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L'Europe en Méditerranée
Europe in the Mediterranean

Projet cofinancé par le Fonds Européen de Développement Régional (FEDER) / A Project cofinanced by the European Regional Development Fund (ERDF)

ACTIVITY REPORT MODEL – 6th REPORT

~~**FEBRUARY 2013-SEPTEMBER 2013**~~ SEPTEMPER 2013 - MAREC 2014

PARTNER NAME: Slovenian Forestry Institute

Report was prepared by: Nike Krajnc, Matevž Triplat, Peter Prislan and Tine Premrl

To be delivered to Lead Partner by March 2014

1. Realization per component

2. Work package 1: Project coordination
Please, give specific and quantified information on:
- Participation, information and materials for Steering Group Meetings
Two representatives of Slovenian Forestry Institute (Nike Krajnc and Matevž Triplat) took part at sixth steering group meeting in Valencia in November 2013. We prepared an overview on WP4 activities and after the meeting minutes for WP4.

- Participation information and materials for National Coordination Meetings
SFI took part at meeting with NC in October 2013

- Production of Activity and Financial Reports
SFI prepared technical report.

- Please, describe your actions as National Coordinator if so

- Did you have any problem? Is the budget in line with the actions? Do you have costs to be declared in the next reporting period?
In this WP we didn't have any problems. We are spending our budget according to plan.

3. Work package 2: Information and awareness rising
Which have been your activities regarding:
Regional events - *In cooperation with machinery rings of Slovenia and The Chamber of Agriculture and Forestry - Institute Novo Mesto we organized 16 workshops with lectures about promotion of wood biomass (topics: Energetic use of wood, safety at work with machines for wood fuel production) in last reporting period (September 2013-March 2014). In totally there were 789 participants reached with this workshops. We also organised 3 demo events with more than 1600 participants. We organised also a dedicated stand at the biggest regional Agricultural fair in Komenda (we reached more than 500 participants).*

List of all organized events is in table 1.

Table 1 *List of all organized events from March till August 2013*

Events organized	**Place**	**Date**	**No. of participants**
Presentation at the fair	G. Radgona	24.-29.8.2013	5000
Demo event - about wood biomass production and use	Velike Lašče	7.9.2013	600
Presentation at the Demo event	Ilirska Bistrica	22.9.2013	900
Demo event - about wood biomass production and use	Slovenske Konjice	10.10.2013	150
Presentation at the fair and Demo event	Komenda	11.-14.10.2013	500
Workshop about wood biomass production and use	Vransko	11.1.2014	12
Workshop about wood biomass production and use	Velike Lašče	17.1.2014	48
Workshop about wood biomass production and use	Slovenske Konjice	22.1.2014	104
Workshop about wood biomass production and use	Litija	25.1.2014	54
Workshop about wood biomass production and use	Šoštanj	31.1.2014	35
Workshop about wood biomass production and use	Orehova vas	31.1.2014	41
Workshop about wood biomass production and use	Škocjan	1.2.2014	23
Workshop about wood biomass production and use	Radlje	1.2.2014	48
Workshop about wood biomass production and use	Lenart	7.2.2014	8
Workshop about wood biomass production and use	Stahovica	8.2.2014	62
Workshop about wood biomass production and use	Bizovik	8.2.2014	32
Workshop about wood biomass production and use	Murska sobota	21.2.2014	136

Workshop about wood biomass production and use	Kanižarica	21.2.2014	51
Workshop about wood biomass production and use	Novo mesto	22.2.2014	38
Workshop about wood biomass production and use	Slovenj Gradec	25.2.2014	39
Workshop about wood biomass production and use	Trstenik pri Bendeiktu	28.2.214	58

Tabel 2 *List of planned events in next period*

Activity title	**Place**	**Date**
Workshop about wood biomass production and use	Slovenska Bistrica,	6.3.14
Workshop about wood biomass production and use	Gornja Radgona	7.3.2014
Workshop about wood biomass production and use	Savinjska dolina	9.3.2014
Workshop about wood biomass production and use	Pivka,	14.3.2014
Workshop about wood biomass production and use	Tinsko	22.3.2014
Demo event - about wood biomass production and use	Slovenske Konjice	25.3.2014
Demo event - about wood biomass production and use	Lenart	May / June 2014
Demo event - about wood biomass production and use	Bohinj	September 2014

Website content

SFI as a WP 4 coordinator edited working files in intranet for WP 4. We added all documents for each pilot action that were sent till now.

We prepared a home page about Proforbiomed project on our server and we are updating it regularly (http://gte.gozdis.si/?page_id=631).

Information for Newsletter

*For Newsletter PROFORBIOMED No. 4 SFI prepared post called "*Production of green wood chips with whole tree is the fastest« Case study in Slovenia*".*

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Appearances in the media

Interaction in Proforbiomed Facebook and Linkedin

Representatives of SFI singed in to Facebook and Linkedin and we are tracking all the news and information on these social media regarding PROFORBIOMED project.

Publication of specialized articles

SFI published 3 articles in different journals:

1. **December 2013** – Article published in the Journal "Eko-Dežela" with the. title "Cene lesnih goriv". Authors: Peter Prislan and Nike Krajnc. (Not available online – please see attachment)
2. **February 2014** – Article published in the Journal "Finance". Title: Kraljujejo drva, prodirajo sekanci in peleti", Authors: Peter Prislan and Nike Krajnc
   http://www.finance.si/8356638/Kraljujejo-drva-prodirajo-sekanci-in-peleti

Distribution of the leaflet

SFI is distributing Slovenian leaflet for PROFORBIOMED project on all the events that are organized by our institute. We also uploaded it on our home page dedicated to PROFORBIOMED project (http://gte.gozdis.si/?page_id=631).

We published selected good practice example in Slovenian and English language (February 2014)

- *Biomass production - Best practice example: comapniy Biomasa d.o.o.*
- *Biomass production - Best practice example: company Biofit d.o.o.*
- *Biomass production - Best practice example: company Energija narave d.o.o.*

Any other dissemination action carried out

Dissemination of PROFORBIOMED in local press – detail information's are in attached document.

1. Wall calendar for year 2014 was published in December. Topic of calendar is wood biomass production, with presented PROFORBIOMED project activates.
2. Project was presented in proceeding of national forest sector development day (3.October 2013), proceedings are available on: http://www.gzs.si/slo/panoge/zdruzenje_lesne_in_pohistvene_industrije/62353

- Did you have any problem? Is the budget in line with the actions? Do you have costs to be declared in the next reporting period?

In this WP we didn't have any problems. We are spending our budget according to plan.

4. Work package 3: Capitalization and long lasting effects
- Implementation of capitalization posters

-Capitalization meetings -
SFI supported capitalisation agreement signed by SEE project FORPA in January in Graz.
- Agreements
Energy pact: We agreed with our national coordinator LEA that we will check the prepared document Energy pact in Slovenian language. Energy pact was signed by legal representative of SFI.

- *Cluster establishment*
Together with LEA we established two clusters in Slovenia. Consortium agreement is already being signed in the case of Primorska region. II wood biomass cluster was established in Podravska region on 20.12.2013 in Žetala. Consortium has 22 partners, 17 municipalities, 2 energetic agencies, 2 forest companies and 1 research institute.
- Operational recommendations

- Did you have any problem? Is the budget in line with the actions? Do you have costs to be declared in the next reporting period?
In this WP we didn't have any problems. We are spending our budget according to plan.

5. Work package 4: Setting up of integrated strategies for the development of renewable energies

As WP leader we prepared an overview for activities for project meeting in Valencia. We collected partners report for all activities done in last reporting period and started to collect draft versions of final reports for each pilot activity. SFI is involved in 8 PA. The activities in all PA are in progress.

1.1 Assessment of the structural diversity of forest habitats
On first meeting in Ptuj (Slovenia) partners have made an agreement about defining pilot areas with a focus on:
- structural habitat diversity, gathering scientific information's about biomass extraction potential, flora, fauna and soil in the regional forest habitats types
- Identifying and characterizing forest management practices per habitat type.

Idea of common methodology (provided by responsible partner CICAE) has been welcomed.

On the 3rd meeting in Faro a common methodology has been presented by Ines Duarte. All partners accepted the proposition.

1. Pilot area

We selected four locations in different forest associations. On each location we have selected one 10x10m plot right next to the plots for pilot actions 1.3 and 1.4.

Site description for selected areas

	Plot 1	**Plot 2**	**Plot 3**	**Plot 4**
Locality	Flancovše - Nanos	Pod Vremščico	Tnovo - Na Dragah	Pod Vremščico (Coppice stand)
Elevation (m.a.s.l.)	890 - 910	575-775	790-880	575-775
Average slope gradient (%)	15	25	10	25
Age (years)	51	70-80		70-80
Growing stock (m^3/ha)	341	266	428	149
Intensity of thinning (%)	22.6	25	22	Clear cut
Average basal area (cm)	17,5	27,9	-	-
Average tree gross volumne (m^3)	0,18	0,39	-	-
Average tree height (m)	13	15	-	-
Main tree species	Norway spruce	European black pine	European beach/ Silver fir	Hop Hornbeam

Map of Slovenia with locations of project plots

2. Methodology used

The work in this pilot action is divided in 10 different actions:

a) Identification of main forest types (e.g. dominant tree species in stand, potential forest association, forest site type)
b) Inventory of forest management plans main specifications
c) Identification of exploitable biomass types in region
d) Inventory of common forestry practices, locally used
e) Identification of possible biomass uses (destinations)
f) Identification and set of pilot areas in a field
g) Field survey in pilot areas to measure forest habitats structural diversity
h) Assessment of forest vertical layers
i) Final assessment of the structural diversity of forest habitats (in selected pilot areas) - comparison of results from field survey
j) Presentation of results to public

Slovenia Forestry Institute (SFI) will not take part in *Inventory of usual forestry practices*, because we have very detailed forest management plans – no other practice is in use. We will also not cooperate in action for *Identification of possible biomass uses (destinations)*, because this is not yet the topic for Slovenia.

