PROJECT FINAL REPORT

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4.1 Final publishable summary report

Executive Summary

The need to provide comparable and compatible biomass datasets on a national level has become imperative in Europe. Member states are explicitly encouraged by the EC to develop national biomass action plans. A uniform methodology for assessing bioenergy will be needed for a European-level aggregation of data and statistics. CEUBIOM intended to contribute to these efforts by focusing on the public sector (i.e. national governments and municipalities) with the mission to propose a framework for bioenergy assessment methodology that could be taken up by the authorities with a relatively small effort. If such a single 'core' assessment method is accepted the results could then be easily aggregated to European level allowing for a much more accurate comparison between the Member States and also a very accurate estimation of potentials for Europe as a whole.

Accordingly, the overall objective of the CEUBIOM project has been to propose a common methodology for gathering information on biomass potential using terrestrial and earth observations. The project deployed a systematic work programme to achieve this objective that started with the assessment of current practices in biomass assessment and resulted in a conceptual framework for harmonisation. Special focus has been given to assessing the conditions in the Western Balkan Countries (WBCs) and to satisfy the needs of the stakeholders from this region. In order to reach this objective a careful review has been necessary as to what elements of the general biomass assessment framework are suitable for harmonisation in the target countries, requiring some rather difficult compromises. The Consortium implemented a focused and pragmatic work plan where the ultimate goal was to propose a specific core method as opposed to simply reviewing the various possibilities.

The Consortium explicitly considered it to be its mission to raise awareness of the scientific community to new biomass applications and especially to the use of remote sensing. The main tool for this has been the project website, which has both an extensive public section with information for visitors and a well-working intranet for the exchange of files and information within the Consortium members. Promotion activities included newsletters, and an intense participation in international events, conferences and workshops, where the project was presented to the European audience. An e-learning programme has been developed to facilitate the quick takeup of project results and to serve as a single entry point for those, who wish to learn more about bioenergy and biomass-related EO applications.

CEUBIOM has delivered a first proposal for a harmonized biomass potential assessment framework for bio-energy in Europe. It should be considered as a basis for continuing discussion and a guideline for developing the details and technical specifications that would be needed for implementation and European deployment. The next step should be the development of the specifications of the foreseen products followed by the actual implementation of the method(s) in one or more countries and/or regions throughout Europe. The lessons to be learned from such implementation exercise could be used to revise the original product range and their specifications eventually resulting in strict (but realistic) guidelines as to the methods used and type of data generated in national bioenergy surveys. It is a proposal of the CEUBIOM Consortium that the actual harmonisation is carried out in several steps combined with implementation monitoring before a new phase is enforced.

4.1.1. A summary description of project context and objectives

Biomass resource assessment studies of different scales and scope have been developed by the authorities of EU Member States and Associated Countries for decades. These national and regional studies are similar in purpose (provide an overview on the availability of biomass and/or provide updates in the changes bioenergy use or availability). The studies have deployed various internationally accepted approaches and best practices and supported the development of national statistics from the results. But since no uniform criteria have been established on how these policy-support assessments should be carried out the results are difficult to compare and aggregate to European level and for this reason the actual amount and type of bioenergy available for European users is still difficult to establish. There are of course some European-level studies that use existing national and European statistics to provide top-down assessments on a European level but the overall accuracy and reliability of studies that use figures from national statistics (that may have been based on different methods) could be further improved if the methods are harmonized.

CEUBIOM was launched in the above context with the overall objective to develop a proposal for a common methodology for gathering information on biomass potential using terrestrial and earth observations. This overall objective has been supported by the achievement of a set of specific goals and horizontal objectives. In summary the project objectives and goals could be summarised as follows:

Strategic Objectives:

- Develop a common methodology for gathering information on biomass potential using terrestrial and earth observations
- Involve WBC partners for disseminating information, best practices and methodology on using earth observations in the assessment of biomass potential for bioenergy

Specific Goals:

- Streamlining research results into a common methodology for using remote sensing for the assessment of biomass potential
  - Reviewing satellites, sensors, their applications and limitations
  - Reviewing indexes and indicators
  - Reviewing environmental and surface variables through direct observation
  - Comparing best European practices for the determination of biomass production and potential
  - Outlining different ways of EO input to biomass production and calculation methods

- Reviewing current terrestrial methods and activities for biomass assessment
  - Comparing methods currently used in Europe
  - Reviewing results from earlier and currently running activities in East and South East Europe
  - Identification of barriers of European harmonized approaches

- Developing harmonized European EO and terrestrial methods
  - Identifying requirements for harmonized approach on a European level
  - Suggesting combinations for EO and terrestrial-optimisation potential
  - Developing technical concepts for a harmonized approach with respect to Stakeholder requirements
  - Identifying technological gaps and definition of a European Research Road Map

- Developing a Platform for Stakeholder interaction, sharing of common datasets and results
    - Demonstrating the use of forums for identifying and further refining biomass user requirements for EO
    - Improving the EO sector's understanding of biomass and agricultural requirements
    - Monitoring international research and updating methodologies

- Deploying a CEUBIOM e-Training Programme on the use of a harmonised EO approach in biomass assessment
- Raise awareness for the use of EO on biomass potential of the scientific community and public

CEUBIOM focused on national-level biomass assessments for energy by combining terrestrial methods with remote sensing based applications with an emphasis on South-Eastern European and Western Balkan countries. The underlying reason for this work has been the fact that national results of national surveys often provide incomparable and heterogeneous results that are difficult to be used for consolidated actions or political decisions. Thus the harmonization of the methods/work processes is essential especially on a national/European level. In this context CEUBIOM has aimed to assess the current practices in biomass assessment in order to develop a proposal for a harmonized method, which should be applicable and relatively easy to implement and in line with the assessed user requirements. Since the integration of remote sensing techniques gives a clear added value in terms of spatial information, it was considered a vital component from the very beginning in the method proposed by CEUBIOM. Therefore the project focused exclusively on the development of a proposal for a spatially explicit methodology, providing a uniform resource-focussed approach for the users.

The logical framework of CEUBIOM has been that of a bottom-up approach (i.e. country level assessments), which then can be aggregated to a common European result; this approach provides detailed and potentially multi-purpose information. The aim has been to find the best compromise in terms of costs, feasibility and methods suitable for national users in order to achieve a common and comparable assessment for Europe.

The assessment procedures designed in the project were always based on surveys collected in the partner countries. The users have been defined as the national ministries and national bodies, which deal with biomass and energy issues. In terms of ministries these are primarily the Ministries of Agriculture, Forestry, Environment, Energy and Economy. In terms of national bodies and agencies, these are for example environment agencies or energy agencies as they could be the users with the willingness to take up new technology, if it fits their need and possibilities. The detailed assessment of these needs and possibilities and earnest considerations were considered as the prerequisite to user acceptance. From an EO perspective it was established that satellite service providers should deal with aspects such as improved market mechanisms, better balancing of supply and demand as well as incentives for end-user engagement and covering of initial costs.

During the course of the project end-user requirements were duly assessed (see CEUBIOM Deliverable 4.1). The main requirements are summarised as follows:

a) Generate one basic potential with well defined frame conditions (assumptions and restrictions) applicable for many users. This basic potential can be further used for individual potential assessments of specific user requirements.

b) Full update every 3 - 6 years, whenever spatial data, e.g. core service products, are available. In addition, an annual statistical update without a synchronous update of the spatial component can only be done for agricultural biomass.
c) Existing – archived - data should be used in order to keep costs as low as possible.
d) The resulting potential should be to satisfy different purposes, as e.g. internal information, policy and planning, dissemination, reporting and maybe (lower priority) also for subsidies and subsidy control. Potentials with very specific frame conditions, which are only important or available in one country or region, cannot be considered.
e) The requested accuracy ought to be in the range of 80 – 85 %, whereas the errors should be documented transparently and traceable wherever possible.
f) It can be recommended to derive at least three main thematic classes, i.e. 'forest biomass', 'agricultural biomass', and 'other biomass'. Further differentiation should be done based on conditions for accuracy, time or costs as well as based on the existence of data (e.g. if from core services already hardwood/ softwood and crops/ permanent crops/ grassland is available).
g) The product should be a continuous GIS map ranging over a scale of 1:75.000 – 1:100.000. Vector data on NUTS levels can be generated from this base level.
h) The method should not be too complex and be accompanied by training. The processing time (without EO data pre-processing) ought to be in the time frame of 6 – 9 months.

The above user requirements are based on the communication with the project's stakeholders from the target countries. These requirements were then processed in the conceptual framework and constraints of CEUBIOM. Two different sets of frame conditions have been distinguished: first, frame conditions, which can be harmonized throughout Europe; and second, specific frame conditions, where local expert knowledge (including scientific studies and literature) is needed to generate a useful result. Such frame conditions are in general not transferable throughout Europe without loosing usability and accuracy in the results. Accordingly the resulting approach is that of a technical-sustainable bioenergy potential using 'snapshot' assessment, meaning that basically no future scenarios and projections are included. For this reason, the suggested assessment method did not take economic boundary conditions into account because they are subject to fast changes and speculative prognosis, which should be avoided in order to provide reliable accuracy information for the users.

Naturally, projections and various models are considered an important tool for decision making therefore special attention has been made to define the 'core' methodology in a way that it can support subsequent modelling and scenario analysis for various purposes. This work can be carried out on a regional, national or European level by utilising datasets that have been generated in a uniform manner. Some of this modelling work could directly be integrated into the framework of the CEUBIOM methodology, making the resulting biomass potential assessment a tool for future scenarios and more advanced assessments. Clearly if such a harmonized approach is to be implemented on a European level, additional user requirements may arise, which could result in changes in the requirements. The methodology itself, however, is believed to be versatile enough to be accepted as a baseline and to accommodate any reasonable changes in user requirements.

During the course of the project work and especially when taking into account the user requirements such as costs, it turned out that the definition of a single approach will not be sufficient to satisfy all demands. To overcome this dilemma it was decided by the consortium to define two approaches, described individually for the following biomass types: forest biomass, annual crops, permanent crops, grassland and energy crops. The two approaches are the so-called 'Basic approach' and the 'Advanced approach' which differ in the extent of which remote sensing data is used.

The benefit of the CEUBIOM proposal for harmonisation is that two important requirements are met simultaneously.

- On the one hand key elements of national bioenergy-related information can be generated in a uniform, harmonized manner all over Europe allowing for an easy aggregation of this data to European level and thus directly supporting relevant decision and policy making processes, and
- On the other hand the proposed approach will allow for the subsequent integration of any national (or regional) priorities and the considerations of any number of environmental, technological, legal, social, economic, etc constraints that otherwise would be very specific to a particular country or region.

Clearly CEUBIOM was not set up with the purpose of taking over the entire task of providing answers to the challenges of biomass harmonisation in the EU and several constraints regarding the level of support this project can give to ongoing efforts. The two main constraints of CEUBIOM are:

- The project was submitted to a specific call for proposals that focused on the Western Balkan Countries. This means that the specific user requirements of these countries have had a significant weight in the formulation of the CEUBIOM methodology. If user requirements were to be updated by the requirements of several additional EU Member states then the proposed methodology should also be tailored accordingly.

- The project was formulated according to the call objectives having a very strong emphasis on the integration and explicit use of Earth observation data. Accordingly, a spatially-explicit method was formulated with all the constraints that come with such an approach. In practical terms it means that the methodology described here places a lot of weight on the cost efficient derivation of the initial theoretical potential (using EO data) and somewhat less focus on the subsequent processing of this information into specific bioenergy potentials.

The methodology framework proposed by CEUBIOM could be considered a “core” part in any bioenergy assessment activities that may take into account technical feasibility, economic, environmental, socio-political and other constraints. Only this “core” part is proposed for harmonisation resulting in datasets that will be comparable and available for European level aggregation. Naturally users may still have any number of specific requirements and they may request any number of specific boundary conditions to be taken into account. These constraints fall outside the scope of CEUBIOM and they are not considered for harmonisation.

Horizontal objectives

Objectives also explicitly included dissemination and the setting up of appropriate communication channels towards the stakeholder community in order to reach a high level of awareness for project objectives from the very beginning. The main tool for this has been the development of the project website, which has both an extensive public section with information for visitors and a well-working intranet for the exchange of files and information within the Consortium members.

During its implementation CEUBIOM worked closely with the BEE Consortium and this cooperation not only increased the performance of both projects (through the exchange of Deliverables and ideas) but it also maximised the impact of dissemination.

4.1.2. Description of the main S&T results/foregrounds

Note: this chapter contains a step-by-step review of project results according to Work Packages (WP2-WP7). In order to keep this report as concise as possible only some of the key steps and findings are discussed here followed by a reference to particular deliverables, which contain a more detailed description of the methods and results.

Brief overview of project activities

Activities carried out in **WP1** were related to the general process of project management and coordination and accompanying measures such as communicating with the European Commission on the Consortium's behalf. Thematic activities started in **WP2** where currently available methodologies for land cover assessment using different satellite data types were thoroughly investigated and limitations and possibilities were duly reviewed. **WP3** was launched parallel with WP2 with the objective to review current terrestrial methods and activities for biomass potential assessment. The goal of this WP was to survey the current terrestrial methods and activities for biomass potential assessment with special focus to the WBCs. This work also delivered specific national information about the methods of biomass assessment in the countries contributing to the present project and also information about activities and their results in other European states. WP2 and WP3 were highly interrelated and the results of these two key work packages were used in the harmonisation Work Package (WP4), which was the integrating focal point of the project with the objectives to propose harmonized biomass assessment approach. Work in **WP4** was therefore based on the results of WP 2 and WP 3 (desk study + surveys). The requirements were defined by the partners, who used national surveys to address the end-users and identify their national issues and requests concerning possibilities to harmonize biomass assessments.

