharing (seminars, brochures, public events participation, etc.); direct contact intended as an exercise of listening and learning (field visits, interviews, consult meetings, workshops, etc.); and joint assessments (like participatory assessments.
- LEVEL 2 - Participation level: when stakeholders interact with the project in a much closer way, including decision making. In WP5 this involves the participation of few local stakeholders in the development of pilot experiences, and therefore they will be involved in decision making on few activities of the project. Some usual mechanisms are: shared decision-making (like public review of draft docs, resolution of conflicts, etc.); collaboration in the project (joint committees or advisor committees); and

empowerment actions (capacity-building activities, support for stakeholders ability for self-management of new initiatives, etc.)

NEEDS OF STAKEHOLDERS CONTRIBUTION IN WP5

Next table summarises the potential contribution to greenGain WP5 from diverse local stakeholders and according to level of participation.

Table 41: Summary of contributions expected by stakeholders in WP5.

Level	Task	Contribution expected	Type of stake
1	5.2	Identification of LCMW: types, harvest, logistic and conversion techniques, regulations, environmental limitations, among others	All of Cat.1 and Cat.2
1	5.3	Specific info for biomass assessment: ratios, GIS coverages	Owner, LCMW service co., permitting authority, research
1 2	5.3	Pathways that can be applied to each feedstock. Decision best pathways for the region	Logistic operators, Conversion, Final consumers, Research
1	5.3	Data on costs for implementing a complete pathway	All of Cat.1 & cat.2. research
2	5.3	Planning of pilot experiences	Selected stakeholders from Cat1. and Cat.2
2	5.4	Execution and monitoring of pilot experiences	Selected stakeholders from Cat1. and Cat.2

7.4.2. Analysis of stakeholders in the model regions

Stakeholder mapping is a process to determine a key list of stakeholders across the entire stakeholder spectrum. It is an important step to understand who your model region key stakeholders are, where they come from, and what they are looking for regarding to the greenGain project. As presented by Morris & Badache (2012) it usually requires research, debate, and discussion among several participants of an organisation.

Identifying may serve to answer the following questions:

- Who are the key stakeholders (primary/secondary/tertiary) relevant for the LCMWs in the model region?
- What are the interests of these stakeholders? How will they be affected (positively/negatively) by the greenGain project?
- Which stakeholders are most important and to contact them should be prioritised?

- How will various stakeholder groups participate in WP5?

These questions, referring to the integration into greenGain have been partially answered in previous pages. But a more complete mapping requires some further analysis, as proposed by Morris & Baddache (2012) in next steps:

1. Identifying: listing relevant groups, organizations, and people.
2. Analysing: understanding stakeholder perspectives and relevance.
3. Mapping: visualizing relationships to objectives and other stakeholders.
4. Prioritising: ranking stakeholder relevance and identifying issues.

WP5 provides simple tools for partners to carry out such identification. The description is prepared below.

IDENTIFYING (1)

An initial list of stakeholders can be created by greenGain partners in each region by means of brainstorm a list of stakeholders without screening, including any entity who has an interest in greenGain, either at the present moment, or in a near future. Identifying individuals per organisation is important.

The stakeholder types can be followed to promote the brainstorm: Owner, LCMW service co., Logistic operator, Conversion, Final consumer, Permitting authorities, Government bodies, Research / environmental Centres, Social groups, Other key actors.

ANALYSING (2)

Determine for each stakeholder the following items:

- Interest in the project: main products or activities of the project that the stakeholder may consider of interest for their profit or future strategies. For this purpose a specific identification of interests has been carried out (see Figure 66).
- Contribution: information, knowledge or expertise that the stakeholder may have and that is of interest for greenGain (see main expected contributions in Figure 66).
- Willingness to engage: hat is appealing from the project? How willing is the stakeholder to engage? In greenGain partners have measured it by means of the current engagement rate, or willingness to participate (0, if not engaged at all, to 3, meaning an interest and commitment to collaborate). It describes how close the relation with the local partner is, and how easy it could be to obtain data or to involve them in actions. These scores have been utilised to build diagrams as presented in section “MAPPING (3)” with an excel tool developed in greenGain (section 7.4.4.). It has been classified as next: 0, if not relevant at all; to 3: meaning actor is crucial for the project.