For forest habitats structural diversity assessment the modified and adopted methodology will be used.

The selected forest plots are very diverse. These forests have various vertical and horizontal structures. In order to get overview of the selected forest area a certain number of representative pilot areas (plots) were selected. The size of the plots will be 10 x 10 meters (or 20 x 20 metres).

On each plot (pilot area):

I) Three dominant tree species were identified in each vertical layer. They were identified according to canopy position in the forest stands as following:
D - Dominant tree;
C - Co-dominant tree;
I – Sub-dominant tree;
O - Dominated tree.

II) The coverage of vertical forest stand layers were assessed. The vertical forest stand layers were estimated visually. In the pilot areas (plots), the forest plants were assessed in eight vertical layers:
1) 0 - 0.5m;
2) 0.5 - 1m;
3) 1 - 2m;
4) 2 - 4m;
5) 4 - 8m;
7) 8 - 16m;
8) Over 16 m.

For the visual cover estimation the following scale was used:
1) Cover between 0 % and 1 % (mean 0.5 %);
2) Cover between 1 % and 5 % (mean 3.0 %);
3) Cover between 5 % and 10 % (mean 7.0 %);
4) Cover between 10 % and 20 % (mean 15.0 %);
5) Cover between 20 % and 30 % (mean 25.0 %);
6) Cover between 30 % and 40 % (mean 35.0 %);
7) Cover between 40 % and 50 % (mean 45.0 %);
8) Cover between 50 % and 60 % (mean 55.0 %);
9) Cover between 60 % and 70 % (mean 65.0 %);
10) Cover between 70 % and 80 % (mean 75.0 %);
11) Cover between 80 % and 90 % (mean 85.0 %);
12) Cover between 90 % and 100 % (mean 95.0 %);

III) Based on existing studies and database the local biodiversity was described. We used the forest information system, published reports, forest management plans for studied area.

3. Results

First results performed in this pilot action is an adaptation of common methodology for field survey in pilot areas to measure forest habitats structural diversity. Later on we prepared a review of existing studies about diversity in forest where local biodiversity were described, based on published studies in last years, in order to complete information about the area. In next step we have organized field survey and collected the field data from all pilot areas. We have deliver our data to responsible partner (CICAE) in accordance with template for technical sheets (characterization sheet, field sheet). First steps in preparation of common report were taken.

4. Lessons learnt
5. Main conclusions
6. Activities planned for next reporting period (till September 2014)

Review of report (guidelines) will be prepared as soon as responsible partner will provide draft version.

1.2 Development of a Geo-Information System for the Potential Forestry Biomass Management

1. Pilot area

We have defined our pilot area in sub-mediterian part of Slovenia and is approximately 52000 ha large. When we were extracting our Pilot area, we had in mind also activities on other Pilot actions, which can be found inside of selected pilot area. The analysis of wood biomass potentials for our selected pilot areas (used also in other pilot activities) is finished and basic maps are availiable. We also prepared analysis of wood biomass potentials for the areas in which other Slovenian partner (LEA) is more active.

After meeting in Valencia SFI has received (from Mr. Joao Martin) adopted methodology with some references to distance-cost model. The data from all partner was processed by Mr.Martins and partners were asked to review results. Some variables used in model were selected from Portuguese dataset, therefore we were also asked to provide regional informations. Such as:

- Consumption points
- Loading and unloading time
- Transportation cost
- Ecological restrictions

2. Methodology used

In the beginning we have fill in the questionnaire (Partner data regarding the establishment of a common methodology) as it was agreed on the 2nd meeting at Ptuj. At this point we have reported about the information (Forest inventory data, Road network, Base cartography,...) that exists in our region and we could produce for this pilot action. Analysis of questionnaires has been done by responsible partner in order to provide common methodology that will be used in the whole MED area.

In next period a document was provided by responsible partner (AFN-PT)"Common methodology for the geographic representation of forest biomass potential". Selected methodology is divided in several steps; some are common for all partners while some are corresponding to each partner regional adaptations:

- Stage 1 – Forest biomass potential evaluations. We have prepared the production potential for 5 classes of dbh for all the presented forest species in selected pilot area. For production potential we used growing stock which was increased with BEF factors (IPCC 2006) for above ground biomass (stem, stump, branches, bark ...) and converted to tones of dry matter with the usage of IPCC (2006) factors for wood density (WD). We have finished with activities in Stage 1.
- Stage 2 – Pilot areas definition –we have provided data for larger area to assure the best efficiency for proposed methodology. We have finished with activities in Stage 2.
- Stage 3 – Delimitation of areas with presence of forest biomass. We have provided ESRI shapefile to Leading partner, the rest of the activities are common for all the partners.
- Stage 4 – Data structure standardization – This is the common step for all the partners and will be done by WP leader.
- Stage 5 – Creation and normalization of the spatial database - This is the common step for all the partners and will be done by WP leader.
- Stage 6 – Raster territorial representation - This is the common step for all the partners and will be done by WP leader.
- Stage 7 – Ecological restrictions – Shape files of areas with inappropriate soil types, conservations areas and other legal regimes that somehow presents restriction for forest production will be prepared.

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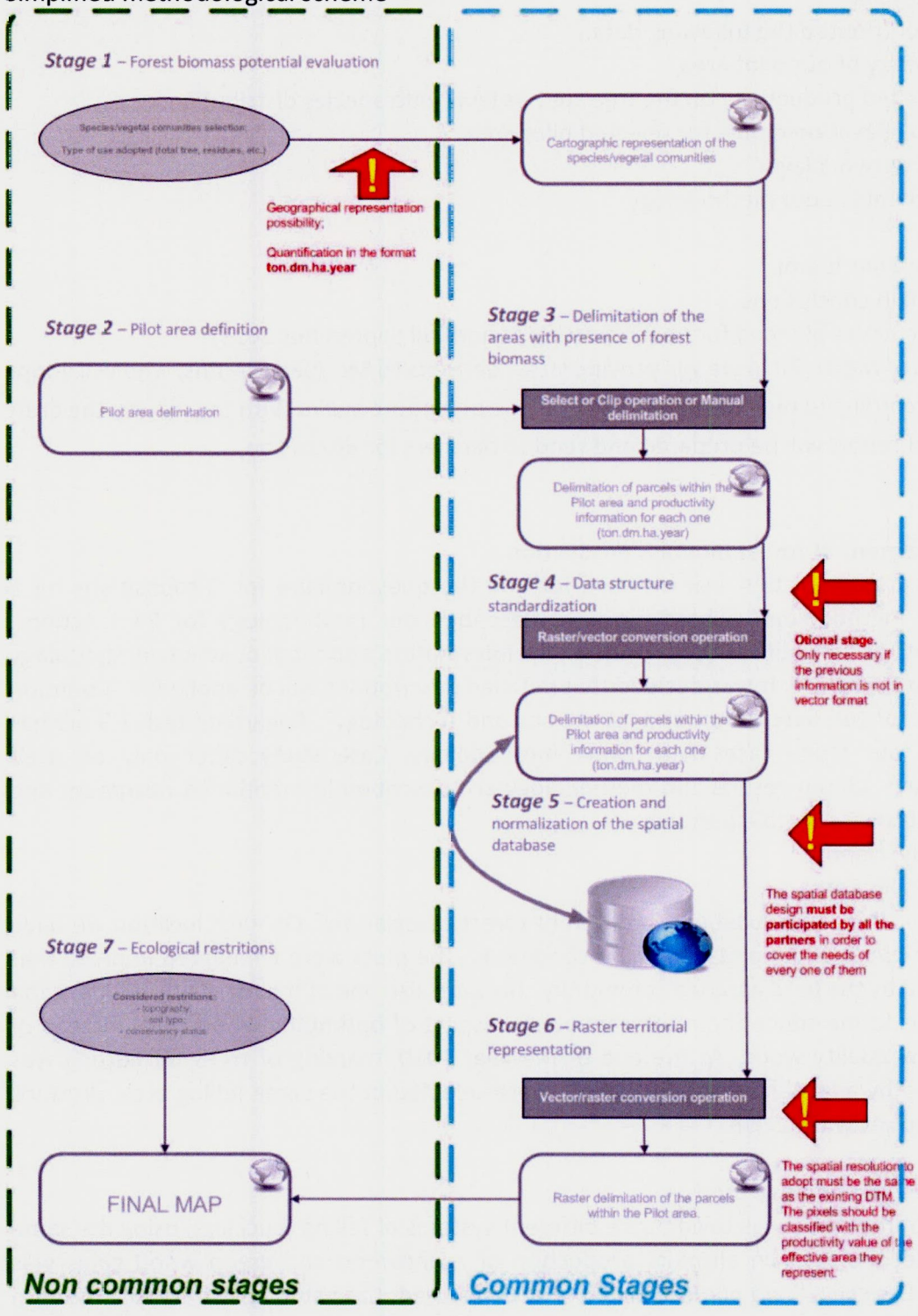
Simplified methodological scheme



3. Results

SFI has contributed the following data:

- Boundary of our pilot area
- Estimated productivity on the tree species level with species distribution
- Digital elevation model for selected pilot area
- Road network layer
- Comments about methodology

4. Lessons learnt
5. Main conclusions
6. Activities planned for next reporting period (till September 2013)

Until end of March 2014 we will provide latest datasets to Mr. Joao Martins, who will adopt model according to regional data and run all the procedure again. With the results, the draft version of report will be prepared and send to partners for discussion.