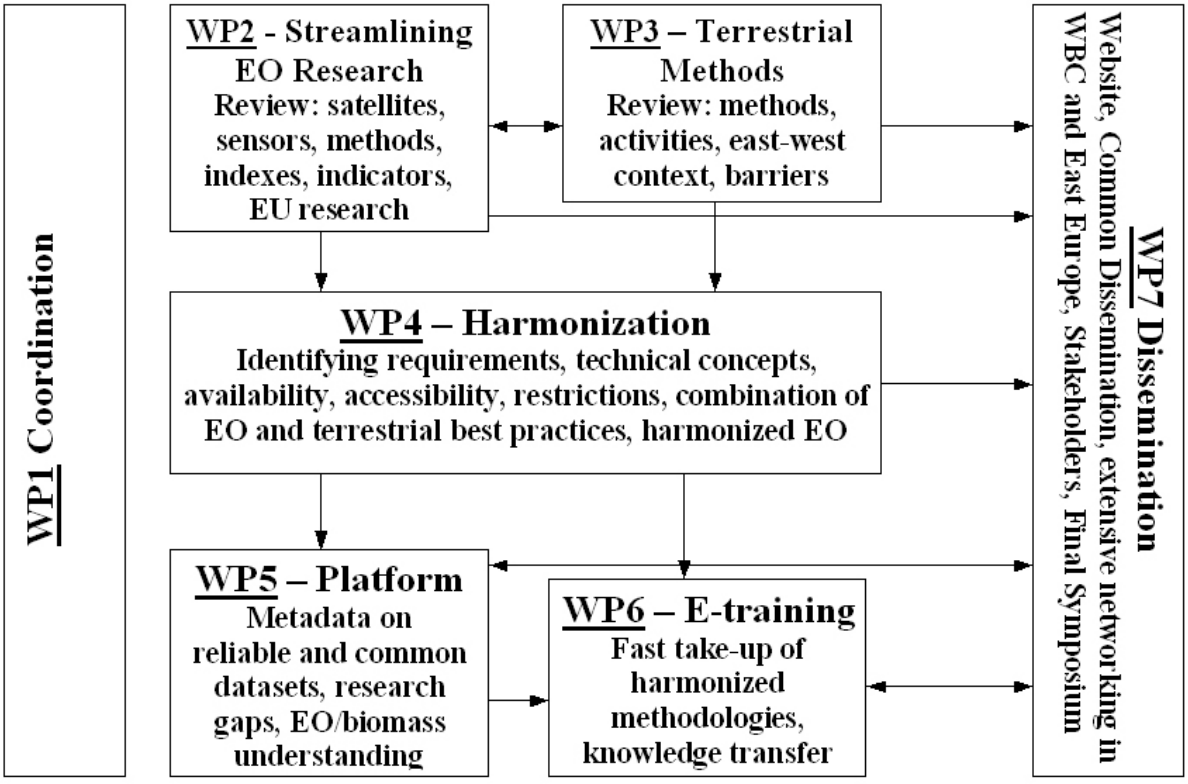


Figure 1. Simplified Pert diagram

WP5 developed a Platform in order to enhance communications among Consortium members and to identify still existing gaps between the currently used and the proposed applications as well as to start up discussions on future research. The Platform served as a forum for interaction also bringing up new ideas. Parallel to Platform activities a simple but robust and highly cost efficient e-training programme was developed in **WP6** to provide additional coordination and support the fast take-up of project results. Finally **WP7** was dedicated to developing and deploying a powerful dissemination strategy to be implemented horizontally with project activities. All partners contributed throughout Europe to the dissemination of information about the project and its results at conferences, seminars, workshops and meetings relevant to the objectives of CEUBIOM. In addition to traditional means of dissemination and awareness raising (such as the publication and printing of leaflets, newsletters and booklets) the power of the Internet has also be taken maximum advantage of.

4.1.2.1 Description of the main S&T results of Work Package 2

Work package 2 (WP 2) "Streamlining research results into a common methodology for using EO biomass potential assessment" started in month 1 and ended in month 16, with 41 person month in total.

The main objective of the WP was to synthesise information with the help of a review of currently available methodologies for land cover assessment using different satellite data types.

Three Deliverables were foreseen:

D2.1 Methods compendium on current state-of-the-art in EO for biomass assessment

D2.2 Study on SAR potential for direct biomass assessment

D2.3 Recommendations on EO data for European users

Activities and results

WP2.1. Satellites and sensors –applications and limitations

Within this sub-work package the different satellite sensors, their characteristics (limitations and possibilities) and features as data availability, cost and constraints were reviewed. The intention of this sub-WP was to give an overview of the state of the art in order to provide a basis for recommendations in D 2.3. The main conclusion of this sub-WP is that there is a wide array of different remote sensing sensors, each featuring special characteristics and like other monitoring methods, remote sensing methods have advantages and limitations. The overall advantage of the technique is the large amount of uniform data, providing large spatial coverage, collected from distance for less expense than field-based mapping. Constraints are the technical limits on feature discrimination, the costs, the required high level of technical expertise and the need for information to calibrate and verify the results. These aspects are analysed and discussed in D2.1.

WP2.2. Review of indexes and indicators

The classical empirical models are based on statistical analysis of experimental data – ground truth data, official statistics – and the remotely-sensed signal. Usually a lot of prior knowledge is needed, e.g. about the land cover and/or the environmental conditions. For this purpose the multispectral signals are transferred into vegetation indices (VI), highlighting important vegetation characteristics while trying to minimize the soil and atmosphere influence on the measured spectral signal. In this way, they reduce the multi-band observation to a single numerical index, typical being a sum, difference, ratio or other combination from two or more wavelength intervals. In the framework of WP2.2 a detailed review of passive / multispectral sensors for biomass estimation and vegetation

indices was carried out, also highlighting the interactions between the vegetation and the reflectance signal in order to understand the underlying mechanisms. The indices were then also assessed in regards to their applicability for vegetation biomass estimation. Most of the reviewed indices have been developed for the measurement of vegetation variables as Leaf Area Index or Crop Yield and not explicitly for vegetation biomass. This is because the most common approach for measuring crop growth is through a direct empirical relationship between a VI and a vegetation variable. Overall remote sensing data have been used in the past for the estimation of biomass, on numerous occasions, considering a range of vegetation types and employing a variety of passive optical sensors and methods. A wide range of indices have been discussed and assessed in order to establish relationships between such data and biomass, or other vegetation characteristics that can be indirectly linked to the amount of biomass present. A conclusion is that the use of remote sensing for estimating national forest inventories, for example, is faster and cheaper than traditional methods and also provides accurate mapping of the forested areas.

WP2.3. Environmental and surface variables through direct observations

This sub-work package focused on the possibilities of active / SAR remote sensing for biomass estimations. The task was to review state-of-the-art SAR data processing and analysis methodologies. The report covered the following chapters, focusing on applications in the agricultural and forestry domain; restricted to temperate and boreal ecozones.

- SAR – technological background of SAR
- SAR sensors – airborne & spaceborne, future missions
- SAR & biomass assessment – state of the art, potential, limitations
- SAR interpretation methodologies
- Review backscatter intensities and their multi-temporal pattern of different wavelengths, incidence angles and polarisations of different vegetation and crop types – based on scientific literature in the light of:
    - surface variables (land cover structure (roughness), soil moisture, local incidence angle)
    - environmental variables (above ground biomass, fraction of vegetation cover, vegetation vitality, moisture content, LAI, etc)
- SAR Interferometry
- Data-fusion with optical imagery. Review approaches and methodologies.
- Potential of multi-frequency and full-polarimetric approaches

The result is a highly scientific report describing the complexity of the SAR topic. Due to its sophistication and complexity it was decided that SAR data would not be suggested for full-scale deployment as a “core method” but rather suggested as an alternative for generating basic data in regions where such information is not yet available and optical sensors are unpractical to use. Also, it was concluded that the fusion of optical and SAR data, which gives more comprehensive information on specific features of vegetation is a promising technique leading to more precise biomass assessment.

WP2.4. Best European practices for the determination of biomass production and potential

From all partners within WP 2 country specific reports were collected covering the following topics:

- General description on national framework

- Information on methods for land cover mapping based on national survey activities
- Information on the methods for biomass assessment (based on EO)
- Information on methods for land cover mapping based on remote sensing
- Conclusion

The reports were all summarized pointing out the most promising approach within each country. Overview lists and tables were created on all national mapping programmes (with a high national coverage) implemented since 1995 that could - at least in parts - be helpful for CEUBIOM. JR additionally reported and summarized all important International and European standards and recommendations, also considering constraints about the users, requirements, scale, accuracy, legal issues, costs, availability and usability for in the methodological framework. Mentioned projects are: CORINE; LUCAS; JRC forest cover; ICP Forests, GMES FM; GEOLAND; Carbo Invent; GOFC-Gold and FAO FRA2010. The output gives a very good overview of all current projects, especially in Europe and is a very valuable input for WP2.5.

WP2.5. EO input to biomass production

Within this sub-work package the results from the previous tasks were summarized. Based on the summary of all satellites currently a matrix was filled out, grouping the sensors with regards to their applicability for specific thematic questions, i.e. forest/non forest, or biophysical parameters from forests. This was seen as an important input for WP 4 (Combination and Harmonization of EO and Terrestrial Methods). Next to that the multispectral and SAR sensor methodology descriptions are adapted for WP 6 (CEUBIOM e-Training Programme Development and Deployment). Concerning the biomass estimation all over Europe there is a great variety of studies on biomass potential but surprisingly few “official” data on biomass. None of the 14 country reports cited a study that used an EO-generated map of an entire country to calculate the amount of biomass. All cited EO-based biomass assessments were derived from relatively small sampling sites that were not necessarily representative for the whole country. These are important points for WP 4 (Combination and Harmonization of EO and Terrestrial Methods), where two main topics have to be differentiated: methods and data sets. On the one hand, methods developed at local scale with small sample sites might still be applicable for national/European approaches. On the other hand, data from a geographically small area can most probably not just be scaled up. For WP 4 it was also considered important to know which projects are currently running – what kinds of data and/or methods are being used there – both on a national and European scale in order to figure the best harmonization approaches.

WP2.6. Collaboration with BEE

During the implementation of this sub-WP communications were primarily routed through the Coordinators in order to keep information flow in a structured manner. This collaboration was later (in WP4) extended to other members of the group and especially WP leaders.

Reports published in WP2

(Note: all reports are available at http://www.ceubiom.org/deliverables/)

D2.1 Methods compendium on current state-of-the-art in EO for biomass assessment

The report concluded that remote sensing techniques have many advantages for biomass estimation over traditional field based measurement methods, plus additionally allow estimations at different scales. The use of remote sensing in combination with field surveys is probably the most cost-

effective solution to monitor large areas in regular intervals. One important issue is the users need and desires – in terms of accuracy, spatial resolution, information detail – which influence the design of the whole estimation procedure. High spatial resolution data (airborne, IKONOS, QuickBird) provide accurate biomass estimation at local scale; however the large data volume restrains its applicability for large regional applications. Medium resolution data (Landsat MSS, TM) possess a high potential for biomass retrieval at regional scale. Restrains when using these data type are mixed pixels and data saturation. Coarse spatial-resolution data (MODIS, AVHRR) provide estimates at national or global scale, but are difficult to link with point based field measurements.

D2.2 Study on SAR potential for direct biomass assessment

The public report was mainly a summary of the internal deliverable ***"Environmental and surface variables through direct observation"*** by IGIK. It focused on the possibilities of active SAR remote sensing for biomass estimations and the general state-of-the-art SAR data processing and analysis methodologies. This report is one of the more scientifically-driven deliverables of CEUBIOM as it outlines some intriguing applications for the use of radar in biomass assessment. The conclusion of the report is however that the overall use of SAR data for the **harmonized CEUBIOM approach** is currently not recommended, as the data handling is still too complex and the accuracy of the results – maps and direct biomass estimation – is not as high as needed for an operational product. Maybe in future with the start of the Sentinel missions (~2011), which are part of the Global Monitoring for Environment and Security (GMES) programme, SAR data and SAR data handling could be an option for CEUBIOM. Or at least the application of SAR derived maps.

D2.3 Recommendations on EO data for European users

Based on all previous findings and under consideration of the needs of the harmonized CEUBIOM approach (WP 4) and the user requirements all satellite sensors (current and future) and derived products (International and European) were highlighted and examined. A conclusion of this report is that for a ***"basic CEUBIOM approach"*** it is recommended to use not directly the raw satellite data but instead the already derived products. Especially suitable is the GMES Core Mapping Service Euroland and its land cover products. By masking out the regions of interest / or non interest for CEUBIOM it could then be updated by the use of medium resolution EO data (RapidEye, SPOT, Pleiades), if a higher temporal resolution than the Euroland product is desired. The regions do not necessarily need to be newly classified but instead pure change detection might be more feasible.

Work Package 2 was completed in month 16. The WP was implemented according to the Grant Agreement in terms of work content and the use of resources.

4.1.2.2 Description of the main S&T results of Work Package 3

Work Package 3 (WP 3) "Current Terrestrial Methods and Activities for Biomass Potential Assessment" started in month 1 and ended in month 12, with 48 person month in total.

The main objective of the WP was to survey the current terrestrial methods and activities for biomass for energy potential assessment, to evaluate them in the viewpoint of the main objectives of the project.

Two Deliverables were foreseen:

D3.1 Report on Pan-European Methods
D3.2 Report on South Eastern Europe

Activities and results

WP 3.1 Review of Pan-European Methods

A questionnaire was developed to collect information within the partners of CEUBIOM on methods and activities on biomass potential assessment. This questionnaire was developed by partners 4 (UL) and 5 (FER) in cooperation with the work package leader. As the questionnaire was designed to serve also for the activities of task 3.2 considerable effort was made in a distinct design. The questionnaire was tested with several partner countries and then circulated to all partners. All partners active in this WP made significant efforts to get the information requested and completed the questionnaires. The information in questionnaires were evaluated by the work package leader and first results discussed with the partners at a dedicated meeting in Šibenik (Croatia) in September 2008. All partners were asked to write a country report as a summary of the information collected in the questionnaires competed with a description of the situation of biomass use and policy in their country. All these information was collected in a report on "Pan European Methods" and submitted as Deliverable D3-1 in March 2009.

WP 3.2 Review of activities focussed on Eastern and South Eastern Europe

Based on the same questionnaire design and the same approach as reported in chapter 3.1 the situation of Eastern and South East European countries was investigated. This Report was submitted in November 2008 as deliverable D3-2.

WP 3.3 Identification of barriers of harmonized approaches

All preparatory activities were implemented in Work Package 3, whereas the core barrier assessment work was to be carried out in Work Package 4. The preparatory activities were done in the framework of the reviews produced for WP 3.1 and 3.2 (i.e. the questionnaires designed and circulated to CEUBIOM partners followed by the evaluation work. Although the information collected in the questionnaires were considered primarily as input to the workshops and discussions of WP4 some facts could already be stated at this stage:

- The principal methodologies used for terrestrial assessments on a national or regional basis were not very different in the countries surveyed and follow a rather uniform scheme (on the base of national statistics with inclusion of agricultural, forestry and production expertise).
- The intention of the activities in the countries surveyed is very different and ranges from the assessment of a rather theoretical potential to very specific realistic (e.g. electricity from biomass in one country). At the moment the assessments are therefore not comparable.
- The data basis for the assessments is very different. In some countries the statistical databases is reported to be poor and incomplete in some other believed to be incorrect in specific

aspects. In other countries highly elaborated databases are available including forest inventories, biomass flow charts etc. This situation seems to be a barrier, but with the ongoing European integration of the Western Balkan countries and the use of the EUROSTAT specifications the quality of national statistics will be of declining importance.