- Influence: How much influence does the stakeholder have? (and which other companies of local stakeholders can they influence?). The degree of influence has been measured from 0 (Not influencing at all) to 4 (Very influencing. An influent stakeholder can
- Contact value: as expressing the necessity of involvement, its relevance for the LCMWs execution and potential relevance for the project. This aspect is registered in the tool by partners who classify stakeholders' value contact: from 0, meaning not being relevant for the project; to 3, meaning the stakeholder is crucial.

The tables with scores are presented in section 7.4.4 of the appendix.

MAPPING (3)

Spider-net diagram:

Also known as radar diagram. This diagram has been facilitated to partners together in an excel tool developed by CIRCE. The tool contains a table to report name and type of local stakeholders identified (according to Figure 65). Then the partner can determine the degree of commitment (0 to 3), the influence in the area (0 to 3) and the relevance for the project (0 to 4). Scores are better described in section 7.4.4 of the appendix.

The tool carries out a weighting of the values by stakeholder class, by aggregating the values of all stakeholders. Three criteria have been established as components ding score to the Spider-net diagram:

- CRITERIA 1: a mixture of the stakeholders' profile, including the scores of contact value, compromise to collaborate and influence in the territory. Values aggregated by stakeholder add scores from 0 to 1.
- CRITERIA 2: beyond the average profile, it is especially crucial to account with several profiles of high influence, and high compromise. Those actors will become a cornerstone to be able to promote LCMW assessment and utilisation. Each stakeholder group is evaluated with values from 0 to 1.
- CRTERIA 3. Total number of stakeholders, measuring just quantity. It adds scores from 0 to 1, considering that more than 4 stakeholders is already a good mark.

As the table is fulfilled the diagrams show the updated representation, showing values from 0 to 3. The results are shown aggregated by stakeholder type. So, the analysis allows an early interpretation of the current state of engagement of the stakeholders per group type in each model region. The spider net diagram (Figure 63) is a way to represent a "gap" analysis, and so, to detect which stakeholders are missing in a simple view of the chart.

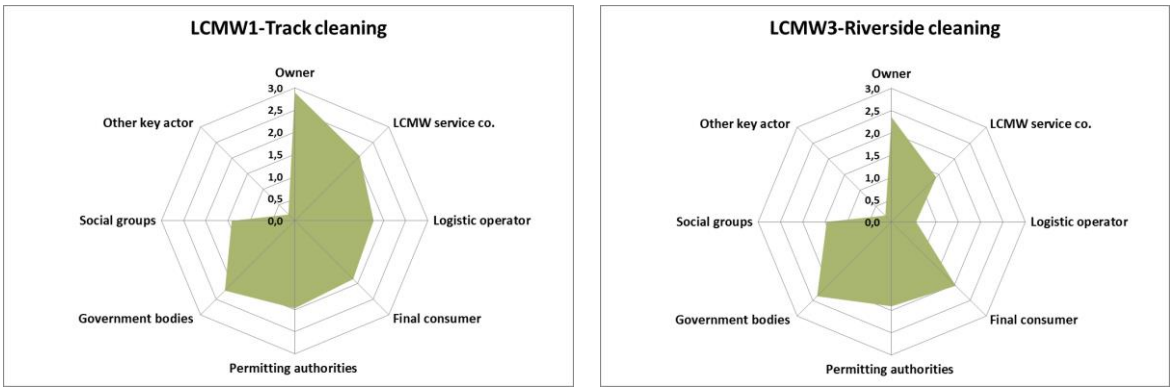


Figure 63: Example of spider net diagram for local LCMW stakeholders' gap analysis in WP5.

As presented in the example, LCMW1 is quite well covered. However there is a lack of Logistic Operators able to contribute to the chain. In such case it would be advisable to promote a further search of this stakeholder's type, or to contact again LCMW Service companies to detect if any of them is already carrying out similar activities like biomass distribution. In the case of LCMW 2 the gap in logistics operators still may request further networking. It must be reviewed if the actors under "other key actors" group can carry out such type of biomass distribution works (e.g.: some authorised scrap dealers have capacity and carry out biomass logistic operations).

Quadrant diagram:

This diagram as proposed by Moris & Baddache (2012) allows placing each stakeholder in different zones, accordingly to:

- Their willingness to participate in the project (can be measured with the marks 1-3 given in the spider net analysis)
- The necessity to involve them: because of their expertise, influence, etc. as described above. Value can get from 1 to 3.

The quadrant diagram shall look similar to the example in Figure 64. As observed there, a total of 9 stakeholders have been depicted. The most relevant is to concentrate in stakeholders which relevance for the project is marked with a value of 2 (Nr2,3,6,7) and with a value of 3 (Nr1,5,9). or those which compromise is lower than 2, the interest must be activated: through direct contacts, or by participating in some of the project activities (workshops, pilot experiences).