1.3 Assessment of forest biomass production

In the first stage of this task we have fulfilled the questionnaire for "Propositions for a common methodology" where we have described our methodology for Pilot Actions. Because it has been difficult to provide all the information's about pilot action methodology in this questionnaire, it was decided that detailed descriptions will be applied in "Common template for the description of pilot actions and technology". Regarding task 1.3 SFI has perform four study cases with same methodology. Case study differ only on used technology. All our results and methodology are described in mentioned document and were sent to responsible partner

Case study: Nanos

1. Pilot area

We have chosen four locations in different forest associations. On each location we have eliminate two 0,25 ha plots in similar conditions. The plots were eliminated in areas that are owned by the local agrarian community. They are also one of the main stakeholders and our goal is to introduce them the economical aspect of optimizing wood chips instead of selling low quality wood. At the end of the year 2010, marking of trees for cutting was conducted by a local forester. Both plots were selected in the same felling area, distance between plots was 0.5 km.

2. Methodology used

The aim of the study was to compare different systems of felling (bucking), using the same type of technology. On all plots production of roundwood and green wood chips was planned. Basically, "two pile cutting method" was used. Case study plots 1 and 2 differ in top minimum diameter of wood, 6-7 cm and 10 cm respectively. On the first plot,

production of green wood chips was promoted, therefore the forest worker made only the quality part of the log (last cross cutting was done at diameter 10-15 cm, average top length was 594 cm), the rest was grinded up for wood chips. On the second plot, production of roundwood including the one with a smaller diameter (last cross cutting was done at diameter 6-7 cm, average top length was 114 cm) was promoted.

On all plots, trees were felled motor-manually with chain saw by two operators working at the same time. Roundwood was collected and transported to the landing site at forest road (with farm tractor Zetor Proxima Plus 105 41 (79 KW) with trailer Palms 82 equipped with Palms 610T crane in one case and with Woody skidder in other case) operated by third operator. Roundwood production and production of green wood chips was separated and performed by two different contractors. Collection of forest residues (branches and tops) with mini excavator (Yuchai YC35-8) followed felling and transportation of roundwood. Forest residues were transported to lending area with smaller size forwarder Novotny LVS 5000, where they were chipped by large-size chipping machine Starchl Mk 86 - 600 with Palfinger crane powered by tractor FENDT Vario 930. The transport of logs or wood chips from landing site to final buyer was not part of our time study.

In our case, forest owner selected the contractors to perform all described activities and we did not influence any decision taken regarding the technology selected. Operators were selected according to offered prices. In the case of roundwood costs of felling and skidding the price agreed amounted to €25/m^3, in the case of green wood chips selling price of wood chips at forest site (not at forest landing area) was negotiated and agreed on €0.3/loose m^3. During the negotiation the price for felling and skidding was lowered for €2/m^3 to €23/m^3, while forest workers did not have to collect branches and tops on stacks in the forest. According to Slovenian legislation, branches and tops of spruce should be gathered in stacks if there is danger of a bark beetle (*Ips typographus*) attack. These types of forests in Slovenia are particular endangered by these beetles; with green wood chips production the possibility for the attack was lowered, which can be considered as a positive side effect of wood chips production.

All forest operations were not performed at the same time. According to limited time and resources we decided that felling will not be studied in detail (studies for new Slovenian norms for felling with chain saw were performed in 2011 by the Slovenian Forestry Institute), time consumption and cost calculations of this operation was gained using new Slovenian norms. After felling and cross-cutting, all wood assortments were measured (middle diameter and length). For all other described operation detail, time studies were performed.

For studies of different technologies used for extraction of forest residues, we have set up and carried out time studies. All operations were recorded by using Trimble Nomad hand-held field computers with the time study software UMT-Plus. This instrument is able to

capture the time elapsed between the start and the end of a previously defined operation. We have been focusing on cycle level of measurements, because in cycle level measurement, the observation unit is a single work cycle (e.g. the felling of a tree, the forwarding of a load etc.) This kind of measurement offers more detailed information and can help us describe the work process with much more accuracy. We have implicated every single working process, but generally they are all divided into three categories (such as productive time or supporting time, all remaining time was considered a delay). Productive time includes only effective time that is comparable among our plots. The time of forwarding (driving the full load from the site to the landing and driving unloaded (the time from the moment when the forwarder leaves the standstill position at the landing until it stops for loading was excluded from comparison of productivity at both plots because of different distances and different arrangement of the strip roads on our plots.

For further comparison of times we have calculated them to percentage of total scheduled time. Regarding all three categories, the total operating time can be defined as:

WP = PW + SW + DT
whereby WP = Workplace time, PW = Productive work time, SW = Supportive work time, DT = Disturbance time.
The percentage for all categories can then be calculated:
PW (%) = PW (hh:mm:ss) / WP (hh:mm:ss) *100

In presence of time study we have also measured all the outputs gained during work process. Outputs are both quantity and quality, which are equally important to evaluating work method (Spinelli, Visser, 2009). That is why the product quality was evaluated by comparing actual product characteristics with market specifications - in our case its moister content, particle size distribution and bulk density for wood chips or quality and quantity classification for logs. With product output data, we were able to calculate productivity of different technologies. In our case productivity is defined as:

Productivity = Product output / Time consumption

Most of our output data was gathered in the way of gaining information about solid volume of logs collected on the forest road (skidded) or loose volume for wood chips. One loose cubic meter corresponds approximately to 0.4 m^3 of solid volume. Roundwood volume was gained with field measurements of middle diameter and length using Huber's formula.

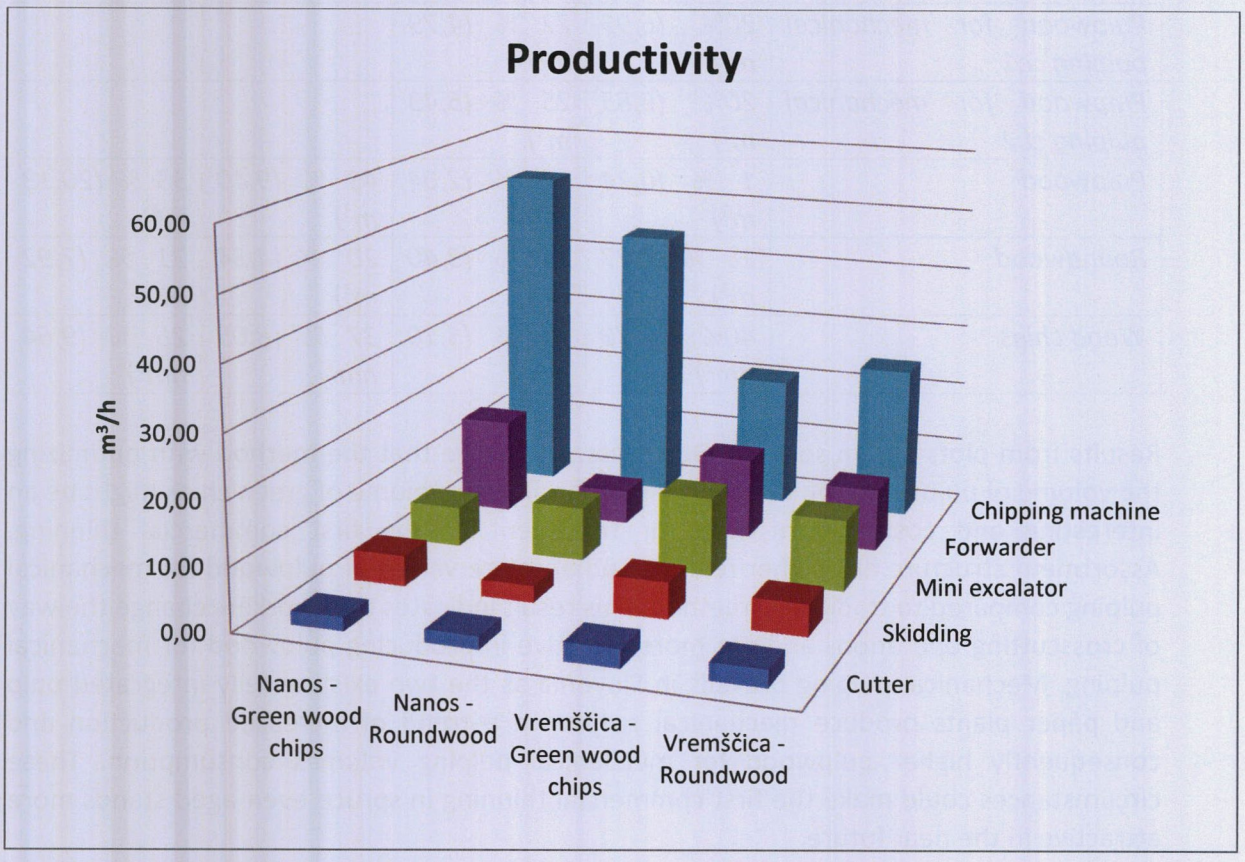
3. Results

Assortment structure comparison is shown in table below:

	Nanos – Green wood chips	*Nanos - Roundwood*	*Vremščica – Green wood chips*	*Vremščica – Roundwood*

Pulpwood for mechanical pulping cl.1	*20% (6,95 m^3)*	*22 % (4,79 m^3)*		
Pulpwood for mechanical pulping cl.2	*20% (6,85 m^3)*	*25 % (5,43 m^3)*		
Pulpwood	*1 % (0,24 m^3)*	*12 % (2,64 m^3)*	*43 % (9,40 m^3)*	*53 % (20,13 m^3)*
Roundwood	*18 % (6,27 m^3)*	*16 % (3,40 m^3)*	*20 % (4,34 m^3)*	*21 % (7,92 m^3)*
Wood chips	*40% (13,70 nm^3)*	*24 % (5,10 nm^3)*	*37 % (8,05 nm^3)*	*26 % (9,64 nm^3)*

Results from plots and in selected DBH classes signalize that the method with optimizing the volume of pulpwood for mechanical pulping and the volume of green chips might be an interesting and cost-efficient way for treatment of the first commercial thinning. Assortment structure has higher relative and absolute values of pulpwood for mechanical pulping compared to traditional method. This result indicates that workers change the way of crosscutting operations and are more effective in producing pulpwood for mechanical pulping. Mechanical pulping prevails in Slovenia as the two existing fully integrated pulp and paper plants produce mechanical pulp with a trend of increased production and consequently higher pulpwood for mechanical pulping volumes consumption. These circumstances could make the first commercial thinning in spruce even-aged stands more attractive in the near future.