- Nearly all partners report a strong interest in their countries on a harmonized approach in biomass for energy potential assessment.
- An obstacle to a harmonised approach could be the need to agree on a common set of specifications and in consequence on common boundary conditions for biomass for energy potential assessment.

WP 3.4 Co-operation with BEE

The cooperation was initiated at the Meeting in Freiburg in spring 2008 and continued at the upcoming meeting in Budapest in April 2009 and at further meetings between BEE and CEUBIOM. As well in BEE (WP4) as in CEUBIOM (WP3) there was a dedicated task on investigating international methodologies and experience in terrestrial biomass for energy potential assessments. Accordingly results were exchanged and mutually reviewed by the Coordinator and the WP leaders.

Reports published in WP3

(Note: all reports are available at http://www.ceubiom.org/deliverables/)

WP3 produced two Deliverables during its implementation with the work separated in two activities:

- WP3.1 Review of Pan-European Methods
- WP3.2 Review on Activities focussed on Eastern and South Eastern Europe (SEE countries)

- Deadline for the submission of D3.1 was month 12 (Feb. 2009)
- Deadline for the submission of D3.2 was month 8 (Oct. 2008)

The focus and the methodology of the two activities 3.1 and 3.2 was in principle the same, only the region to be investigated was different.

The reason for separating the work on the reviews was the unclear situation in the WBC countries in respect of data availability and of expertise and institutions being active in the field. The countries reviewed were the succession states of the former Yugoslavian Republic, and Bulgaria, Greece, and Romania, where the situation seemed to be less clear, when activities were designed for this WP during the formulation of the project proposal and the Grant Agreement negotiations afterwards. In order to concentrate the work on this area and to have some additional time for discussions and for doing some follow up work if necessary, the survey on WBC (South Eastern Europe) countries in WP3.2 was done first.

At the WP3 workshop in Sibenik (September 9th) the data submitted for WP3.2 were discussed and it could be stated, that the reports from WBC countries were fairly comprehensive, the content was very clear and the situation interpretable. The situation in these countries could be characterized by partially poor data quality (compared to other European countries) whereas expertise is available in a high degree. The methods reported for biomass potential assessment are in principal the same as in other countries. Sometimes instead of national data, estimations by FAO or other international organisations were used. After the submission of D3-2 in October 2008 the data of all the other countries (EU members) were also incorporated, interpreted and conclusions made for the review on the Pan-European situation (D3-1). For the sake of complexity this deliverable also incorporated results from the SEE study since these results were readily available.

The reports on the national methods of bioenergy potential assessment in Europe showed that the assessments in general are based on national information on production of biomass and on national information on land use (including forest inventories, if available). Only very specific assessments (for specific species or specific uses (e.g. biogas)) are done based mainly on primary data for small regions. The assessment methods all over Europe are very similar and follow a rather uniform scheme. Beginning with the question driving the assessment, boundary conditions (economic, social demands, socioeconomic demands) are specified, that can be very different depending on the specific question. Typically, based on national statistical information the biomass potential is generated by including agricultural and forestry expertise. Depending on the question driving the assessment, the assessments are snapshot analyses or forecasts.

The involvement of agricultural and forestry expertise is essential for assessing the results of productivity development and/or land use changes (soil fertility environmental effects etc.) and for consideration of restrictions induced by specific boundary conditions (e.g. economic, socioeconomic, environmental and social). In the case of forest inventories (as a special form of land use information) various indicators are used for assessing the capability of forests for future biomass production. These indicators include special information on soil fertility, condition of the forest (plant density, crown condition), and stock of living biomass. Forest inventories are not available for all countries.

The studies confirmed that at the moment, the different bioenergy potential assessments done in the different countries are not comparable. Reasons are the different information requests (questions) driving the assessments, resulting in different boundary conditions which give different results. A specific principal methodology for common practice could easily be established, if an agreement on the information request (question to be answered by the assessment) can be achieved. In this case the biomass potential assessments for different countries would use identical boundary conditions and so would be comparable to each other and could be summed up. Due to different statistics available in the countries the methodologies would differ in details, but not in the principal approach.

The results of WP3 served as a basis of the activities of WP4 “Combination and Harmonization of EO and terrestrial methods (together with the results of WP2 (“Streamlining research results into a common methodology for using EO biomass potential assessment”).

Work Package 3 was completed in month 12. The WP was implemented according to the Grant Agreement in terms of work content and the use of resources.

4.1.2.3 Description of the main S&T results of Work Package 4

Work Package 4 (WP 4) "Combination and Harmonization of EO and Terrestrial Methods" started in month 13 and ended in month 33, with 64 person month in total.

The main objective of the WP was to act as an integrating focal point of the project with the objectives to set up a harmonized biomass assessment approach and to work out guidelines for a methodological framework.

Three Deliverables were foreseen:

D4.1 Summary of country reports of requirements and RTD needs
D4.2 Compendium on combined methods
D4.3 Report on the harmonized approach

Activities and results

WP 4.1 Identifying the Requirements for Harmonized Approach

Work started with identifying the requirements for a harmonized approach of the different methodologies together with working out a guideline for best practise and identifying further RTD needs. In order to facilitate these activities a user requirements questionnaire was developed and sent to the partners together with the request to identify the national users in each of the partner's countries. Example answers were given in order to facilitate the understanding and the template was sent to all partners. The questionnaires were collected from all partners and analyzed in detail. Based on these questionnaires, the D4.1 was produced and finalized in August 2009 in line with the work plan. Due to the large variety of user needs, it was soon realized that it is not possible to fully satisfy all user requirements with one approach, thus the consortium tried to find the best compromise in order to satisfy most of the requirements. In order to do so the following compromise was established with regards to end-user requirements:

- Generate one basic potential with well defined boundary conditions (restrictions) applicable for many users. This basic potential can be further used for individual potential assessments for specific user needs (e.g. economic potential, modelling of future potentials), but not be done in the frame of the harmonized approach.
- Have a full update every 3 - 6 years, whenever spatial data, e.g. core service products, are available. In addition, a statistical update of the potential (maybe only for agricultural biomass) can be done annually.
- Keep the costs as low as possible by using already existing data and products.
- Make the resulting potential suitable for different purposes, especially for internal information, policy and planning, dissemination, reporting and maybe (lower priority) also for subsidies and subsidy control. Potentials with very specific boundary conditions only important to or available in one country or region cannot be considered.
- Aim at an accuracy in the range of 80 – 85 % and the errors should be transparently documented and traceable wherever possible.
- Generate at least the three main thematic classes 'forest biomass', 'agricultural biomass', 'other biomass'. Further differentiation should be done based on accuracy, time and cost considerations as well as based on the existence of data (e.g. if from core services already hardwood/ softwood and crops/ permanent crops/ grassland is available).
- Produce a continuous GIS map with a scale of 1:75.000 – 1:100.000. Vector data on NUTS levels can be generated on this base in addition

- Keep the method to intermediate complexity and provide training. The processing time (without EO data pre-processing) should be around 6 – 9 months.

These suggestions constituted an important base for the development of the conceptual framework of the CEUBIOM harmonized approach.

The definition of user requirements mentioned before is a very important, but only one of the three main pillars for the definition of the harmonized approach. The other two pillars could be constructed from the results of WP 2 and WP 3: the remote sensing options and available products coming from WP 2 and the terrestrial assessment review in the countries in WP 3. The *Recommendations on EO data for European users* (WP 2) already recommends using existing products from European projects and initiatives instead of the direct satellite data in order to save time and efforts. The GMES Core Mapping Service Euroland and its land cover products were identified as most appropriate, eventually updated by additional data with a higher temporal resolution (e.g. RapidEye). It was also suggested to define a specifically a "Renewable Energy Downstream Service" based on Euroland products and existing terrestrial data from national and international studies. For an optional "advanced CEUBIOM approach", also data and method recommendations were given involving the use of multispectral time series for a more accurate assessment of agricultural biomass, the use of SAR data for direct biomass assessment and the use of LiDAR data for improved biomass assessment in forested areas.

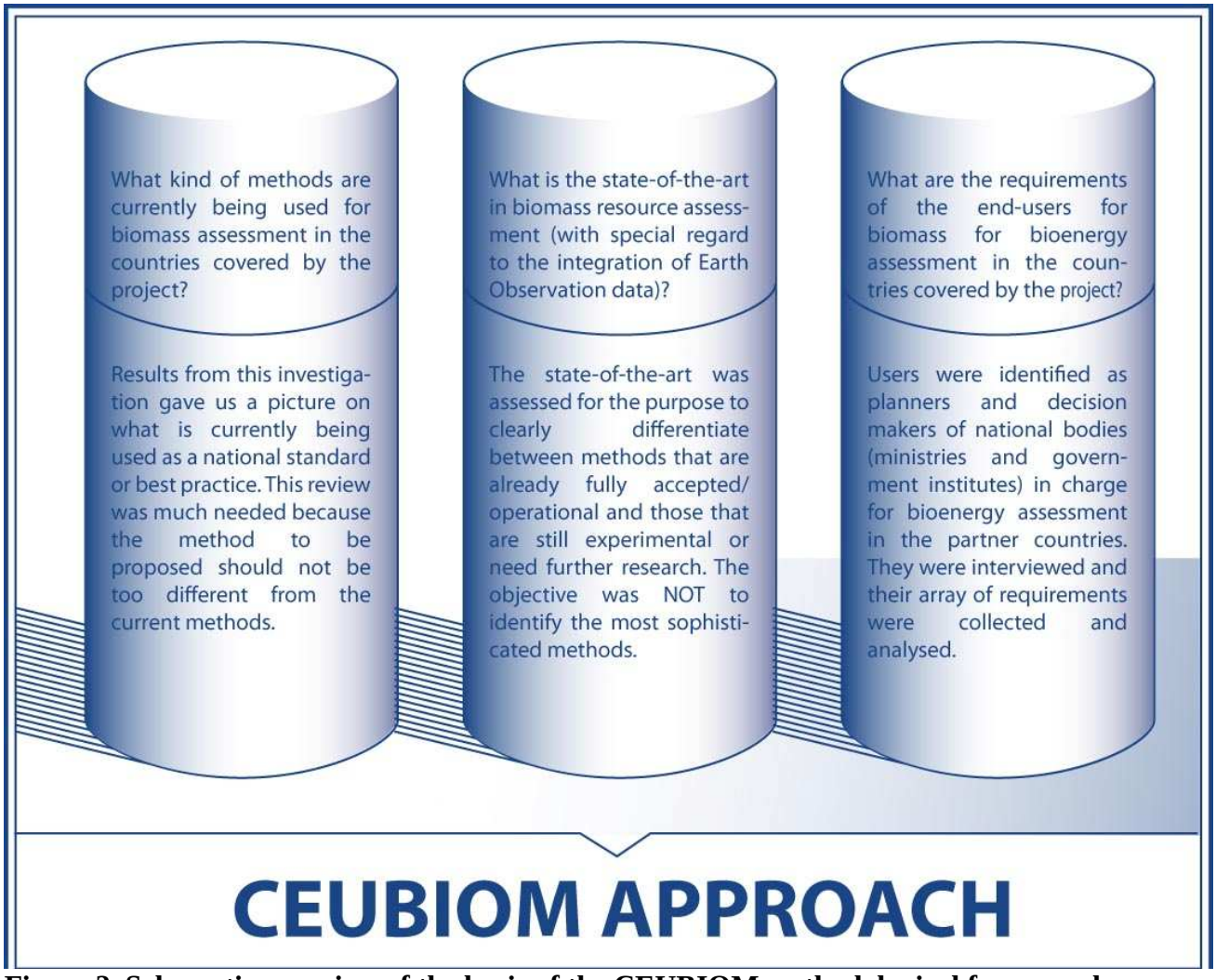


Figure 2. Schematic overview of the basis of the CEUBIOM methodological framework

The central input from WP 3 was a thorough understanding of the main procedures currently in place and to shape the 'new' approach in a similar and thus easily acceptable way. A conclusion drawn from WP3 activities was that for any approach to work there will always be a need for expert interpretation and this should be integrated in any harmonised bioenergy assessment methodology to be developed. In addition, WP 3 gave a good insight into the necessary boundary conditions to be set for energy use of biomass.

Additionally in WP4, each partner completed a **list of data and availability** regarding different terrestrial basic data sets and information on boundary conditions. This analysis nicely shows the general situation in terms of data availability in individual countries as well as the gaps.

The main gaps in terms of agricultural terrestrial data in the covered countries are:

- Area and yield of energy crops are missing in some countries
- The amount of different crop types needed for food and fodder is missing in Italy, Hungary, BiH and Romania
- Export statistics for individual crops are apparently also missing in several countries

The main gaps in terms of forestry-related terrestrial data in the covered countries are:

- Czech republic has the least information on forestry and short rotation coppice
- Import- and export statistics are missing in several countries
- The amount of timber needed for industry (wood, pulp and paper) is known in very few countries only.

WP 4.2 Combination EO and Terrestrial methods

The next task in WP4 was the **assessment of the possible methods in order to integrate remote sensing data and products with terrestrial data**. This was done in the form of a literature review with special emphasis on using terrestrial data from various sources (not just data specifically collected for this purpose as such information might be lacking in several countries). The latter restriction is important, because the proposed method should be cost-efficient and thus use as much existing data as possible. During the methodological review it became clear, that agricultural and forestry-related combination methods differ quite significantly. To reflect this fact review activities were **structured accordingly into forest and agriculture**.

Forest biomass estimation methods – conclusions:

A large variety of algorithms to estimate standing forest biomass from remote sensing and terrestrial data are available. National forest inventory data (either plot-level or allometric equations) is the widest available and most commonly used terrestrial data source. Among the combination approaches, bottom-up approaches are generally more accurate than top-down ones, however top-down approaches are easier to implement and more flexible for frequent updates. In addition, the co-location of NFI plots and remote sensing data and dealing with related uncertainties are not trivial in bottom-up approaches and can thus lead to errors. A good predefined stratification, e.g. into different species classes, elevation classes or density classes typically improve the results for all methods. Tree height as a main information parameter leading to higher accuracy is still missing for large areas and should thus be mapped preferable by LiDAR or for frequent and more economic updates by combining LiDAR DTM and satellite photogrammetry-based DSM.