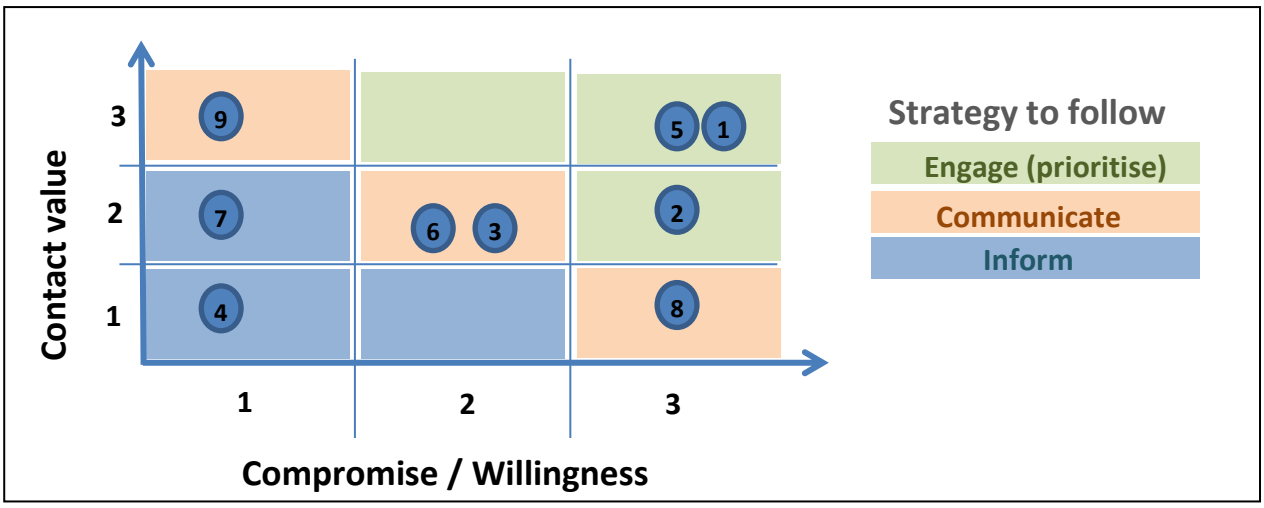


Figure 64: Example of quadrant diagram for the analysis of stakeholders and selection of approaching strategy.

Stakeholder Nr9 is crucial for the project. Therefore, even not still interested in the project, or with a willingness to participate, it must be subject of a direct contact. The contact should cause a raise of its interest for the project, and so it might be already interesting to involve them in relevant activities.

In the case of Stakeholder Nr7, its contribution to the project is evaluated as relevant. However it is completely unaware of the project. Providing information may cause the actor to be attracted and to show more interest. At this moment it would occupy a position like stakeholders Nr6 and Nr3 in the central quadrant. By a direct contact this stakeholder might get attracted and then result to be motivated with higher willingness to participate, occupying the cell currently occupied by Stakeholder Nr 2. At this moment this stakeholder is in the position of substantially be involved in relevant activities of the project, like providing valuable specific information from its expertise, or like the implementation of the pilot experiences.

In the left corner at the bottom, stakeholder Nr 4 can contribute in a limited way to the project, and currently is not engaged at all. It can be subject of information (newsletters, e.g.). This can increase its interest in greenGain, and could move in the time to a position as it is occupied now by Stakeholder Nr8 (rightmost at the bottom). In such case this stakeholder, even its contribution is limited, might be contacted in order to obtain mutual feedback.

In other words, this diagram can support the decision for contacting stakeholders, and through our action, to cause them an increase in the willingness to participate, that is, a movement to the right in the diagram.

The cells marked as green and as orange, contain the stakeholders that can be considered part of the greenGain Local Working Groups (LWGs). It must be beard in mind that LWGs is a concept to refer to the stakeholders which: (1) are relevant for LCMW study and for

promoting or implementing new LCMW supply chains; (2) because of the interest in the project, are involved in interviews, meetings, or implementation of pilot experiences.
This diagram has been included in the excel sheet for analysis of stakeholders.