The comparison of productive times has shown time savings in case of green wood chips production (top minimum diameter of wood 10 cm), mainly because of time savings for felling (cross cutting at larger diameter and less delimbing of tree tops), collecting and transporting of roundwood with tractor and a trailer (collecting and transporting of logs with larger diameter) and forwarding of forest residues (larger concentration of forest residues and tree tops in piles) to lending at forest road.

4. Lessons learnt

Utilization of forest residues in Slovenia, where selective cutting and cut to length system prevails, is not considered common forest practice. The natural conditions, stand characteristics and harvesting conditions can vary considerably even on small distances in even-aged stands and can have influence on forest residues utilization. Our hypothesis was that change in cross-cutting diameter and change in delimbing of tree tops can influence the productivity of main operations in roundwood and wood chips production as well as assortments structure and revenue. According to results obtained from this particular experiment we can conclude that i the optimisation of green wood chips (higher diameter of tops left for collecting, forwarding and chipping) can lead to higher productivity.

One of the most important results we were looking for are forest residues utilisation rates for different technologies and different amounts of trees marked for cutting. As it is seen in table represented in results, production of wood fuel was higher on the plots where production of woodchips has been promoted.

5. Main conclusions

Taking positive effect on bark beetle attack prevention, mechanization of manual work and negative consciences of utilization (damages on trees and soil and nutrias lost) into consideration, it is hard to conclude whether forest restudies utilisation should become a common practice in Slovenian situation or not. For more comprehensive conclusions about economical (additional revenue), environmental (fire and bark beetle attack prevention) and social (new jobs and new activities for forest entrepreneurs and forest owners) benefits, additional studies are required and will be carried out in near future.

Results from all four locations are available and under further analysis – final results and recommendations will be prepared during next reporting period.

Case study: Vremščica – Trnovo – Mixed alpine forest

1. Pilot area

The study area is located in a karst-plateu in the south-west part of Slovenian Dinarides within the forest management unit Trnovo. Most of the forest in the area is public forests and are managed by Farmland and Forest Fund of the Republic of Slovenia. The primary function of the forest is wood production. The site is open and easy to access with forest machinery. Mean growing stock at in the forest management unit amounts around 293 m^3/ha; 32.8 % coniferous and 67.2 deciduous species.

The selected plots are of the *Omphalodo-Fagetum* forest type containing *Fagus sylvatica* (62 %), *Abies alba* and *Picea abies*. Average annual increments vary around 6.22 m^3/ha.

The who e forest management unit (FMU) has a size of 4612.18 **ha**, with the elevation range from 550 m a.s.l. ti 1445 m a.s.l. Annual mean precipitation varies between 2000-3000 mm. The study site is within Natura 2000 protected area.

2. Methodology used

The study was designed similar then at other plots. The aim was to compare two methodologies; a commonly used approach where round wood production is the priority and another approach where the amount of residues (mainly due to larger tree tops and round wood of smaller dimensions) was increased. At both plots round-wood and green wood chips were produced. The goal was to compare production times and cost while using the same technology at both plots. At the first plot the last cross-cut was performed at the

steam diameter size of 10-15 cm and at the second plot at the diameter size of 6-7 cm. At both sites the residues were grinded up for wood chips.

Mechanized logging and skidding with forwarder was followed at both plots. The processes were carried out by the concessionaire, within the regular forest work in public forests. For green wood chips production the concessionaire hired a subcontractor. The trees were selected by a district forester. For the purpose of the time study, all trees were numerated and measured.

The work was carried out by two workers; one was performing the logging operation (with harvester John Deere 1470D) according to length-tree harvesting method, another worker was helping in the phase of logging since some trees were too large for the harvesting head. After a short period of unfavorable weather the workers preceded with skidding, which was performed with John Deere 1410 Eco III forwarder. After approximately one year (due to unexpected complications) the wood chips were produced from the residues; a large chipper Eschlböck Biber 80 based on an Iveco Stralis 430 truck with Epsilon 165Z loading device was used.

3. Results

Logging: Logging was performed mechanised, with John Deere 1470D harvester.

At both plots Length-tree harvesting method was used. At the first plot the last cross-cut was performed at the steam diameter size of 10-15 cm and at the second plot at the diameter size of 6-7 cm. At both sites the residues were grinded up for wood chips.

Productivity:
Green wood chips: Plot 1 28.41 RWE/h

Round wood: Plot 2 33.15 RWE/h

Skidding: Skidding of round-wood and forest residues was performed with John Deere 1410 Eco III forwarder.

Productivity:
- Roundwood (assortments):
  Plot 1 (promotion of green wood chips): 13.66 RWE/h and
  Plot 2 (promotion of roundwood): 17.35 RWE/h
- Forwarding of logging residues:
  Plot 1 (green wood chips): 12.89 RWE/h and
  Plot 2 (promotion of production of roundwood): 4.56 RWE/h

Chipping: Chipping was performed at both plots plots at the truck road with Eschlböck Biber 80 chipper based on an Iveco Stralis 430 truck with Epsilon 165Z loading device.

Productivity:

Plot 1 (green wood chips): 16.35 RWE/h
Plot 2 (promotion of production of roundwood): 13.70 RWE/h

4. Lessons learnt
5. Main conclusions

In case of cost calculation we were referring to the Catalogue of the cost for forest mechanisation by Klun et al. (2009). The analysis of the direct costs of the mechanisation showed that the costs (recalculated on round-wood equivalent - RWE) were 40 % higher at plot 2 then at plot 1. The difference can be ascribed to significantly longer skidding times for forest residues with forwarder; the costs of logging and skidding of round wood are higher at plot 1 (23 %) then at plot 2. The total cost of logging and skidding were at plot 1 higher (4.043 €/RWE) then at plot 2 (3.11 €/RWE). At both plots skidding of round wood with forwarder presented almost 95 % of the cost.

Total direct costs for wood chip production were 6.58 €/RWE at plot 1 and 14.49 €/RWE at plot two. In case of wood chip production the direct costs of skidding with forwarder at plot 1 were 4.066 €/RWE or 63 % if total cost and at plot 2 11.49 €/RWE or 79 % of total costs. The costs of chipping were relatively low at both sites; 2.52 €/RWE at plot 1 and 3.01 €/RWE at plot 2.

Calculated direct costs of the mechanisation in case of round wood and green wood chip production were 10.62 .52 €/RWE at plot and 17.61 €/RWE at plot 2 respectively. The ratio between the cost of round wood production and green wood chip production at plot 1 was 38:61 and at plot 2 18:82.

Case study: Vremščica – Coppice Hophornbeam forest

1. Pilot area

The study was conducted at the forest management area Sežana, at the forest management unit Vrhe Vremščica. Almost 74.8 % of the forest area is privately owned. The selected study site is owned by the Agrarian community Gaberče. The whole forest management unit (FMU) has a size of 9989.32 ha, with the elevation range from 280 m a.s.l. ti 1027 m a.s.l. Mediterranean and continental climate regimes are influencing the area, however the selected plots are influenced predominantly by Mediterranean climate regimes.

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Rock types at the site are carbonates and limestone with rendzinas, brown soils or Terra rossa soils. On extreme undeveloped soils, without the organic horizon, and with poorly developed mineral horizon, lithosols were formed, the slopes are predominantly colluvial.

The selected plots are of the Seslerio –Ostryetum forest type which succeeds mostly on low elevations, open, sunny and dry sites. It presents secondary vegetation, formed by antropozoogenic factors. Typical species for the selected sites are oaks (Q. cerris and Q pubescens), hop-hornbeam (Ostrya carpiniforlia) and ash (Fraxinus excelsior). The predominant species at the selected plots were hop-hornbeam, ash and hornbeam (Carpinus betulus).

Mean growing stock at in the forest management unit amounts around 198.2 m3/ha (19.2 % are conifers). Average annual increments vary around 4.48 m3/ha. The study site is within Natura 2000 protected area.

2. Methodology

At the selected site, two plots were selected, each with the area of 0.25 ha. The major goal of the study was to compare different felling (bucking) methodologies while using the same technology. The study was designed to compare the production of green wood chips and round-wood of smaller dimension in a hop-hornbeam coppice forest. At plot 1 full-tree harvesting method was used; logging was performed by forest workers with chain saws and skidding with adopted tractor. The green wood chips were produced at the forest road from whole trees. At plot 2 the logging was performed according to length-tree harvesting method, followed by skidding with adapted tractor. After logging and harvesting of round-wood, residues should be collected with mini excavator and removed from the site with forwarder. The round-wood could be traded as wood of lower quality and the residues as green wood chips, however these was not possible due to law limitation at the site. The residues were therefor not removed from the site.

3. Results

Logging: Logging was performed manually, with professional chain saws by two operators at the same time.