Basically all of the methods described in the review aim at calculating either total biomass or above-ground biomass; thus additional steps are necessary to calculate the amount of biomass available for energy purposes. This amount depends on a large variety of boundary conditions or frame parameters

such as industry needs; market prices for fuel wood versus industrial wood, ecological and technical considerations. The framework conditions needed to be defined for an assessment would become part of the deliverable D4.3. A general suitability of the different methods with regard to estimate the biomass for energy share could be given as a result of the assessment work:

- Using bottom-up approaches (like kNN methods) with both optical or RADAR data, the amount of biomass for energy can only be assessed by using an approximated share depending on the area (country or district, wherever this has been assessed). Sources of this information are NFI data or literature.
- Using top-down approaches, the other parameters such as crown cover, species and stage of stand development (if available) can be used to better estimate this share.
- Using LiDAR data, the same applies as for the top-down approaches, but with even more spatial detail and higher accuracy, since tree height and stem density are also available. These are two important parameters to assess the potential for energy (thinning of young stands, i.e. stands with limited vegetation height).

Agricultural biomass estimation methods - conclusions

For agricultural biomass (including agricultural energy crops), there are rarely any papers available integrating remote sensing and existing terrestrial data such as statistics. The best operational example is probably combining IACS data, satellite imagery and yield models. However, this method is using low resolution spatial data, which is not detailed enough regarding the user requirements. Most studies use terrestrial data specifically generated for this purpose in order to be temporally compatible with the remote sensing imagery. Among those, direct biomass measurement using SAR or optical data is a straightforward approach at the cost of high complexity. Crop area estimation and yield are often supported by modelling including meteorological, pedological data and phonological information as well. Achievable accuracy and spatial detail are reversely correlated: for low resolution data with spatial resolutions with more than 100 m the errors are small, while for detailed mapping the errors are much higher. For most studies, a two step procedure is performed: First, classifying the area into different crop types and second, correlating biomass with image features individually for each crop type.

Basically the same considerations apply to agricultural products as for forestry products. Frame conditions determine the amount expected to be usable for energy purposes rather than the total amount. For agricultural products, this is even a more conflicting issue (‘food versus fuel’). Measurement systems such as remote sensing can only deliver total amounts and indicators for ecological considerations, all additional restrictions have to be defined by legal or expert frameworks. In D4.3 a method is presented on how to consider the most important frame condition in a common way.

WP 4.3 Technical Concept for a Harmonized Approach with Respect to User Requirements

This “unifying” sub-WP integrated results from previous activities in support of the development of a “Technical Conceptual Framework” for a harmonized approach of bioenergy assessment with special emphasis on East and South East Europe including data availability, accessibility and user requirements. The initial idea during the formulation of the project proposal was to develop one single approach. However, based on the gathered information and user requests it became quite clear that forestry-type biomass for energy and agricultural products for energetic use have to be assessed differently (both from the user requirements and also from the methodological point-of-view).

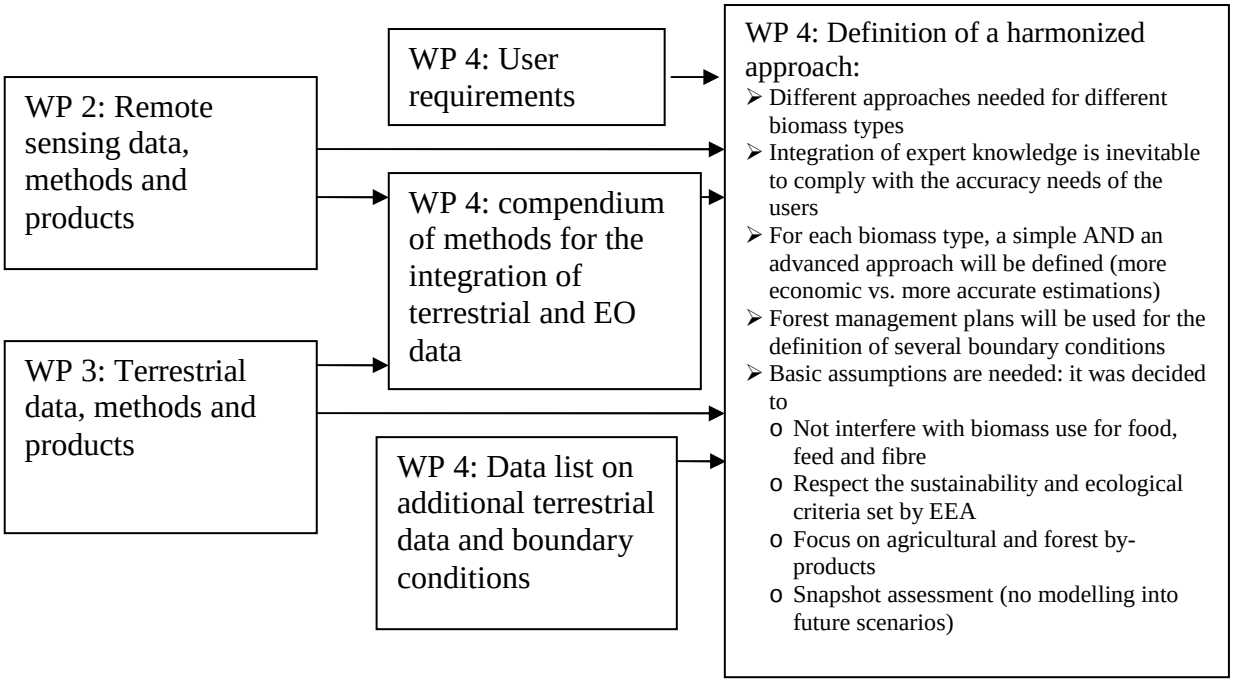


Figure 3. Work flow supporting the development of the methodological framework

In response to end-user requests it was decided by the consortium to define two approaches, described individually for the following biomass types: forest biomass, annual crops, permanent crops, grassland and energy crops. The two approaches are:

- **Basic approach** and
- **Advanced approach**.

The **basic approach** is designed in order to fulfil most of the user requirements. This implies a rather small role of remote sensing techniques, because the users require a method which is similar to their known procedures and they often do not have the capacity to do extensive remote sensing surveys. Since most users are interested in implementing the assessment in their own institutions, the latter is an important restriction. Thus, the basic approach is an indirect assessment using mainly existing land cover classification based on remote sensing data in combination with well established terrestrial surveys such as EUROSTAT. The added values of the basic approach compared to a simple statistical assessment as currently done in many countries (see Deliverable D3.1) are described in the following:

- **Spatial dimension**: By including land cover maps, the potential can be geo-located and thus enable the stakeholders to obtain a more detailed view not only on the amount but also on the distribution of the biomass.
- **Low cost**: The basic approach is designed to make optimal use of existing products and services at national and European level- meaning that this approach is relatively cheap.
- **Fast implementation**: Since basically all input information is available through other projects or initiatives, the combination of these input data can be done quite fast.
- **Harmonized data**: Although the basic approach strongly relies on local expert knowledge in order to guarantee the incorporation of local conditions, the use of a quality assurance system as suggested by CEUBIOM will significantly improve the harmonization.

- **Applicability** to all considered countries: The approach relies on existing information and thus it was secured, that all needed input data are available or have a quality alternative.

The main drawbacks of the basic approach are also related to the advantages. As an example, the use of existing data as an advantage turns into a disadvantage in case this existing data is not accurate or reliable. Thematic details of land cover maps are sometimes not detailed enough to accurately combine them with statistical data. In order to overcome the drawbacks of the basic approach, a more advanced approach in the inclusion of remote sensing methods is also developed.

The **advanced approach** contains a set of remote sensing options, which can be combined either in a direct or indirect assessment. Several options are given in order to give the user the option to pick the one that suits his/her data availability and knowledge best. More detailed and thus costly data is considered, such as LiDAR data or multi-temporal data sets. Furthermore advanced methods are suggested, which can only be applied by remote sensing experts and also might need longer processing time and thus increase the costs considerably. However, there are significant advantages using the advanced approach:

- **More thematic and spatial details**: Using target-oriented land cover classes instead of existing ones. Classes which are specifically selected for biomass for energy can be distinguished thus leading to a more detailed result. The use of more detailed data can also improve the classification accuracy.
- **Independence from existing data**: Sometimes an independent assessment is needed, especially if existing initiatives are depending on political decisions and may be on hold for some time. In this case, the advanced approach is an independent and suitable alternative.
- **Less local expert knowledge needed**: Generally the use of local expert knowledge is important in order not to ‘equalize’ circumstances, which are not equal in different countries and regions. However, using more advanced tools help to minimize the efforts for local experts incorporation and at the same time keeping the quality and (correct) heterogeneity of the output.
- **Faster updates**: In case of big projects, such as European-wide land cover maps or statistical assessments, the delivery time is sometimes quite long for the basic approach and the results might not be sufficiently up-to-date. With the advanced approach, national assessments can be done faster according to the specific temporal needs.

The methodological framework developed respects the flow of bioenergy potential assessment in general in a sense that it starts from a theoretical potential and then coming to technical, ecological or sustainable potentials, and, finally to an economic/implementation potential. However, generally speaking the processing chain is not as straightforward as the figure might suggest. In reality, the different potentials intersect and some frame conditions could be counted as restrictions in several steps. It is thus more important to clearly **declare, which frame conditions are applied** than to classify the potential into one of these categories. However, the theoretical potential is the foundation for all further calculations. It is important to mention that any error in the theoretical potential will be retained in all other potentials and also in the results of any applied modeling approaches.

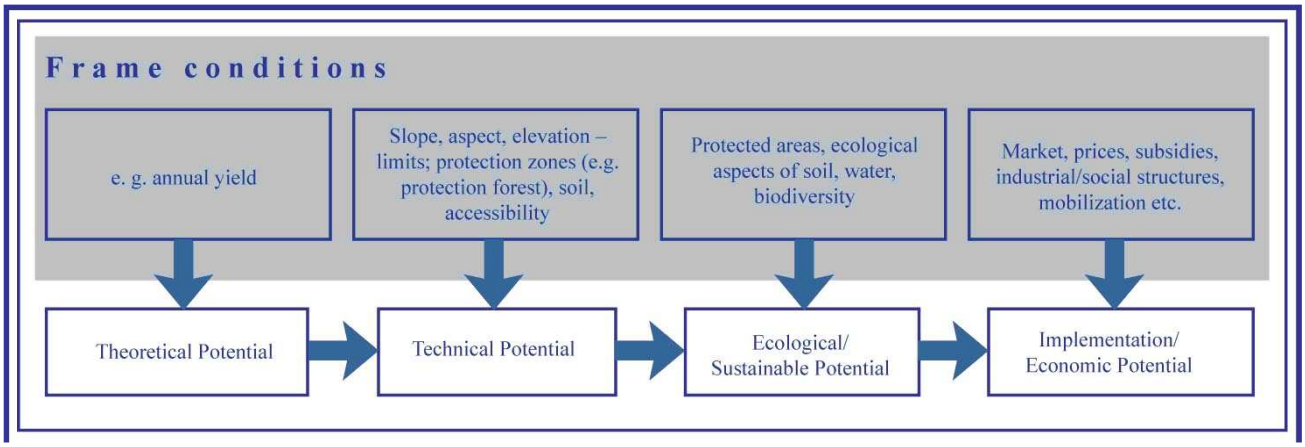


Figure 4. Schematic overview of the role of boundary conditions in bioenergy potential assessment

The classification of a methodology strictly into these categories is often difficult, since there are overlaps between the potential types. It is also more important to clearly define the boundary conditions and assumptions made than to categorize. Thus, the suggested assessment protocol in CEUBIOM can not clearly be categorized into any of the above mentioned potential types, but is rather a mixture of elements of the technical, environmentally sustainable and to some extent implementation potentials that suit the needs of the project endusers.

The developed methodological framework was published as Draft D4.3 in October and a shortened version of this document, including the main parts of Chapters 1 – 4 and 8, as well as workflow examples from the Basic and the Advanced approach, were sent directly to 160 persons of relevant background in order to get an expert feedback on the validity of the project findings. The exact amount of distributed forms is not known, as it is not exactly clear how often the email has been forwarded and distributed in total. The short version was accompanied by a feedback form, in which the readers were asked for their judgements on three main parts of the document as well as for general and specific comments. The Consortium received 58 completed feedback forms, plus three separate e-mails that contained comments but not the form.

The experts contributed from 14 different countries, as shown in the Figure below. It can be seen that not only the target countries of the project (South-eastern Europe and Western Balkan), but also some people from Northern and Western Europe were involved in the feedback collection.

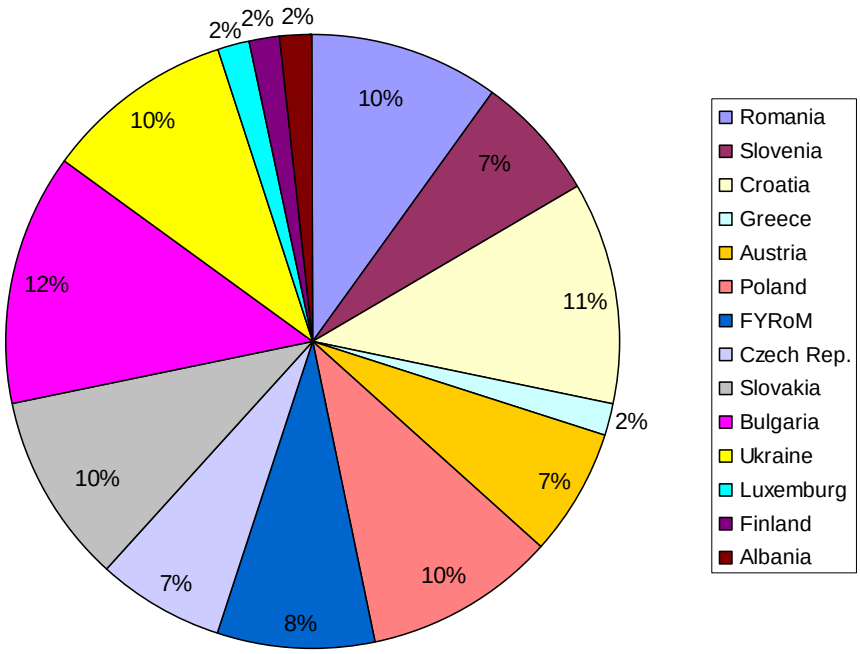


Figure 5. Country of origin of the experts giving feedback to the approach

In terms of the background of the readers they could be distinguished into four main groups: (i) the initial end-users of the project, who are typically from energy policy and either affiliated with governments or work as consultants for governments; (ii) practitioners, who carry out the assessments today with varying affiliations ranging from research to consulting; (iii) researchers typically from academic institutions and finally (iv) remote sensing people coming from research, industry or consulting. The comments were duly processed and taken into account by the Consortium in the final version of D4.3, whenever it was possible.