PRIORITISING (4)

As explained by Moris & Baddache (2012), it is not practical to interact with all stakeholder groups with the same level of intensity at all time. Prioritising from whom an engagement is required can help saving time and organising the stakeholders involvement strategy.
The previous spidernet and quadrant diagram can be quite a support. Spidernet diagram does provide a sectorial vision. If any of the stakeholders profile (owner, service company, logistic operator, etc.) is not well covered in the region, partners must promote actions for approaching and engaging them. In contrast the quadrant diagram states the specific analysis by individual stakeholder. The diagram supports who should be approached.

7.4.3. Counsel to approach stakeholders

TYPES OF TECHNIQUES

A wide range of techniques can be used to reach out to stakeholders. The different means to approach them are quoted according to the level of strategy as defined in the quadrant diagram are summarised by Morris and Baddache (2012) as next:.

- Informing activities: websites, maps, articles in local papers, publications, press releases, marketing campaign, educational displays in public spaces, among others
- Communication activities: invitation to conferences, bilateral meetings, surveying, specific updates of project, alignment in social networks
- Engagement: joint participation (e.g. in the pilot experiences), common research, sponsoring of a project event, co-organisation of a workshop or conference

STEP-WISE APPROACH

WP5 does not stablish a preferred route for greenGain partners. However, a simple approaching method is provided next:

1. List the relevant stakeholders for each LCMW in your area.
2. Discover gaps (in greenGain a spider net graph and tool is facilitated, as shown in Appendix 1.
3. Select the crucial actors to be contacted.
4. Identify the interests that greenGain can have for the selected stakeholder (greenGain see Appendix 2).
5. Prepare an invitation to contact. It can be an email, a letter, or a direct call (in such case prepare a scheme to follow during the conversation, so that the relevant aspects like the potential interest of the project for the stakeholder is stressed out).
6. Prepare a meeting. It may be bilateral, a multiple meeting with several actors or a phone call, with a previous date with the corresponding person.

7. Note the interests and commitments achieved. Mark needed actions in your work plan.
8. Make a follow-up of the stakeholders for reminding / updating them. For updates the greenGain news releases or newsletter can be a simple and effective path.

7.4.4. greenGain stakeholders assessment tool

The scoping of the tool and the stakeholder strategy found inspiration in two documents publicly available [ADB 2001; Morris et al. 2012]. A view of the construction table tool is given in Figure 65.