At the first plot whole-tree harvesting method was used and at plot two a conventional long tree harvesting method. On plot 2 chainsaw operator had to perform also crosscutting of branches which were left in stand (due to forest regulations).

Productivity:
Plot 1 (Green wood chips): 6.42 RWE/h and
Plot 2 (Roundwood): 3.19 RWE/h

Skidding:

Roundwood was collected and transported with adopted farmer tractor (Massey Ferguson 4345, upgraded with chassis protection, reinforced frame, front ramp and Igland 6002 winch).

In case of whole-tree harvesting method the whole trees were removed from the forest site (with branches and leafs or needles), consequently trees were processed at the forest road and not at the logging site. At plot two the forest worker processed the tree according to common practice; after trees were felled, the steams were cut in length and the residues were further processed in accordance with the forest order (cutting them into a small pieces (less than 1m)). In this case the production chain ended with the skidding of round-wood to the storage place at the truck road.

Productivity:
Plot 1 (Green wood chips): 3.31 RWE/h and
Plot 2 (Roundwood): 1.85 RWE/h

Chipping: Chipping was performed only at plot 1 at the truck road with Albach Silvator 2000 chipper.

Productivity:
Green wood chips: Plot 1 34.31 RWE/h and

4. Lessons learnt
5. Main conclusions

The methodologies of logging and skidding are differing significantly among the plots and consequently also the direct costs of the mechanisation.

The analysis of the direct costs of the mechanisation showed, that the costs (recalculated on round-wood equivalent - RWE) were 35 % higher at the plot 2, then at plot 1. The difference can be ascribed to significantly longer transport / skidding times of residues with the adopted tractor. At plot 1 (whole-tree harvesting method), the skidding costs were 6.6 €/RWE and at plot 2 (length-tree harvesting method) 11.7 €/RWE.

At plot one, the green wood chips were made out of the whole trees, therefore the costs of chipping also need to be considered, however they were relatively low 1.2€/EOKL. At plot two the management was performed according to common practice, therefore the sentiments/products were sold at the forest rood in form of small diameter round wood and the forest residues were left at the stand.

In the case of whole-tree harvesting method (plot 1), 85% of the total costs (calculated on the roundwood equivalent) are logging and skidding costs, the rest (15%) are chipping costs. At plot 2 in case of round wood production, almost 90 % of the costs represent the skidding costs with tractor

The calculated direct cost of mechanisation (recalculated on RWE) in case of round-wood production are 6.97 €/RWE at plot 1 and 12.53 €/RWE at plot 2. The calculated values are without the labour and management costs. Total direct costs of mechanisation (cost of logging, skidding and chipping) amount around 8.17 €/RWE at plot 1 and at plot 2 around 12.53 € / RWE. The ratio between the cost of round wood production and green wood chip production at plot 1 is 85:15.

Case study: Maritime pine forest

1. Pilot area

The study was conducted at the forest management area Sežana, at the forest management unit Vrhe Vremščica. Almost 74.8 % of forest area is in private ownership. The selected study site is owned by the Agrarian community Gabrče. The selected forest site covers around 100 ha. Based on relief conditions, harvesting with tractors is possible at the entire area. The average annual increments amount around 4.84 m3/ha.

2. Methodology

At the selected site, two plots were selected, each with the area of 0.25 ha, approximately 500 m apart. The major goal of the study was to compare different felling (bucking) methodologies while using the same technology during the entire production chain. At both plots the production of round wood and green chips (from forest residues e.g. tree tops, twigs and needles) was foreseen. The methodologies differed in the degree of bucking (i.e. the degree to which a tree steam was processed); at plot 1 the forest worker performed the last cross-cut at the steam diameter of 10 cm and at plot 2 at the diameter between 6 and 7 cm. The methodology used at plot 2 is a common practice to process a tree steam (to cut logs) in Slovenia, with higher total amount of round wood, but also higher share of les qualitative round wood . Contrary, at plot 1 higher amount of forest residues (tree tops) is produced and, which can be used for production of green wood chips.

3. Results

Logging: Logging is performed manually, with professional chain saws by two operators at the same time. At the first plot the forest worker performed the last cross-cut at the steam diameter size of 10-15 cm and at the second plot at the diameter size of 6-7 cm. At both sites the residues were grinded up for wood chips.

Productivity:
Plot 1 (Green wood chips): 2.93 RWE/h and
Plot 2 (Roundwood): 2.77 RWE/h

Skidding: Roundwood was collected and transported with forest tractor Woody 110 equipped with remote control double drum winch. Residues (tree tops and larger twigs) were collected and transported to the logging trails with mini excavator Yuchai YC35-8. The residues were then transported to the storage at the forest road with a small size Novotny LVS 5000 forwarder.

Productivity:
Skidding of roundwood:
Plot 1 (Green wood chips): 5.78 RWE/h and
Plot 2 (Roundwood): 5.09 RWE/h
Collecting of logging residues (mini excavator):
Plot 1 (Green wood chips): 5.89 RWE/h and
Plot 2 (Roundwood): 5.27 RWE/h

Skidding of logging residues:
Plot 1 (Green wood chips): 6.05 RWE/h and
Plot 2 (Roundwood): 4.68 RWE/h

Chipping: Chipping was performed at the forest road. They used a large chipper Starchl Mk-86-600 with a crane (Stepa) for raw material supply, powered by tractor FENDT Vario 930 .

Productivity: : 50 nm3/h
Plot 1 (Green wood chips): 9.86 RWE/h and
Plot 2 (Roundwood): 11.40 RWE/h

4. Lessons learnt
5. Main conclusions

The analysis of mechanisation costs recalculated on round-wood equivalent showed that the in case of plot 2 the cost were 13 % higher in comparison with plot 1. The difference can be ascribed to significantly longer transport / skidding times of residues with forwarder. The finding is also in agreement with the results from the firs site Nanos (Norway spruce) but the differences in case of Vremiščica (black pine) are significantly smaller. At Nanos the differences among plots in skidding times were more than 66 % and at Vremščica, just 23 %.

The production of green wood chips represents up to 80% of total costs (in round-wood equivalent – RWE) at both study plots. Within the cost structure of green wood chip

production, transport or skidding of residues represents the highest share: 58 % at plot 1 and 66 % at plot 2 respectively.

In case of round wood production, skidding with tractor and forest trailer represents almost 80 % and 81 % of cost at plot 1 and 2 respectively.

The calculated direct cost (recalculated on RWE) in case of round-wood production are 4.60 €/RWE at plot 1 and 5.16 €/RWE at plot 2. The calculated values are without the labour and management costs. Direct cost for wood chips production amount 17.68 €/RWE at plot 1 and 20.41 € / RWE at plot 2. The ratio between the cost of round wood production and green wood chip production is at both sites 20:80.

6. Activities planned for next reporting period (till September 2013)

At end of February 2014 we have received draft version of task 1.3 report. Report will be reviewed and feedback will be given to responsible partner.

1.4 Assessment of the environmental impact of forest biomass harvesting or extraction

For this pilot action we have prepared and send final report.

1. Pilot area

For this pilot action Slovenian Forestry Institute has evaluated too possible environmental impact as a result of WB extraction. Potentially positive impact of WB extraction on lowering fire risk – FOREST FIRE and potentially negative impact on forest productivity - NUTRIENT.

Mediterranean region in Slovenia

2. Methodology used

NUTRIENT

Simplified mass balance was applied for N where main N input (yearly deposition = N_{dep}) and main output (direct export due to biomass extraction = N_{harv}) were compared. Biomass expansion factors and N concentrations in different tree parts were used to calculate N content of whole forest stand.

FOREST FIRE

We used a simple literature review approach. By doing that we have tried to cover various geographically distinct areas, although it should be highlighted that available references from this area cover mainly parts in US, boreal forests and less Mediterranean basin. In attempt to make review as consistent as possible a few colleagues from abroad were asked to give advice on best literature in their area – Italy, Austria and US.

3. Results

Results are presented in a brief report.

NUTRIENT

Relationship between return period for nitrogen and forest growing stock and return period and forest volumetric increment is significant positive correlation for both measures of forest productivity.

FOREST FIRE

With extraction of this wood biomass we can achieve positive impact on lower of fire rise and spreading of ground fires.

4. Lessons learnt

NUTRIENT

- Nutrient extraction is larger and return periods are longer for more productive forest stands; in these stands excessive nutrient export might occur when harvesting rotations are shorter than nutrient return periods
- Smaller soil nutrient stock of the less productive forest stands less efficiently counteract abrupt nutrient losses due to biomass extraction than soil of the productive forest stands
- Substantial differences between harvesting scenarios exist: compared to stem-only harvesting, stem + branches and stem + branches + leaves regimes increase nutrient export and return periods on average for 54% and 108%, respectively.
- Calculations for test sites revealed larger nutrient exports and return periods for variants where biomass (woodchips) was preferable in comparison to those where wood sortiments were targeted but return periods are still within safe limits due to slow forest regrowth
- Additional work is needed to refine the estimates of N input and develop impact assessment for other nutrients, particularly phosphorus. Indirect nutrient loss due to harvest also needs to be inclucled in future assessment (larger leaching losses, erosion, etc.).

FOREST FIRE

- With wood biomass extraction we archive positive impact on reduction of fire risk.
- With thinning we influence on crown density. Less density forests release more sun on the ground what influence on residues drying process and influence on presence of wind.
- After thinning operations wood biomass extraction is recommended.