Reports published in WP4
(Note: all reports are available at http://www.ceubiom.org/deliverables/)

WP4 produced three Deliverables during its implementation with the work separated in three activities:

D4.1 Summary of country reports of requirements and RTD needs
This report is based on user questionnaires gathered by the project partners from national users in their countries. The questionnaire itself was developed by the consortium in the frame of two meetings (January 2009 Graz and March 2009 Budapest). The topics of the questionnaire range from questions about the current situation and experience in the field of biomass potential assessment to the type, spatial, temporal and thematic resolution of the data needed. All in all, 43 national users have been questioned mainly through personal interviews, sometimes through telephone interviews and in few cases through literature review. This survey helped the consortium to understand the theoretical requirements of the users and it lead to the formulation of some realistic requirements designed to fit the needs of most users.

D4.2 Compendium on combined methods
The aim of this report was to identify different options to combine terrestrial data with remote sensing imagery. The study underlined that for the CEUBIOM approach, obtaining large amounts of terrestrial data specifically for biomass potential assessment all over Europe is probably not viable.

Therefore the focus is on using terrestrial data, which were collected anyway and/or for a different purpose. Such data for example can be all types of statistics, general landcover information, and national forest inventories (NFI), etc. The data has to be analysed and the satellite based classification procedures have to be adapted in an appropriate way. In addition, also remote sensing data should be used, if already available, such as the GMES data sets 'image2000', image2006', CORINE land cover products, MARS products, etc. A review of methods to combine these data sets with remote sensing was given in this Deliverable.

D4.3 Report on the harmonized approach

The aim of this document was to describe the methodological framework that was developed in response to the end-user needs and as a result of the systemic assessment work carried out in the project. During the course of the work and especially when taking into account the user requirements such as costs, it turned out that the definition of a single approach will not be sufficient to satisfy all demands. To overcome this dilemma it was decided by the consortium to define two approaches, described individually for the following biomass types: forest biomass, annual crops, permanent crops, grassland and energy crops. The two approaches are the 'Basic approach' and the 'Advanced approach'. The different complexity is mainly related to the level of integration (and also its sophistication) of remote sensing data and spatial manipulation methods while the general framework conditions, assumptions and terrestrial data mostly remain the same:

Work Package 4 was completed in month 33 following a 3-month extension approval by the Project Officer that allowed for a period of stakeholder involvement and the collection of feedbacks. The WP was otherwise implemented according to the Grant Agreement in terms of work content and the use of resources.

4.1.2.4 Description of the main S&T results of Work Package 5

Work package 5 (WP 5) "Platform development for Stakeholder Interaction, Common Datasets and Results" started in month 15 and ended in month 33, with 48 person month in total.

The main objective of the WP was to add flexibility to the scientific work enabling the consortium to react to emerging needs. The Platform served as a forum for interaction, bringing up new ideas and also to involve and interact with external stakeholders.

Five Deliverables were foreseen:

D5.1 Handbook for improving EO sector on understanding of biomass requirements (renamed to Handbook on Earth Observation Techniques for Biomass Assessment)

D5.2 Meta-database of a reliable and common dataset on biomass potential

D5.3 Definition of gaps in European EO/biomass research and policies

D5.4 Research Road Map

D5.5 Biomass/EO Platform

Activities and results

WP5 played an important "horizontal" role within the CEUBIOM project, as it collected the results of the analyses carried out in the previous WPs and created the basis for further discussion and refinement. WPs 2 and 3 were completed before the initiation of the WP5, whereas WP4 run in parallel, so much of the discussions that lead to the formulation of the methodological framework were actually carried out as a part of the Platform activities of WP5. So, while WP4 had the role of defining the harmonised method, WP5 implemented a set of support tools, documents and services to help refining the method and to suggests new ways of research. WP5 officially was due to start at month 15, but some preliminary management work was carried out before the actual start including preliminary discussions at the first interim meeting in Budapest. This was necessary in order to coordinate a group of participants to the WP which was by definition (due to the transversal role of this WP) large and heterogeneous (all project partners contributed to this WP).

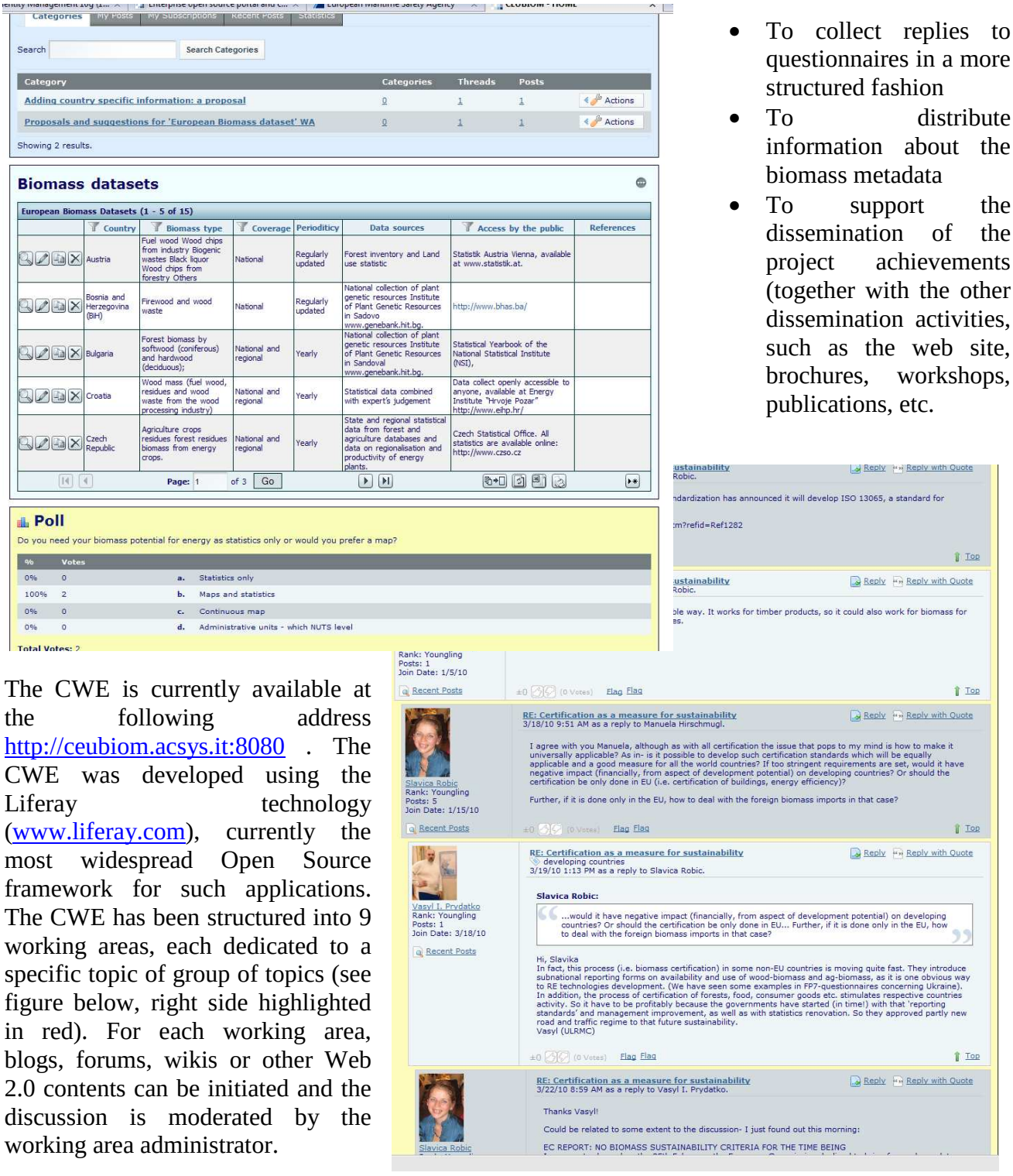
Key activities of WP5 were:

- Collecting the results of the analyses carried out in the WP2, WP3 and WP4 and analyse them in the light of identifying possible shortcomings and gaps
- Developing a platform for consortium members and for stakeholder interaction aimed at:
    - identifying the critical issues related to biomass assessment approaches
    - refining biomass requirements
    - implementing a forum for global interaction, bringing new ideas and supporting researchers to access and share information on the European research frontiers
- Providing a web based access to a biomass assessment documents, resources, metadata

All major developments in this WP were centered around the **CEUBIOM Platform (**sometimes also referred to as the CEUBIOM Collaborative Work Environment - CWE), a Web 2.0 tool dedicated to Biomass Assessment methodologies. The CEUBIOM CWE allows user to interact by means of forums, blogs, wikis, discussion and many more embedded services.

The objective of the CWE is manifold:

- Allowing different stakeholders to interact and discuss about biomass assessment topics
- Allowing consortium partners to converge (with the support of external CWE users) towards an harmonised approach, and in more general terms to refine all output and deliverables of the project in a participatory approach
- Implement a one-stop-shop for all material related to the biomass for energy assessment
- To collect replies to questionnaires in a more structured fashion
- To distribute information about the biomass metadata
- To support the dissemination of the project achievements (together with the other dissemination activities, such as the web site, brochures, workshops, publications, etc.



The CWE is currently available at the following address http://ceubiom.acsys.it:8080 . The CWE was developed using the Liferay technology (www.liferay.com), currently the most widespread Open Source framework for such applications. The CWE has been structured into 9 working areas, each dedicated to a specific topic of group of topics (see figure below, right side highlighted in red). For each working area, blogs, forums, wikis or other Web 2.0 contents can be initiated and the discussion is moderated by the working area administrator.

Figures 6-7. Screenshots from the CEUBIOM Platform

Moreover other means have been developed to collect the information from the various CWE users are via the usage of interactive tables, polls and questionnaires. The figure below presents a page where 2 types of contents are included:

- An interactive table with a list of available reliable biomass metadata
- A simple poll retrieving the opinion of multiple users on simple structure questions

The interactive table is a list where all authorized users (all those who have requested and have been granted access to the CWE) can visualize and update the biomass information, for example, correcting the info of the various datasets or adding new datasets. This type of objects follows the same paradigm of Wikipedia, whereby the information reliability is self-guaranteed by the process itself, in that all users can improve and/or correct the information inserted by the other users and at the end the whole set information is publicly available to all subscribers. In some working areas the polls have been addressed to a larger community, e.g. students, in order to see their perception of the role of biomass as source of renewable energy, etc.

During the course of its development the CWE counted over 60 active members, distributed among researchers, industries, decision makers, etc. In this respect the CWE serves as a fundamental tool for allowing stakeholders from a variety of perspectives to interact into the discussion and indicate their point of view. Although all discussions are in principle open, it has been the role and mandate of the Working Area administrators to stimulate and moderate the various discussions towards the end objectives of the project in particularly related to the following points:

Figure 8. Login page to the CEUBIOM Platform

- Identification of gaps in the current state of the art with regards to defining a harmonised technique for assessing biomass for energy in Europe
- Definition of a research roadmap in order to define priorities and objectives of future research in the related field

Altogether 10 different forums, with about 24 specific topics were created by the WA administrators to enhance participation and dialogue between experts. The following working areas have been created and managed through the course of the project:

1. Questionnaires and survey
2. Identification of barriers of EU Harmonized approaches
3. Forest biomass and its role in the renewable energy strategies

4. Role of biomass in energy planning
5. Research Roadmap
6. Stakeholders interaction, policy frame work
7. Harmonized European EO and terrestrial methods
8. Common Innovative EO methodology for biomass assessment
9. European Biomass dataset
10. Guest area

The Platform also hosts an interactive meta-database which contains an overview on the current Biomass data used in each country. The intention is to draw an overview of the data situation in Europe and identify points that require further investigation. It is supposed to be a quick list of biomass metadata available to users in order to facilitate research and study in CEUBIOM countries.

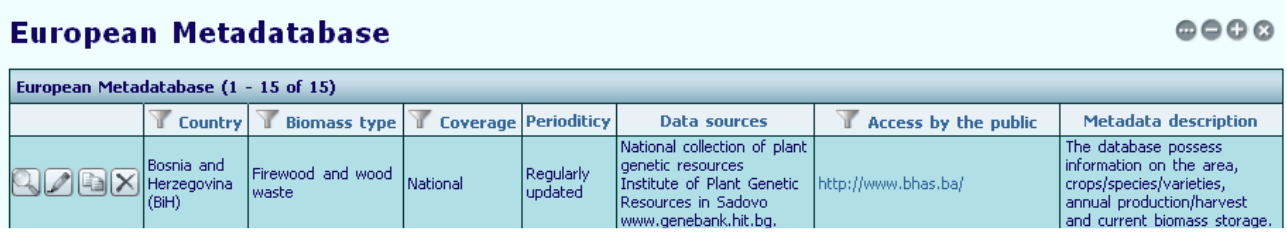


Figure 9. The CEUBIOM meta-database on the Platform

The official language is English but in order to stimulate the participation of various user groups different forms of communication (graphic and language) have been made. For example, in the WA dedicated to the Questionnaires and survey, specifically targeting on the participation of university students as well as teachers and Experts, all graphics have been changed and the contents have been translated into several languages.

While much of the initial work was mainly dedicated to the set-up of the CWE and the creation of a significant amount of contents to start-it-up and to attract new people, subsequent activities were dedicated to maximise the CWE dissemination and participation including a larger number of users, taking maximum benefit by the interaction of subjects that area external to the project (either other similar projects, such as BEE or other independent initiatives) so as to synthesise different points of view into the harmonised approach. Another fundamental outcome of the second phase of activities was to keep under continuous validation the concepts of harmonised biomass assessment approaches that were developed in the WP4.

Reports and Deliverables created in WP5
(all reports are available at http://www.ceubiom.org/deliverables/ the CEUBIOM Platform is accessible at http://ceubiom.acsys.it:8080)

D5.1 Handbook on Earth Observation Techniques for Biomass Assessment

This deliverable supports the general goal of the WP 5 activities in terms of bringing CEUBIOM knowledge to a broad range of non-expert scientists and engineers, who wish to learn more about the use of remote sensing in bioenergy assessment but lack formal education in this domain. Therefore a key objective of this document is to bridge the knowledge gap by describing in practical terms the remote sensing techniques and their application in the bioenergy assessment. Previous technical CEUBIOM publications have been reviewed and streamlined in a form that can be easily understood and followed by operators who will eventually handle the biomass data and therefore, even if not specialists of remote sensing, shall be able to understand the implications and trade-offs of the applications of certain methodologies.