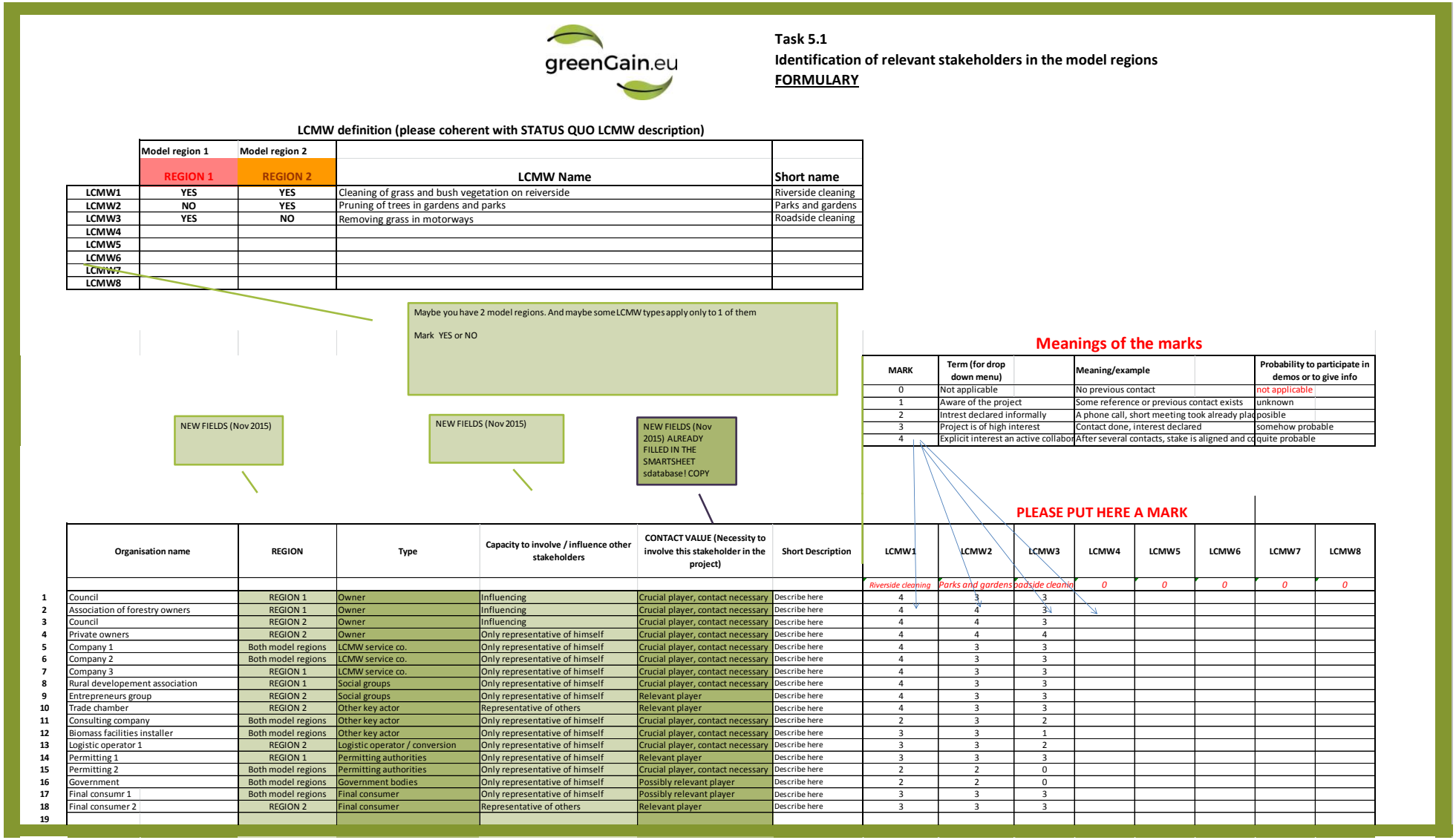


Figure 65: Screenschot of greenGain stakeholder tool; main page for introducing scores by stakeholder, by LCMW and by region.

Task 5.1

Identification of relevant stakeholders in the model regions

MENUS definition (do not change)

Definition of stakeholders (participating / permitting LCMW biomass chains)

1	**Owner**	Can be private or public. Person, company, private institution or public body belonging the land subject of treatment., or havinfg some legal bound for the execution of works (e.g.: farmers which fields are limiting with hdges and tree alignmentsubject of maintenance works)
2	**LCMW service co.**	Companies able to execute the LCMWs, e.g: forestry service companies.
3	**Logistic operator / conversion**	Any intermediary stakeholder dedicated to handle, treat and/or distribute biomass, and that could be interested in LCMW biomass. It includes plants producing energy carriers like pyrolisis oil,torrified biomass, syngas, etc.
4	**Final consumer**	Energy consumer, which could be interested in the utilisation of LCMW biomass.
5	**Permitting authorities**	Public body or service providing licenses, official certificates or documents granting authorization for execution of LC
6	**Government bodies**	Public administration carrying out the political direction and control exercised over the actions of the members,
7	**Social groups**	Relevant social groups which may neither be owners, nor actors of the value chain, but which live in the area and may have some opinion. The idea is tosee which social groups are near to our greenGain partners: neighbour association, NGOs, ecologist groups, associations for local developement, etc.
8	**Other key actor**	Other like research centres, consultancy or engineering companies. They may support or have influence, even though their relevance may depend on each region.

MODEL REGIONS

REGION 1

REGION 2

Both model regions

Capacity to involve / influence other stakeholders

The idea is that in some regions there are not many individual stakeholders, but the project is working with some strong associations, which are directly interested in the project, and that could mobilise some of their asociats.
So, in a region where a relevant cluster of LCMW service companies is involved, the cluster could retrieve data from several companies, and also accounts with multiple opotions to collaborate in the pilot experinces.

0	**Non influencing at all**	Just a local actor, that may be ienterested in greenGain, but not able to support or influence the project.
1	**Only representative of himself**	A company not necesarily influencing other companies.
2	**Representative of others**	They crepresent others, may expand ideas or news, but their usual role is not the active involvement of others with projects or initiatives.
3	**Influencing**	They can influence, and may get engaged other of their associates or connected companies
4	**Very influencing**	Like an association of farmers (can influence in their opinion of associates) or like a professional cluster can do. Or like a local person can do as being a respected figure. Mark as very influencing when you think the cluster can have power to engage sufficient stakeholders with greenGain activities

Evaluation of stakeholders for the LWGs

CONTACT VALUE (Necessity to involve this stakeholder in the project)

0	**Possibly relevant player**
1	**Relevant player**
2	**Crucial player, contact necessary**

Figure 66: Tables with the arrangement of stakeholder classes, model regions, and coring for the degree of influence and stakeholder relevance.