5. Main conclusions

NUTRIENT

- For average forest stands of Slovenia even the most intensive harvesting rates (whole tree) do not possess large threat for forest production, because return rates are shorter than forest regrowth
- However, return periods for some of the most productive forests are shorter than ten years which is dominant thinning frequency in Slovenia.
- Simple linear relationship between thinning rate and return period exist: twice the thinning intensity – twice the nutrient extraction and hence return period.
- Compared to stems only harvesting nutrient export is substantially increased when leaves and branches are also harvested and moderately when branches are also harvested
- For deciduous trees whole-tree harvesting in leafless stage (winter) is preferable
- To mitigate indirect losses after harvest (erosion, leaching; not estimated here) it is encouraged that certain percentage of harvested biomass is left in the forest

FOREST FIRE

- Wood biomass extraction is recommended as it is lower fire risk.
- If wood biomass extraction cannot be done it is recommended to stacked forest residues.

6. Activities planned for next reporting period (till September 2013)

In the next period we are going to cooperate with other partners to prepare final conclusions.

1.5 Development of a system of traceability of the biomass

1. Pilot area

For this pilot action pilot area is not determined our intention is to select companies and test the traceability protocol.

2. Methodology used

Main partner (FLA) prepared a biomass system of traceability, SFI took active part in preparation of this system. The system will be introduced to some real cases (biomass producers) in Slovenia. Some companies were already contacted and the methodology was introduced. Pilot implementation will take place in next period. Since SFI is involved in BiomassTradeCentre2 project, we prepared a separate chapter about Quality control and

quality assurance system that was developed in the frame of BLTC II project. This QA/QC system was developed for smaller wood biomass producers. .

3. Results

Protocol for traceability of biomass was developed, company for testing was selected. Company selected is one of the biggest wood chips producers and they are starting also with pellet production. A modified system of developed protocol was prepared that will be based on internet inquire and it will be tested in next months.

4. Lessons learnt

5. Main conclusions

6. Activities planned for next reporting period (till September 2013)

We are waiting for FLA to define the biomass system of traceability, so that we will have some starting points for the agreement with different companies for testing the biomass system of traceability.

1.6 Demonstration plots with short rotation energy plantations

Plantation of short rotation trees in Velenje was founded on agricultural land, where the whole area is collapsing because of the mine activities. Founder of this plantation was coal Mine Company, Premogovnik Velenje d.d. We are monitoring the plantation since its establishment in 2009. The plantation consists from willow trees (clones *Tordis* and *Inger*) and is 3.4 ha big. Trees are planted in double rows; width between individual trees in a double row is 0.75 m. The distance between cuttings is 0.41 m, average width of driveways is 3.1 m. With such distribution of cuttings planting density is around 10,000 individuals / ha. Planting of SRC is a mechanical operation. The plantation was plant with 'step' type planter.

1. Methodology used

Field measurements

The test plantation was founded on agricultural land, where the whole area is collapsing because of the coal mine impact. Founder of this plantation was coal mine, Premogovnik Velenje d.d.

Trees are planted in double rows; distance between individual trees in a double row is 0.75 m. The distance between cuttings is 0.41 m, average width of driveways is 3.1 m. With such distribution of cuttings planting density is around 10,000 individuals per hectare.

With the measurements of plants on the test plantation we were able to determine production potential of different willow clones *Tordis* (Salix schwerinii x S. viminalis x S. vim) and *Inger* (*Salix triandra* x *S. viminalis*) as an alternative energy source in Slovenia. We were able to determine growth rate, rate of survival, volume of coppice etc. in different years of rotation period.

Measurements of the plants were performed according to methodology developed by the Department of Forest Engineering and Economics of Slovenian Forestry Institute and were already presented in the PA 1.6 report.

In the plantation a random position within a row was selected and then each 50 m (from the initial position) along the row a new position was determined. At each position, perpendicularly to the planted rows, a transect was determined (which was marked with a stripe). In the first year (2009) in each row, ten willow plants left and ten plants right, from the transect line were included in the measurements (as illustrated on figure 2). Such comprehensive measurements were possible, since the plants were relatively small and head a relatively low number of shoots. In all the subsequent years, measurements of just five willow trees on the left site from the transect line were performed (figure 2).

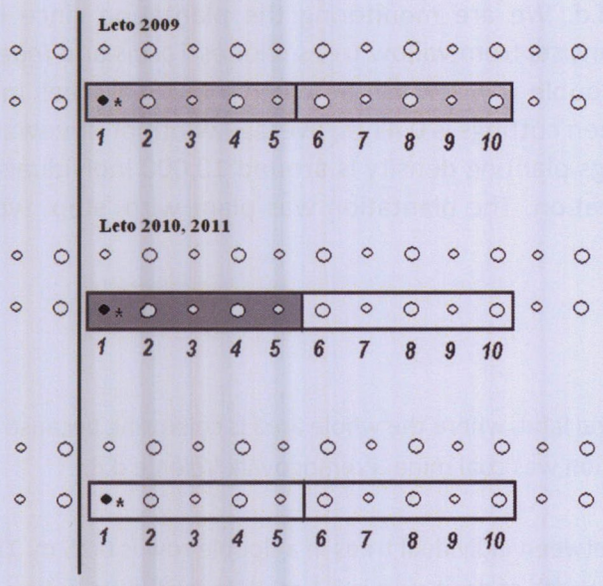

Figure 1: Measurements / Inventory of trees in first and subsequent years of growth.

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After the first growing season, one or more coppice shoots grow out of the planted tree. A sampling unit is a line of 5 or 10 trees in a left or right direction from the transect line. The first tree in the line represents a coppice of shoots where the height and diameters (at different heights) of all shoots were measured.

On the standing trees the measurements were performed with a calliper. On the first plant the height and the diameter of each shoot in a coppice was measured. The diameter was measured every 0,5 m along the shoot height. On all other plant just the height of the shoots was determined. The number of survived plants in the sampling unit was also determined, to calculate the degrees of survival and the average number of shoots in a coppice.

For determination of wood moisture content and wood density in the laboratory, smaller samples of randomly selected shoots were collected. Wood moisture content (u) was calculated as a fraction of the weight of water in wood and the weight of (oven) dry wood (formula 1). Water content in wood (w) is the quotient between weight of water in the wood and the weight of fresh (green) wood (formula 2), where m_0 is the mass of absolutely (oven) dry wood, and m_{vl} the mass of green wood and m the weight of water in the wood.

$$u = (m_{water})/(m_0) \times 100 = ((m_{vl.} - m_0)/(m_0)) \times 100\ [\%] \quad (1)$$

$$w = (m_{water})/(m_{vl}) \times 100 = ((m_{vl.} - m_0))/(m_{vl}) \times 100\ [\%] \quad (2)$$

Wood density is defined as a quotient of mass and volume. We calculated the basic density R which is the quotient between the weights of absolutely (oven) dried wood and the maximum volume of fresh (green) wood. The basic density describes the amount of absolutely dry substance in the volume of fresh wood and is calculated according to formula 3;

$$R = \frac{m_0}{V_{vl}} \left[\frac{kg}{m^3}\right] , \quad (3)$$

where m_0 is the weight of absolutely dried wood and V_{vl} volume of fresh wood.

Data analysis

The calculations and analysis were performed for each clone separately. The trees were planted in 2009, however only measurements of the subsequent years were considered in the analysis.

The mean height and diameter of the shoots were calculated, the number of coppices with a certain amount of shoots were evaluated, as well as the mortality of plants and the volume of the shoots.

In addition the mean volume of the coppices, as well as the mean volume, mean height and the maximum height of the shoots in the coppices was calculated. The volume of the shoots was evaluated based on the measurements of the first shoot in the row (where the diameter were measured in 0,5 m intervals along the length of the shoot). The volume of the shoot was then calculated as the sum of all cylinder volumes.

In the laboratory at the SFI, the collected shoots were analysed; first they were cut on 20 cm long pieces and after that the diameters at each end of the pieces were measured with the calliper and weighed with the laboratory scale. After that the samples were dried for 24 hours at 105 °C. After drying the pieces were weighed again. From the collected data volume of fresh shoots, basic density of wood, density of fresh wood, wood moisture and water content were calculated.

The yield of the plantation (in tons of dried substance) were calculated as a product of mean volume of the coppice, number of shoots in a coppice per hectare and mean basic density of the shoots.

Carbon sequestration

Carbon stock (CS) was calculated as a product of aboveground biomass productivity (P) and carbon fraction (CF) of dry matter (IPCC, 2003):

CSt = P (t of dry matter/ha) x CF (t C/t dry matter)

CSq = (P (t of dry matter/ha) x CF (t C/t dry matter))/years of growth

CF = carbon fraction of dry matter (default = 0.5), tonnes C (tonne d.m.)-1

2. Results

Table1: Results of the analysis of short rotation plantation in Velenje

	Tordis			Inger		
	2010	2011	2012*	2010	2011	2012*
Sampling units inclouded in the research (number)	72	72	72	35	34	26
Mean height of the shoots/single coppice (cm)	147	319	621	136	290	365
Mean diameter of the shoots/single coppice (at 1,0 m height) (mm)	8,1	14,5	28,4	7,6	13,5	16,7
Survival of plants (%)	87%	85%	84%	85%	81%	75%
Mean number of shoots in a tuft	2,3	2,1	2,2	2,2	2,6	2,6
Mean volume of the shoot (cm^3)	95	559	2270	90	416	850
Water content -w (%)			42 % - 52 %			42 % - 52 %
Calorific value - Hi,daf (MJ/kg daf)			18,8 ± 18,4			18,8 ± 18,4
Wood density - R (kg/m3)	431,4	432,7	450	339,7	437,8	430
Mean density of green wood (t/m3)	0,867	0,807	0,860	0,796	0,818	0,85
Growing stock of the plantation (m3/ha) - aboveground biomass	2,03	10,57	51,14	1,59	7,98	17,74
Yield / Productivity (t atro/ha)- aboveground biomass	0,88	4,58	28,13	0,63	3,49	9,76
Carbon stock (t/ha)	0,44	2,29	14,065	0,315	1,745	4,88
Carbon sequestration (t/ha/year)	0,4	1,1	4,7	0,3	0,9	1,6

*Results are preliminary

Results are not final; we will prepare final results after end of this rotation period. We already wrote an article about this planation and the preliminary results, a report was also prep eared within the PA 1.6.