D5.2 Meta-database of a reliable and common dataset on biomass potential

The biomass meta-database is a list of available reliable biomass metadata information collected from various Collaborative Working Environment CWE users of the Platform. The database is available on the CEUBIOM CWE - also referred to as the CEUBIOM Platform -, into the 'European Biomass Datasets' specific working area. The meta-database can be accessed in different ways by all type of users (registered or not) but its update is reserved to (CWE) authorized users only (all those who have requested and have been granted access to the CWE) because user authentication always is required for an active participation in the platform. In fact user authentication serves as a kind of quality control procedure, as it must be possible to trace who did any modification on the meta-database and, in more general terms to restrict uncontrolled access to it.

D5.3 Definition of gaps in European EO/biomass research and policies

The aim of this report was to identify technological gaps in European EO/biomass research and policies between the currently used and the proposed applications in order to summarize the possible challenges for a biomass assessment harmonized approach. The goal was to identify the points that need further investigation through dedicated research lines. Due to the multi-disciplinary nature of the biomass estimation task, the analysis was carried out under different perspectives and therefore the resulting report turned out to be rather heterogeneous in its list of topics. The preliminary analysis that led to the generation of this document started from a larger list of issues, and has been finally restricted to those that are most relevant in terms of gaps between state-of-the-art and the actual needs of a biomass standardised assessment approach. The following list of topics was addressed: geographic information - availability, quality and reliability; local expert knowledge data quality acquisition approaches and assessment; energy statistics; forest biomass estimation; agricultural biomass estimation using statistical approaches; EO techniques.

D5.4 Research Road Map

During the development of the CEUBIOM project a number of possible methodologies have been drawn for the assessment of the biomass for energy usage. Typically the methodologies have been set-up by finding the optimal compromise between stakeholder's requirements and the availability of data and methods. The aim of this report was to follow up the analysis which was carried out and documented in D5.3 and to define guidelines and priorities for the specific research in order to fill the described gaps. The typical point under investigation was how to substitute missing data or how to improve the available accuracy with alternative means. Priorities were defined as perceived by the stakeholders and type of research activities were defined, aimed at identifying alternative data/methodologies for filling the gaps focusing separately on forest biomass, agriculture biomass, standardization of geo-information products and improving remote sensing techniques.

D5.5 Biomass/EO Platform

This deliverable consisted of the creation and the subsequent development of the CEUBIOM Platform, also defined as the CEUBIOM Collaborative Work Environment (CWE), a Web 2.0 tool dedicated to Biomass Assessment methodologies. The final version of the CEUBIOM CWE allows user to interact by means of forums, blogs, wikis, discussion, etc. The objective of the CWE was manifold: i) allowing different stakeholders to interact and discuss about biomass assessment topics ii) allowing consortium partners to converge (with the support of external CWE users) towards an harmonised approach, and in more general terms to refine all output and deliverables of the project in a participatory approach, and iii) implement a one-stop-shop for all material related to the biomass for energy assessment.

Work Package 5 was completed in month 33. The WP was implemented according to the Grant Agreement in terms of work content and the use of resources.

4.1.2.5 Description of the main S&T results of Work Package 6

Work package 6 (WP 6) "CEUBIOM e-Training Programme Development and Deployment" started in month 13 and ended in month 33, with 37 person month in total.

The main objective of the WP was to deploy a simple but robust and cost efficient e-training programme with the overall purpose increasing the efficiency of project dissemination by reaching a wider audience..

Two Deliverables were foreseen:

D6.1 E-training Curriculum
D6.2 E-Training Course

Activities and results

The main objective of the e-learning was to increase the dissemination potential of the results by bridging the gap between the developed new concepts and the stakeholders. Anyone who now uses this e-learning programme will have better knowledge on what the state of the art remote sensing methods to assess biomass potential and how can those methods be used to derive useful information in order to estimate bioenergy from biomass sources. Moreover the developed e-learning facility gives an insight to what terrestrial (other than remote sensing based) methods have been used to estimate bioenergy in agriculture, forestry and industry. The CEUBIOM project activities covered 15 European countries thus the accumulated materials and derived e-learning curriculum gives comprehensive knowledge of past and current biomass assessment methodologies.

WP 6.1 Setting up e-Learning software environment

The coordinator decided to change the originally planned e-learning management system software. The Course Management Module called "Moodle" was originally suggested to use because it's a free software package. During the process of the project after evaluating the needs of the e-learning user community and the usability and effectiveness of this on-line tool, it was decided that a newly developed e-learning environment would serve better the needs. The decision on changing e-learning software environment did not have any negative effect on the project implementation in fact this decision was made because it offered a more logical solution and better adaptability to project purposes. As a result of planning and work that the IT department put in this sub-task, the demonstration course that was launched in month 26, became more rationalised and focused in functionality thus more user-friendly than the originally planned customised Moodle. During the second stage of software development a home specific page was planned and designed by technicians, which started to operate in Month 26. Trough this initial home page the user is now able to log in to the e-learning facility, with a pre-given user name and password. After login the user can access the training shell.

The main goal with this e-learning facility, is not to teach "the student" to be able to perform estimation of biomass for bioenergy but to teach what is needed to understand assessment methods which aims to assess biomass for bioenergy. To reach this objective, students are able to access information from the various work phases of CEUBIOM project. General information on remote sensing, earth observation products and different types of terrestrial methods are all included in an easy-to-understand manner by this distance learning tool.

WP 6.2 Developing e-Learning curriculum

To meet with internal deliverables and to fulfil contractual deliverables with the EC Geonardo started building the curriculum already in Month 14, parallel with programming and system engineering. Mrs Izabella Pinter, holding a master degree teaching in geography, was in charge to draft an initial curriculum that later was supplemented and extended several times. The base materials to initiate the draft curriculum were:

WP2

- Deliverable 2.1
- Deliverable 2.2
- Deliverable 2.3

WP3

- Deliverable 3.1
- Deliverable 3.2

The first draft the curriculum was released in Month 18 and it was available at a public domain from the very beginning:

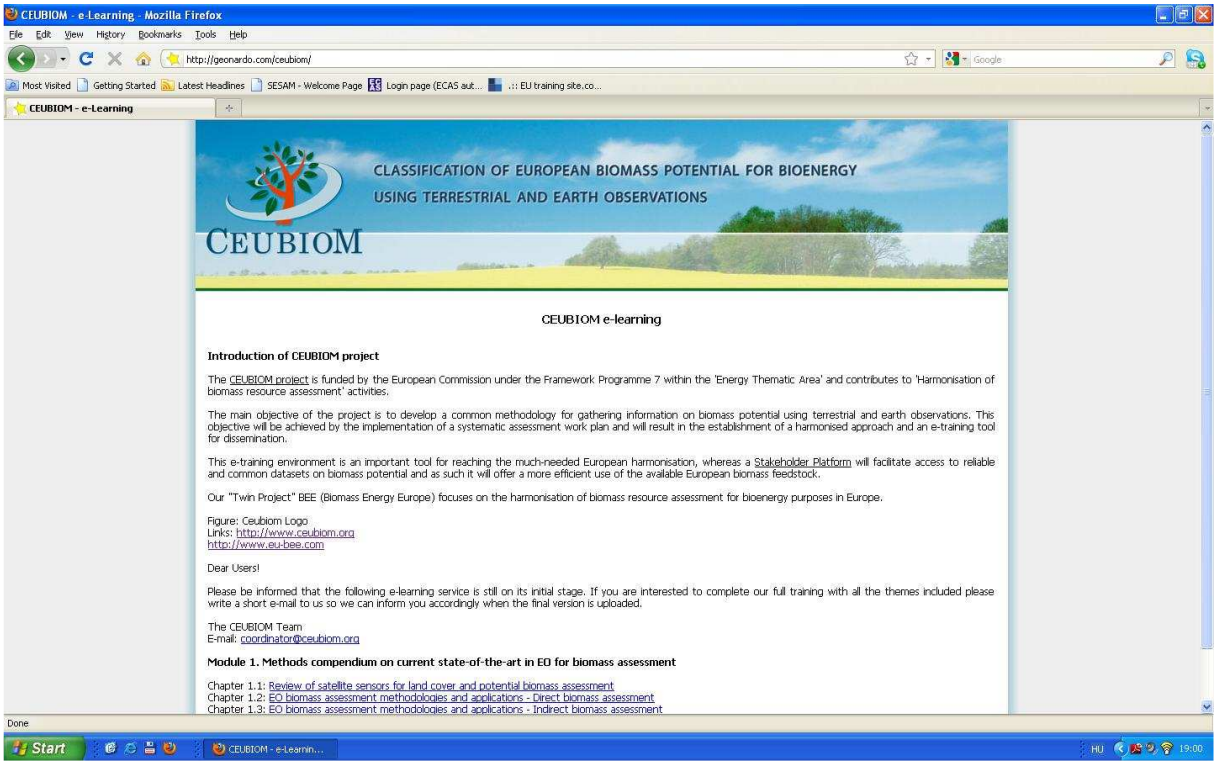


Figure 10. Interface of the initial draft e-learning curriculum

Different sections were allocated in the e-learning curriculum to biomass experts and remote sensing processing experts, so that these two groups can both learn something new. The Initial Curriculum that was released consisted 2 main Sections. Section I was based on WP2 materials dedicated to e-learning users who are interested in more knowledge on RS and image processing. Section II was for those users/students that are not quite familiar with current terrestrial assessment methods for biomass estimation. Accordingly the initial table of contents was set up the following way:

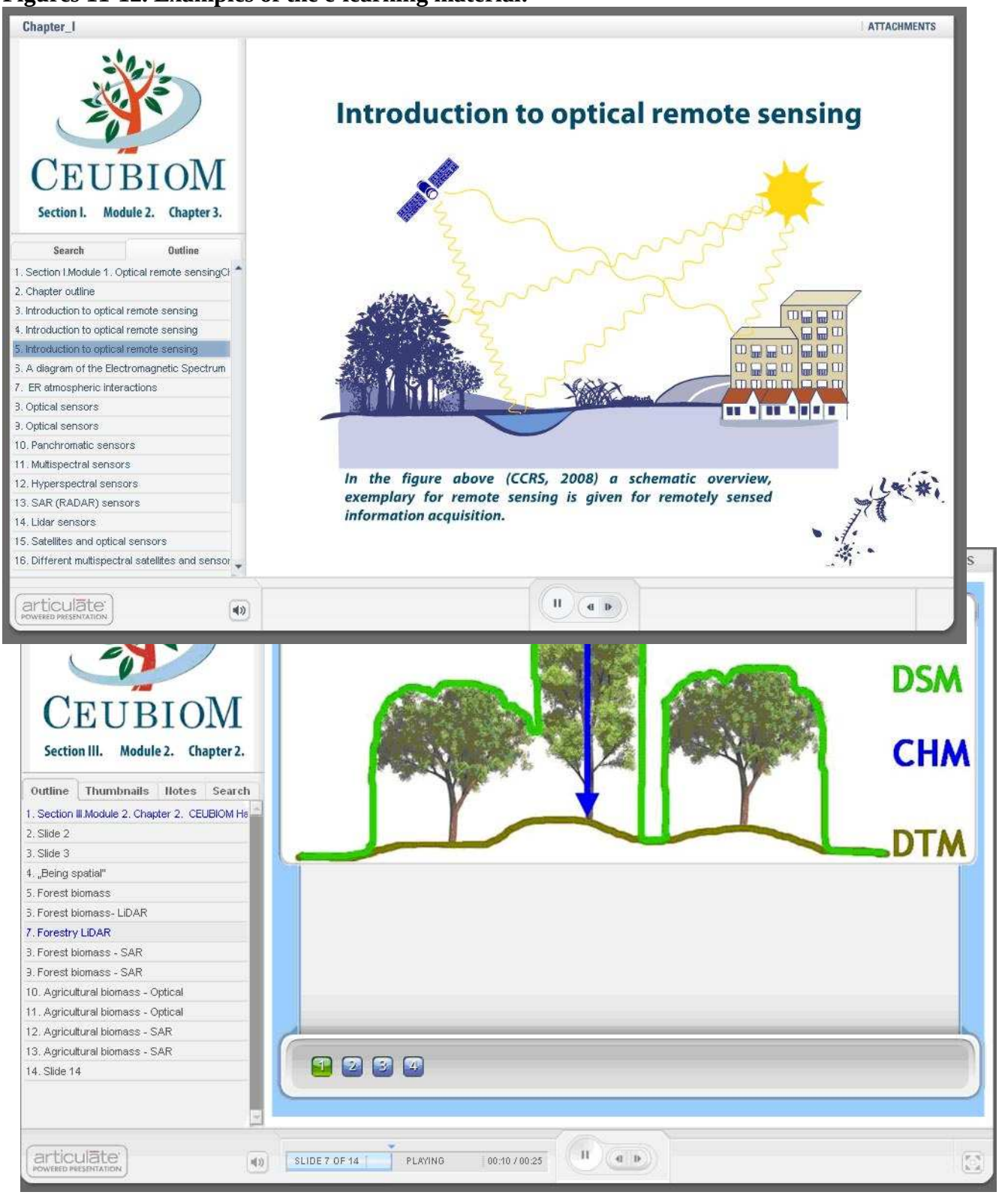
Section I. - Streamlining research results into a common methodology for using EO biomass potential assessment (WP2)

Module 1. Methods compendium on current state-of-the-art in EO for biomass assessment

Module 2. Study on SAR potential for direct biomass assessment
Module 3. Recommendations on EO data for European users

Section II. Current Terrestrial Methods and Activities for Biomass Potential Assessment (WP3)
Module 1. Pan-European Methods
Module 2. Visualising terrestrial methodologies in South Eastern Europe

Figures 11-12. Examples of the e-learning material:



The curriculum was under continuous development until the end of the project, growing as materials accumulated during the implementation of WP4 and WP5. In the last significant development period of the e-training programme the strength of a very powerful tool had been exploited. The education material had been extended with additional audio component. After the studio works the audio material was integrated under the slides of the e-training chapters. More than 86 Megabytes of audio files were recorded. The last versions of the chapters were therefore released with audio and visual additions. Voice files were rendered to almost half of the total number of slides. The visual extensions included flash animations and interactive annotation layers. In addition, quizzes had been constructed with the help of the contributing partners. The quizzes were designed to update the e-training users after the modules therefore they can be found after the respective modules. The questions of the quizzes refer to each of the corresponding chapters.