3. Lessons learnt

4. Main conclusions

This plantation is only as a pilot project for the remediation of subsidence area. Regarding the eligib lity of such plantations in Slovenia, there are some concerns. These plantations are in agricultural areas and the share of agricultural land in Slovenia is already so small that the use of land for energy purposes is questionable. Moreover, in our forests and abandoned areas there are a lot of unused wood residues, which could also be used for energy purposes.

More conclusions will be possible to give after the end of short rotation period, when plantation will be cut and wood chips will be produced – we will get correct amount of biomass yield and costs of management.

5. Activities planned for next reporting period (till September 2013)

The plantation parameters were measured at the end of 2013; however the data still need to be analysed. We are planning to monitor harvesting operation, wood chips production and prepare the final calculation of biomass yield and economics in the first rotation period.The owner planned to harvest the trees at the beginning of 2014, but due to unfavourable weather conditions the harvest operation was postponed.

In Guidelines (Recommendations for short rotation plantations) we will be co-authors of Energy crops production process, economic consideration, other consideration, conclusions and further options.

1.7 Development of forest biomass management plans

According to development of the project we have decided to make a forest management plan for Agrarian Common Čezsoča.

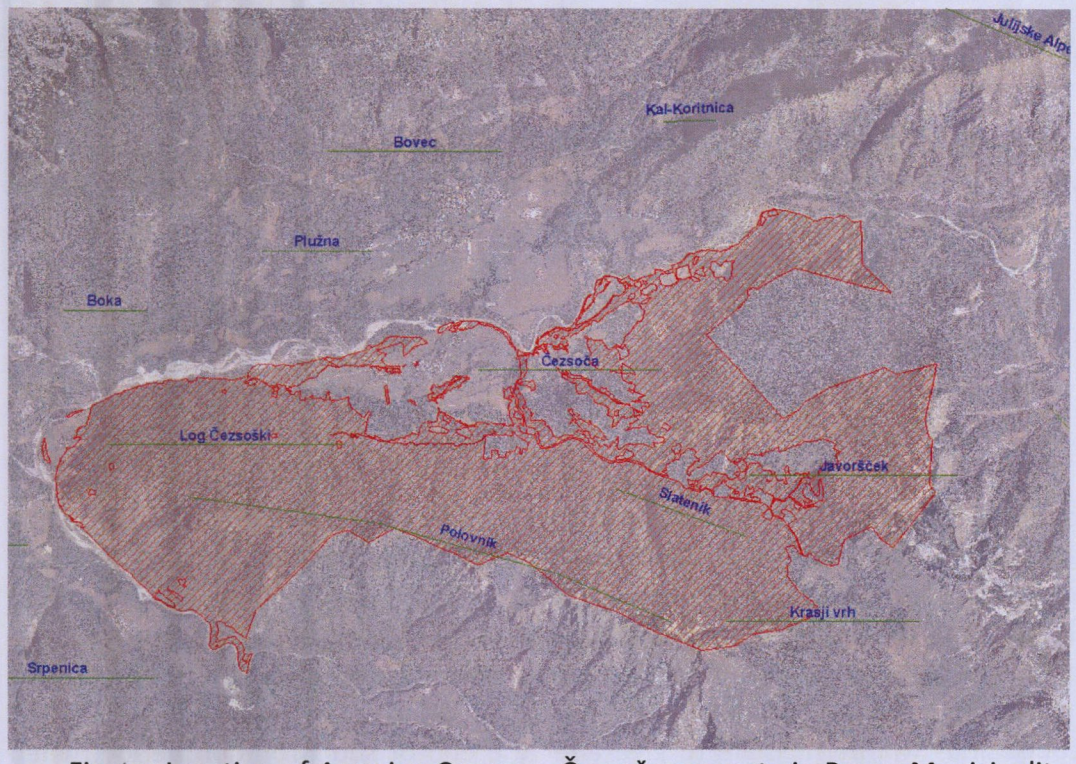

Figure: Location of Agrarian Common Čezsoča property in Bovec Municipality, Julian Alps, NW Slovenia

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Property of Agrarna skupnost Cezsoca is located in North West part Slovenia in Municipality Bovec and in the Forest Management Unit Bovec on the slopes of mountain Polovnik and Javorscek (approx. centre point is located on: Lat:46°18'26,59" (46,307385°) Lon:13°32'42,46" (13,545129°)). All property area presents 2688,42 hectare while forest present 2314,34 hectare or 86,09 % of area.

1. Methodology used

Forest management plan is essential tool for sustainable forests use. In Slovenia forest management plans are based on three piles sustainably, multipurpose and close to nature management. They are elaborated for all forest, irrespective of ownership or size of property. It is obligate to management forest according to the plans that are approved by ministry responsible for forestry.

Slovenian forest management systems know four different management plans:

- Regional forest management plans,
- Regional haunting-breeding plans,
- Sliviculture management plans,
- Unit forest management plans.

First three above listed plans influence more on logging activities and with that also on wood biomass utilization, even though none of them explicitly talks about it.

On different spatial levels from forest stand to region they include information about forests and for forest management useful information. Typical information are: growing stock, wood increment, tree species, harvesting possibilities and limitations, GIS information, socioeconomic information... Majority of information are included also in Forestry Geo Information System.

Those planes are general not directly applicable on the level of forest holding as information are gathered and published on different spatial level not on level of land cadastre parcel or holding. Result is that property owner without GIS analyses cannot directly use this information. In a forest ownership structure in Slovenia we mainly have forest owners who own few hectares of forests but there are also bigger individual forest owners, community forest owners and common forest owners. Common forest owners are particularly frequently present in western part of Slovenia who was in a part selected for pilot area. There are more than hundreds of them present in pilot area with average holding size of 350 hectares. We have identified them as key forest owners which can contribute in forest and biomass goals stated in PROFORBIOMED project. They mainly don't have their management plane with which they can made management decision. We have decided that we are going to select those commons who have the highest potential for wood biomass development to support them with FBMP. FBMP made for selected commons is going to be useful management tool applicable also for other types of forest ownership and areas.

Some of the above mention was also present in questioner LAW COMPILATION RELATED TO FOREST MANAGEMENT prepared by partner DGMA. According to SGM Portugal partners decided to prepare at list one FBMP plan for selected area. Methodology and content of the FBMP is going to be based on national legislation and PA leading partner guidelines. For FBMP data from PA 1.1.- 1.4. should be compile.

We have prepared pilot forest property management plane with special focus on wood biomass. To achieve this goal we have used existed Slovenian Forest Service databases but we have to use GIS tools and other database programs to modify and recalculate information on the property area. Additionally we have made meetings with owners' representatives and employees of Slovenian Forest Service. For the energetic part of the property plane we have used information from local energy concept plan.

2. Results

Final product of this PA is forest management plan. Results in this management plan shows use following:

- Climate conditions in the area are influent by alpine and sub Mediterranean climate factors.
- Property is located in very step and agitated surface of Julian Alps with an altitude from 400 to 1700 a.s.l. Average slope is 21,24 % with maximum slope of 199,33 %. Information for slope calculation were taken from DEM 12,5X12,5.
- On the property level we were manly facing a problem of accessibly of forest for management with economical visible technologies.
- Growing stock of conifers are 99965,68 m3, growing stock of broadleaves are 178876,39 m3
- Sum of allowable cut is 14567,03 m3, low quality timber allowable cut is 9605,918_m3 and quality timber allowable cut is 4961,092 m3
- Owners of the property and representatives of Agrarna skupnost Cezsoca are highly motivated to step in wood biomass supply chain as a producer of wood chips for local town district heating station which is in the future municipal plane.
- Local district heating plan is seen as a good opportunity for selling their low quality timber while for quality timber they are thinking to join in to the supply chain of local sawmill in the establishment process.
-

3. Lessons learnt

- Present forest unit management plans cannot be directly used for biomass management
- Agrarian commons are important forest owners in this area
- GIS tools are useful tools for forest management planning

- From the property management plan we can predict feasibly quantities of wood for the market as forest owners motives are integrated in management plan.
- Also big property cannot sustainable cover all wood biomass needs of local town district heating and saw mill.
- Also big forest owners have to associate and cooperate on the market

4. Main conclusions

/From the agrarian common and form the local Slovenian Forest Service Office we get a positive feedback. They stressed that "property forest management plan" is a good tool for taking decisions – managing their property and good information source for local municipality about possible partners in local wood biomass supply chains.

5. Activities planned for next reporting period (till September 2014)

Further activities on this PA depend on:

- Results from other PA
- Definition of second pilot area in East Slovenia
- Interests of forest owners to cooperate in FBP

On the bases of these activities we are going to prepare at list one FBP.

As FBP is done a main activities for the next reporting period is focused on cooperation between partners in integration of PA results.

2.2 Presentation of existing good practice examples of forest biomass use

1. Pilot area

Good practices examples will be selected and adapted to different forest conditions. SFI will present examples from different areas of Slovenia – we included cases from different municipalities – heating of public buildings (Ljubljana, Železniki,), heating of industrial buildings (Ig, Novo mesto), district heating systems (town Lenart), company involved in wood biomass production - Biofit (Kranj) and Biomasa d.o.o., company involved in pellet production (using local material) – Energija Narave.