Parallel to the development of the e-learning curriculum extensive marketing campaign was conducted in order to inform potential users about the training. The effort of the Consortium members was honored with hundreds of users who decided to take advantage of the services of the e-training (towards the end of the project around 300 students completed the training). Please find a graph below about the distribution of the users by country.

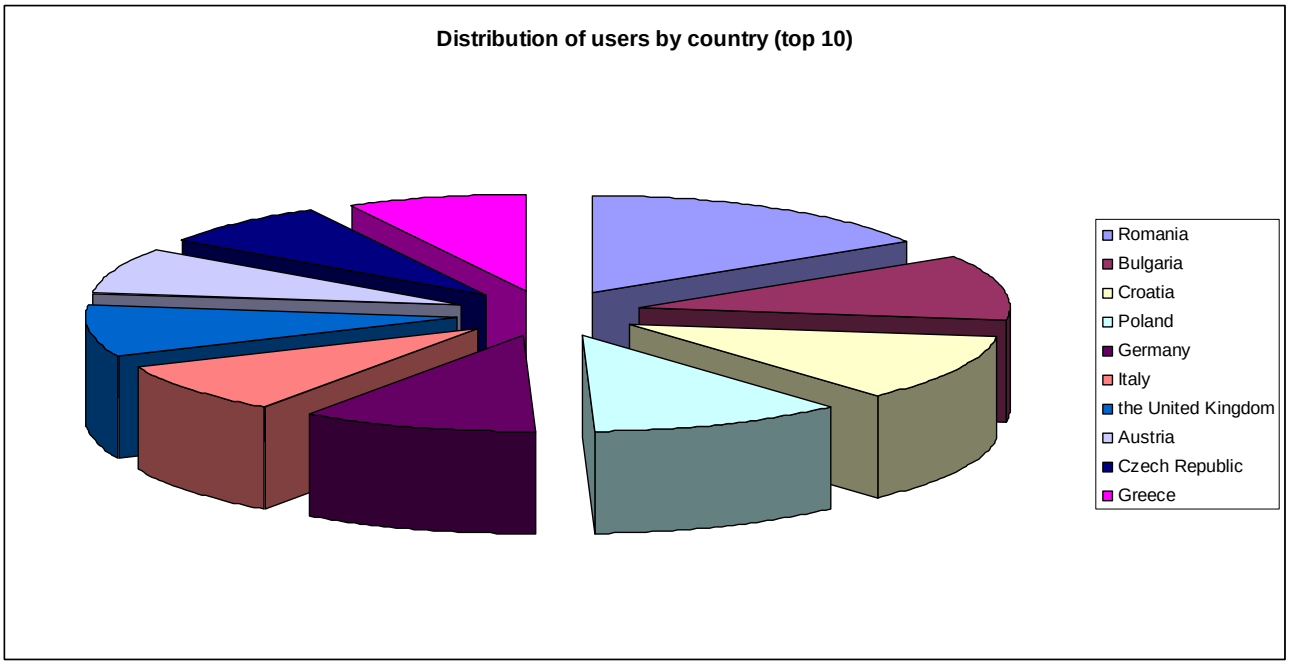


Figure 13. Top 10 of 244 e-learning participants by country (as of 8 November, 2010.)

The last phase of the curriculum development was the deployment of a new section (Section 3) that was exclusively based on the CEUBIOM methodological framework. The finalization of these chapters took place after the Final project meeting in Brussels where the final version the WP4 Harmonized Approach was presented by Partner No 7 - JR. The development of the corresponding chapters was a collaborative effort.

WP6 produced two Deliverables during its implementation:
(all reports are available at http://www.ceubiom.org/deliverables/
the e-learning programme is available at www.geonardo.com/ceubiom)

The e-learning training course consists of three Sections, seven Modules and eighteen Chapters. There are four "Test your knowledge" applications following four Modules in the curriculum.
The structure of the e-learning curriculum is highly flexible thus can be personalised to anyone who uses it. It was designed to serve both the biomass/bioenergy experts' and the EO specialists' needs in order to extend their knowledge in the field of biomass potential assessment. Technically speaking, the users are able to use only one chapter to enhance their expertise but one can finish the whole course if this type of information is new to him/her.
Thus **"completing the e-training"** could mean different scenarios. The participants did not have to complete all Sections or Modules to officially complete the e-learning, they signed up for those parts only that fit their interest. I.e. one user could be interested only for "SAR remote sensing" so read this module, while another user might have been seeking for "End-user requirements" that is only a single chapter.

CEUBIOM did not measure how many users finished how many sections, only the total number of signed up users who started at least one section of the training (feedbacks and analyses of e-learning database see below).
Nevertheless, the project received several positive feedbacks after the release of the e-learning that provided us satisfaction that many of the users consider it a useful tool and they can benefit from the provided knowledge. Some quotation from the mailings:

"Dear CEUBIOM representative,
thanks for the link.
I am the member of the GISIG consortium (see http://www.gisig.it), so maybe your offer could be extended to other members of the consortium.
Regards
P. Fabian"

"Dear Madam, Sir
Thank you for the kind invitation to try the new CEUBIOM e-learning course on how remote sensing can be used for assessing biomass potential.
Here in VEDA we appreciate very highly every learning& knowledge capacity building opportunity. From the first look on the program it seems very. We would like to ask if it is possible to disseminate information for the course among other VEDA staff/members/partners in order other interested in the topic persons to be involved as well. Thank you in advance.
Best regards"

Dear CEUBIOM Coordinator,
Indeed, that's a very interesting course, thank you for your offer.
Best regards, Dimos

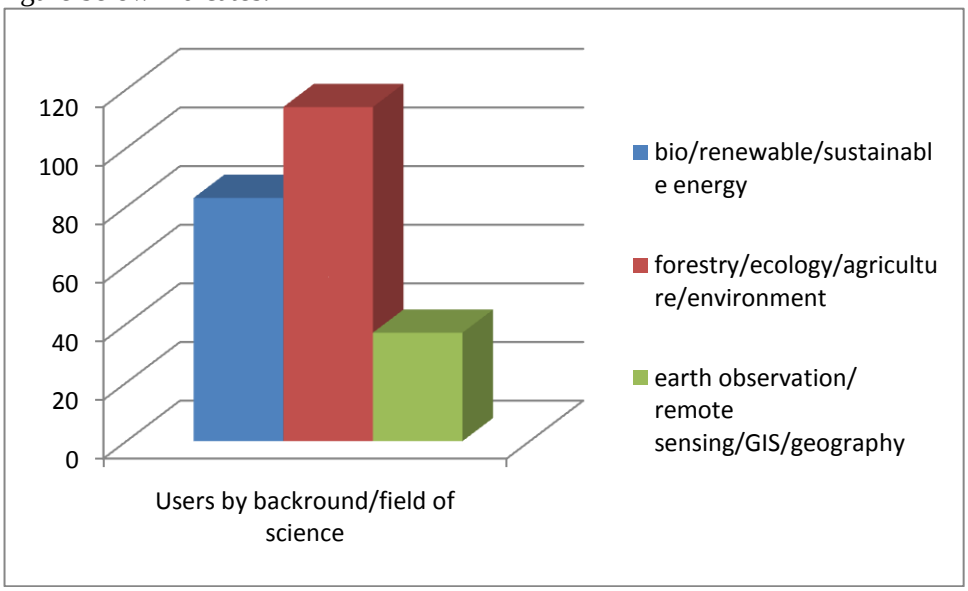
Additionally of course we measured the statistic of the website (www.ceubiom.geonardo.com) by web stat application. The number of "unique visitors" (approximately 300) confirms the absolute number of the registered users. The number of registered users multiplied with the average length of visit on the website is around 8000 minutes (based on web stat), which means an average 32 minutes spent on e-learning per users. Given that approximately 4 minutes (together with audio content) is needed to complete any of the chapters, it means that around 50% of the total training material was read by every users (32min of av. length of visits/4 min for every chapter = 8 chapters read out of 18).

It would also be convenient to provide more detail on the profile of these students, notably regarding their background and occupation.

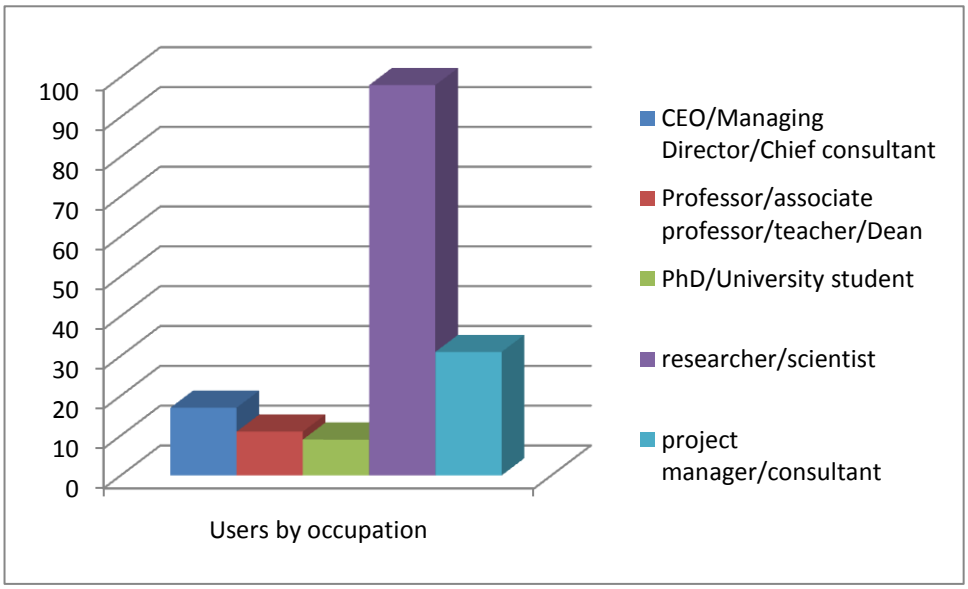
Please note, that not all registered users could be included in the following statistics due to missing fields in their registration profile or not sufficient information in the respective field!

1, USER PROFILE

Collecting and analyzing the user profiles and user details from the e-learning, we were able to prepare the following quantified answers for the above request. The first figure shows the background and/or the field of science of the registered people. We grouped the users into three main categories as the figure below indicates.

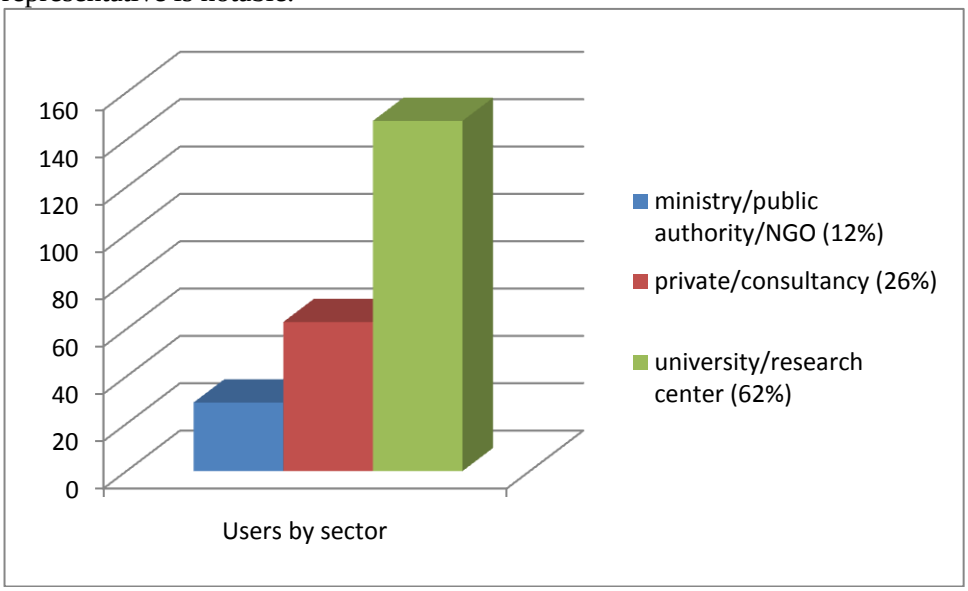


The statistic on the occupation of the users shows nothing unexpected. Most of the e-learning users indicated their position as "scientist" or "researcher". Teachers and students (including PhD) are among the registered people as well.



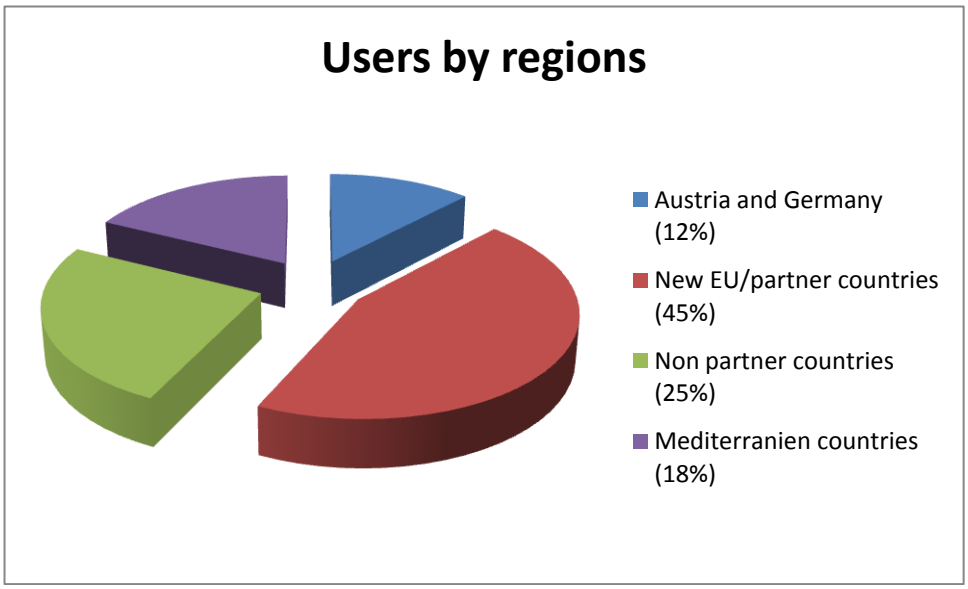
2, SECTOR

The "Users by sector" figure shows the dominance of the RTD sector among the CEUBIOM e-learning users. This can be correlated with the "nature" of the partnership of the Project's beneficiaries' network, that is obviously "research" type, but the high number of the private sector representative is notable.