2. Methodology used

The resu t are folders with selected best practice examples which are used for promotion and can be used also after the project period. Each best practice example is described on one sheet and printed in 500 copies, pdf versions will be uploaded on Proforbiomed web page and SFI web page. Examples are from different areas depending on current situation

of wood biomass users in the different areas of Slovenia. Key target groups are municipalities, local stakeholders, forest owners and forest associations.

Main partner of this pilot action sent us templates for preparation of good practise examples and instructions for the redaction of the good practise guide. We are will try to act by them, but we already have our own template for preparation of good practise examples, which has already proved that it is useful.

3. Results – we already published 7 good practise examples about different parts of biomass production chains:

- Slovenian Forestry Institute is heated with wood chips, Ljubljana - 500 copies in SI language
- Use of wood chips in industry, Ig - 500 copies in SI language
- Wood biomass district heating system, Lenart - 500 copies in SI language Using wood chips for heating greenhouses, Novo mesto - 500 copies in SI language
    - Best practice example of Company Biofit PRODUCTION AND SUPPLY OF WOOD BIOMASS in SI and EN language 2 x 500 copies
    - Best practice example of Company Biomasa d.o.o. PRODUCTION AND SUPPLY OF WOOD BIOMASS in SI and EN language 2 x 500 copies
    - Best practice example of Company Energija narave d.o.o. PRODUCTION AND SUPPLY OF WOOD BIOMASS in SI and EN language 2 x 500 copies

Two good practice examples prepared together with LEA were prepared for printing but not printed yet.

- Best practice example of gardening company Zupanič Danilo s.p. – USE OF WOOD BIOMASS in SI and EN language 2 x 500 copies
- Best practice example of Primary school Cirkulane d.o.o. – USE OF WOOD BIOMASS in SI and EN language 2 x 500 copies

4. Lessons learnt

We found out that this kind of presentation of different cases of wood biomass production and use are very useful, since they give to potential users or investors a good overview over the situation and that is why it is easier to them to decide about their further steps.

5. Main conclusions

We will proceed with this kind of practise, publishing of good practise examples and dissemination of them among the target groups, during this project and also during our next projects.

6. Activities planned for next reporting period (till September 2014)

We are planning to publish at least 4 new good practice examples generated from other PA in WP4.

- Did you have any problem? Is the budget in line with the actions? Do you have costs to be declared in the next reporting period?
In this WP we didn't have any problems. We are spending our budget according to plan. We have decided not to publish example of Črni vrh – wood biomass heating system as we could not get enough information. We are expecting to publish one best practice example more.

6. Work package 5: Renewable energies as an opportunity for local and regional economies

SFI is involved in pilot action 4 – Application on field of best practices of sustainable forest management.
Currently we are preparing an agreement with external expertise (Slovenia Forest Service) for work regarding pilot action 4.
Pilot action 4.3
SFI is involved in pilot action 4 – Application on field of best practices of sustainable forest management.
Currently we are preparing an agreement with external expertise (Slovenia Forest Service) for work regarding pilot action 4.
In this report period we were working on diagnostic, demonstration and communication phases of a pilot action.
For diagnostic phase *we have analyses and selected 2 "Best Practice" examples FOREST MANAGMENT INT THE AGRARIAN COMMONS "Best practice example Agrarian common Ravnik Orlovše" and PRODUCTION AND SUPPLY OF WOOD BIOMASS" Best practice example company Biofit do.o."*
In the demonstration phase we have developed some demonstrations on the field. We have also organized some of the events were we have invite interested public:
1. event with forest owners, Slovenian Forest Service, harvesting companies, wood biomass companies, research institutions. Event takes a place in Gabrče. We have demonstrated wood biomass extraction from pine stands forests.
2. event with forest owners, Slovenian Forest Service, harvesting companies, research institutions. Event takes a place in Gabrče. We have demonstrated wood biomass extraction from pine stands and coppices stands forests. 05.03.2013
3. event with forest owners, Slovenian Forest Service, research institutions. Event takes a place in Podnanos 06.12.2013
4. event with forest owners, Slovenian Forest Service , research institutions, harvesting companies. Event takes a place on Nanos 19. 12.2013

For dissemination phase *we have prepared some leaflets about forest management practices (Green wood biomass from coppices, Green wood biomass from spruce stands, Green wood biomass from pine stands)*

- Did you have any problem? Is the budget in line with the actions? Do you have costs to be declared in the next reporting period?
In this WP we didn't have any problems. We are spending our budget according to plan.

7. Work package 6: Intelligent energy management systems at local and regional level

SFI is involved in working group 3 (WG3) Optimization of Biomass Supply Chain Management, within which three existing wood biomass production chains in selected regions in Slovenia will be studied; proposals for optimization will be prepared and presented as good practise examples. We will analyse technical, economic, environmental and social aspects of production chains. Data for logistic optimisation were send to Greek partners (main partner). Carbon footprint for one of our wood biomass producer was prepared and an application for carbon foot print calculation (presented by CTFC) was used. Main partner has propose a logistic model for selection of the best possible location for new facilities. The model was modified with Slovenian data and main partner was requested to review it and to give remarks (September 2013). Until now SFI did not receive any feedback.

After meeting in Valencia main partner has proposed workflow for final period.

Proposed timeline for WG3:
1. *SICILY sends the data required for WG3 to Ignacio-CTFC (end of November 2013)*
3. *CTFC sends to the WP leader the final report for Working Group 3, taking into account the contribution of SICILY, UOWM and SFI (end of December 2013)*
4. *Final guidelines are prepared (end of January 2014)*
5. *Rotation of final deliverable for improvements, add-ins if any by all the participating partners (until 15th of February 2014)*
6. *FINAL GUIDELINES are submitted to the coordinator, final report of Working Package 6 (end of March 2014)*

- Did you have any problem? Is the budget in line with the actions? Do you have costs to be declared in the next reporting period?
In this WP we didn't have any problems. We are spending our budget according to plan.

2. Publishable information on project (for Programme Med website and general external communication activities)

2.1 Description of activities, outputs and results since the project start

We prepared "State of the art report for wood biomass preparation and use in Slovenia", where data about market situation in last years were gathered and analysed. In the frame of different pilot actions we are finishing with presentation of results for dissemination. Mainly results are available, final reports for dissemination are in final stage of preparation. A lot of dissemination activities were organised, 9 DEMO events with more than 5.000 participants were organised and 36 workshops with more than 1890 participants. We presented project at dedicated stand at international fair in Gornja Radgona (more than 5000 visitors were reached) and regional fair in Komenda (more than 500 visitors were reached), we participated in two conferences and produced 13 articles, 9 examples of good practises, 1 national newsletter and 2 wall calendar for years 2013 and 2014.

2.2 Description of activities, outputs and results during the reporting period

Please, describe in detail the section

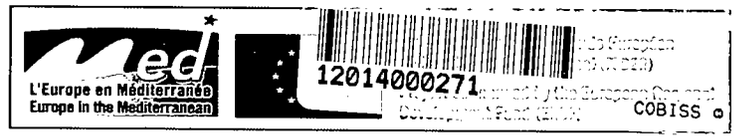
Our main activities in this reporting period are concentrated in WP4: Setting up of integrated strategies for the development of renewable energies. In this WP we are finishing all planned activities in all pilot actions that we are involved in. SFI finished analyse of data from all pilot actions, final report is prepared according to common index prepared by each pilot activity leader. Data are now in the phase of preparation for larger dissemination. Important task in this reporting period was also promotion of project ideas among target groups, we disseminated project idea within several events - SFI organised 3 larger DEMO events to bring modern technologies for production, preparation and use of wood biomass to local population. More than 1650 peoples were reached, among which forest owners, farmers and representatives of local communities prevail. We organized 16 workshops trough which we reach 789 participants. We produced 2 articles and 5 examples of good practises. We presented project at dedicated stand at international fair in Komenda (more than 500 visitors were reached).

2.3 Next steps to be taken

The most important actions in next period will be in the frame of all pilot actions in WP 4, WP5 and WP6. The most important task is analysis of data and dissemination of these results to selected target groups. We will also organise some more workshops and demo events for local communities, farmers, forest owners and different experts. In the frame of WP 3 we will also take active part in organisation of cluster of local communities. A common guidelines and handbooks will be prepared in different pilot actions.

2.4 Publishable material and eventual copyright

SFI published 2 articles in different national – professional journals, reports from all organised events are available, and pictures from all this events are available. National



version of newsletter is available on internet side and it was disseminated at organised events. Hard copies of good practice examples are still available.

March 2013 – Article published in the Journal "Kmetovalec;". Title: Katalog proizvajalcev lesnih goriv za večjo organiziranost trga. Authors: Tina Jemec and Nike Krajnc.

March 2013 – Promotion page published in a book with the title: Lesna biomasa
Title: PROFORBIOMED: Promocija pridobivanja, predelave in rabe lesne biomase v Mediteranu.

March - April 2013 – Article published in the Journal "EGES – Energetika, Gospodarstvo in Ekologija Skupaj". Title: Proizvodnja lesnih pellet v sloveniji (*Pellet production in Slovenia*), Authors: Nike Krajnc, Tina Jemec, Mitja Piškur

July 2013 – Article published in the Journal "EGES – Energetika, Gospodarstvo in Ekologija Skupaj", Title: Lesna biomasa iz »lesnih njiv« (Wood biomass from plantations). Authors: Tina Jemec and Nike Krajnc

In the frame of PROFORBIOMED project SFI published wall calendar for year 2013, topic of which is regarding forestry, mainly wood biomass use and production. We printed 300 copies of the calendar.