3, GEOGRAPHIC DISTRIBUTION

Finally the "Users by regions" statistic also bears achievements. Since the majority of the Consortium came from "new member states" the biggest portion of the registered e-learning users originating from these countries. However CEUBIOM could make a quite significant impact in other EU countries such as in France, Sweden or in the UK (non partner countries – 25%). The absolute number of users from Austria and Germany (24 ~ 12%) is also significant.



D6.1 E-training Curriculum

The released initial curriculum consisted text taken from deliverables of WP2 and WP3 customised specifically for the purpose of the e-learning facility. Beside text picture and figures were also taken from the deliverables for illustrating the main points of single parts of the learning material. Also tables were inserted for better understanding of message of text material. The developers not only used materials from the deliverables (text, figures, pictures, tables) but also used materials available on public domains and resources in its own property (raw and processed RS images, etc.) that can help the fast take up of e-learning by users/students.

D6.2 E-Training Course

The Initial Curriculum was converted into a comprehensive training course, adding all possible functionalities that are customary in e-learning including audio and animations. After the studio works the audio material was integrated under the slides of the e-training chapters. More than 86 Megabytes of audio files were recorded. The last versions of the chapters were released with audio and visual additions. Altogether voice files were rendered to almost half of the total number of slides. The visual extensions included flash animations and interactive annotation layers. The course is fully operational and maintained by the Coordinator free of charge.

All in all WP6 was implemented according to the Grant Agreement in terms of work content and the use of resources.

Work Package 6 was completed in month 33. The WP was implemented according to the Grant Agreement in terms of work content and the use of resources.

4.1.2.6 Description of the main S&T results of Work Package 7

Work package 7 (WP 7) "Dissemination" started in month 1 and ended in month 33, with 45 person months in total.

The objective of this WP was to disseminate information about the project, its objectives, the approaches and results through electronic and traditional methods.

Eight Deliverables were foreseen:

D7.1 Website

D7.2 Interactive CD

D7.3 Brochure1

D7.4 Brochure2

D7.5 Brochure4

D7.6 Newsletters

D7.7 Popular Science Publication for the Public

D7.8 International Symposium and Stakeholder Event

WP 7.1. Website

The CEUBIOM site was created by the Information Department of MAICh and is available at http://ceubiom.org/ since March 2008.

The website contains:

- Consortium structure, list of partners and contact points.
- A restricted access page available to the partners, for communication/exchange of files.
- Network of stakeholders from each partner
- The latest issues of brochures and newsletters.
- Occurrences of dissemination of the project by its partners to conferences and meetings (can be found in 'News' page of the CEUBIOM site).
- Announcements of relevant future meetings that partners could attend.
- Reports/Minutes of the kick-off, interim and final meetings (accessible only to partners).

The efficiency of project promotion is also visible on the Internet with over 10 thousand hits to the search word "CEUBIOM" and the project webpage being first on the hit list:

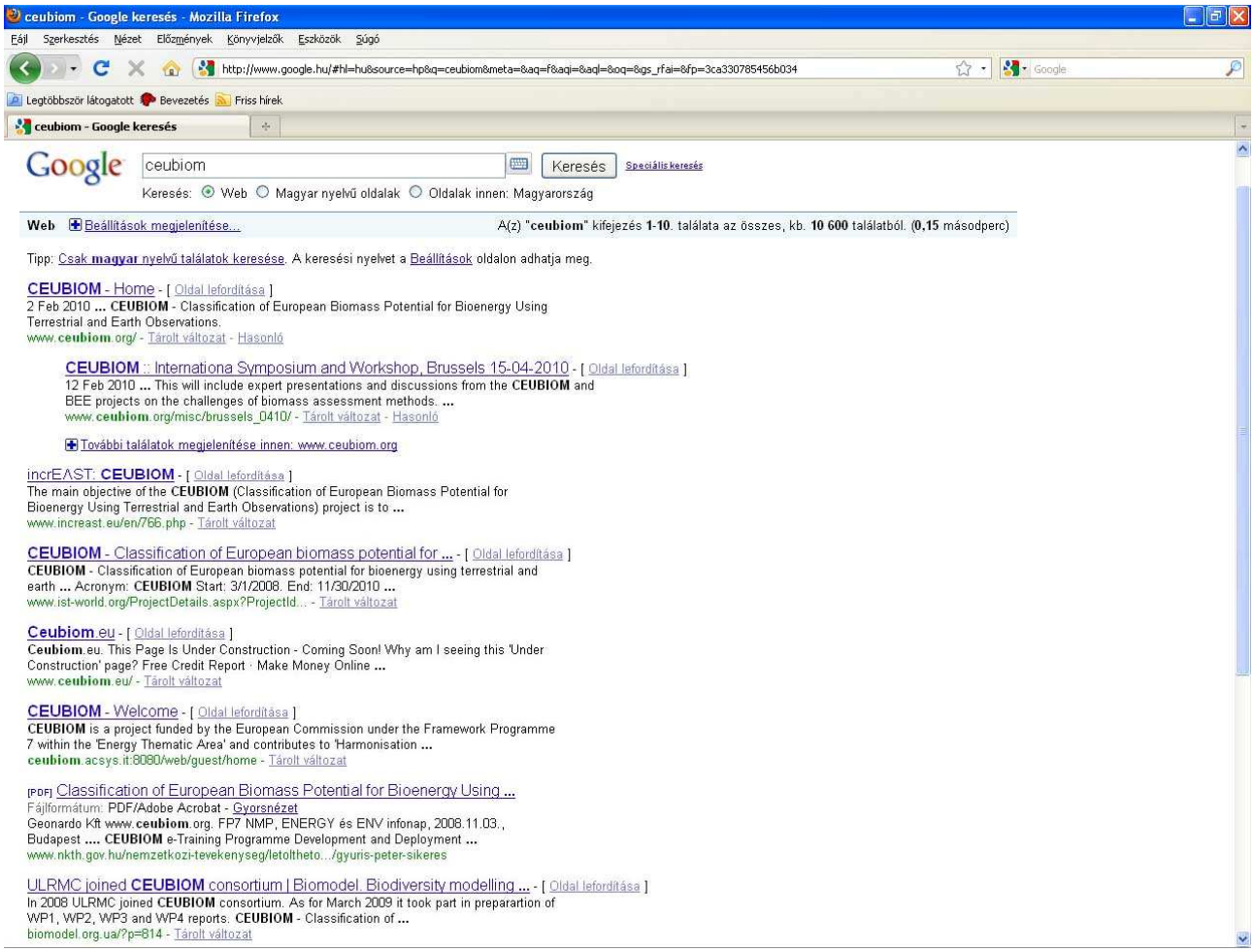


Figure 14. Google results to the search word "ceubiom"

The CEUBIOM website was updated continuously during the entire project period and even a new interface was created (Partners Area) to improve the functionality of communication in the consortium. The website served as a location for the submission of registrations for the "International Symposium on Biomass Assessment Methods" and also served as a means to reach the public, during the process of requesting feedback for the deliverable on the harmonised biomass assessment method of WP4 (Draft version of D4.3).

WP 7.2. Common Dissemination Activities

The MAICh team created a draft project logo which was sent to the partners and following minor modifications the final version was delivered by the beginning of March 2008.

A. Brochure

A draft version of the first issue of project's brochure was prepared by MAICh team, circulated to the partners for input and the final version was printed at MAICh Graphic and Art design unit. Each partner received 30 hard copies of the brochure in order to be distributed to stakeholders relevant to the objectives of the project.

- Translation of the first brochure to the partners' languages finalised on 16/04/09.
- On April 2009 the CEUBIOM network and the translated versions of the 1st brochure were uploaded on the web site.

- In June 2009, the Graphic Art and Publishing Department of MAICh printed out the BEE brochure and copies were sent to CEUBIOM consortium. Additionally, copies from CEUBIOM brochure were posted to the BEE consortium.
- First draft of the second brochure was developed by MAICh team and circulated to the partners for reviewing during February 2010. The finalized version is uploaded in the CEUBIOM website and translation to the partners' languages is also available.

B. Newsletters

The first issue of Newsletter was ready by the end of May 2008 while the second issue was released on February 2009. Both issues are available on the website and are accessible to the public. A very successful joint newsletter with the BEE consortium was released on September 2009. Report about the project and the meeting in Budapest in the Joanneum Research Newsletter No. 13 on South-East European activities sent out to approx. 400 persons in 24 countries.

C. Presentations

- The team of JR presented an abstract about CEUBIOM to a conference on energy that took place in Graz, Austria from 29 June to 2 July 2008 (http://www.aes08.tugraz.at)
- MAICh team presented a relevant paper and a poster to the 28th Symposium of the European Association of Remote Sensing Laboratories (EARSeL), which took place in Istanbul, Turkey between the 2nd and 5th of June 2008 (www.earsel28.itu.edu.tr).
- Mr Balazs Bodo (Project's Coordinator) presented the ambition, the objectives and the work-packages activities of CEUBIOM project in the 7th Balkan Power Conference that took place in Šibenik, Croatia, 10 - 12 September 2008.
- The project was presented by FER team at the Workshop related to "Climate Change III in South-Eastern European Countries: Causes, Impacts, Solutions" which took place on 18th and 19th September 2008 in Graz, Austria (http://www.janneum.at/climate/Workshop%20Graz/Workshop.html).
- Ms Nicoleta Ion (ENERO) presented a paper titled as "Modern Methodologies for Identifying the Energetic Biomass Potential. The European Project CEUBIOM" to the "Green Energy: An Alternative for Sustainable Development 2008-2025" Symposium that took place on 6th November 2008, in Bucharest.
- The project was presented by FER team at the – International Conference of "Forestry and wood biomass in Croatia" that took place on 1th and 2nd December 2008 in Vukovar, Croatia.
- The CEUBIOM project was also presented by the Coordinator team (GEO) to the FP7 Untold Stories II event that took place in Budapest, 4-5 December 2008.
- Mr. Peter Gyuris (GEO) gave the following presentations about the project:
- National Office for Research and Technology event: FP7 NMP, ENERGY and ENV infoday (03.11.2008, Budapest).
- Hungarian Investment and Trade Development Agency (ITDH) event: From Clasters to the FP7 Programmes of the EU (03.02.2009, Budapest).
- Nagykanizsa (Hungarian city) and its Region GIS Association event: 8th GIS conference in Nagykanizsa (12.03.2009, Nagykanizsa) (http://unsdihu.blogspot.com/
- Mr. Cristian Tantareanu (ENERO) presented the CEUBIOM project to the Romanian National Seminar "Mechanisms for Development of National Strategies and Action Plans in the Biomass Field" that took place on 29th January, in Bucarest.
- Project partner SIEA presented CEUBIOM at several energy-related conferences and trade fairs including Racioenergia Bratislava 31. 3. - 4. 4. 2009, For Energo Banska Bystrica

21.04.2009 - 24.04.2009, Aquatherm, Nitra, 09.02.2010 - 12.02.2010. CEUBIOM leaflets were also distributed during above-mentioned trade fairs.

- Mr. Gyuris (GEONARDO) presented CEUBIOM project to a meeting that took place in Budapest on 02/03/2009.
- Mr. Gyuris (GEONARDO) presented CEUBIOM project to the "Geospatial Hungary" meeting that took place in Nagykanizsa on 12/03/2009.
- Dr. Zianis (MAICh) was invited to present CEUBIOM project to the Research Connection meeting of EC in Prague 08/05/09 within the session of "Energy Research for a sustainable energy system". The presentation titled as "Experience gained from CEUBIOM project".
- A poster was presented in the 29th EARSeL Symposium (15-18 June, 2009) by Dr. Kalaitzidis (MAICh), Dr. Heinzel (RSS) and Dr. Zianis (MAICh). The content was derived from the report on vegetation indices used from optical satellites.
- Dr. Aladjadjiyan (BGBIOM) presented the "Assessment of Biomass-for-Energy-Potential in Bulgaria in frames of CEUBIOM Project" to the International Conference of Balkan Environmental Association (15 – 16 June 2009, Tekirdag).
- Dr. Aladjadjiyan (BGBIOM) presented the "Current State of Biomass-for-Energy-Potential Assessment in Bulgaria" to the International Conference of Young Scientists (18 – 19 June 2009, Plovdiv).
- In May 2009, Project partner XCZ participated in the International water management and ecological fair (WAT Envi Brno) and made informational campaign about CEUBIOM project. Project promotional materials (leaflets) were distributed. CEUBIOM project has also been promoted in workshops and events organized by XCZ.
- Max Lauer (JR) presented WP3 results of CEUBIOM project to the 17th European Biomass Conference and Exhibition in Hamburg, June 29th to July 3rd 2009
- Dr. Pašičko (FER) presented a paper titled as Project "CEUBIOM and sustainable biomass use" to the "Climate Change in South-Eastern European Countries IV: Adaptation Strategies for Economy and Society" meeting which was held in Zagreb, on the 19th and 20th October 2009.
- Dr. Hirschmugl (JR) presented the Ceubiom Project at the Intelligence Energy Europe (IEE) contractors meeting in Brussels, 8-9 December 2009.
- CEUBIOM was presented at the "Climate Change in South-Eastern European Countries" workshop which was held in Zagreb on 19th and 20th of October 2009. CEUBIOM was also advertised ad some local websites such as i.e. My Energy Web Portal[2] and Forest Biomass web page[3].
- Mr. Bojan Rantasa presented CEUBIOM project at the CEEWEB Academy on Biomass that was held in Esztergom, Hungary on 9-10 May, 2008.
- Mr. Bojan Rantasa presented CEUBIOM project on June 16, 2008 at the Sector for Spatial Information System of the Ministry of Environment and Spatial Planning.
- Mr. Bojan Rantasa presented CEUBIOM project on June 27, 2008 at the Macedonian Center for Energy Efficiency – MACEF.
- Mr. Vlatko Andonovski made a presentation of the CEUBIOM project during the VI European Mountain Convention – How to generate added value from the Europe's mountains, which was held from 8 to 10 October, 2008 in Brig, Switzerland.

[2] http://www.mojaenergija.hr/index.php/me/Knjiznica/Teme/Obnovljivi-izvori-energije/Izvori/Biomasa/Biomasa-u-Hrvatskoj

[3] http://www.sumska-biomasa.hr/medunarodna_suradnja.asp

- Mr. Vlatko Andonovski on May 20, 2009 made a presentation of the CEUBIOM project to the staff of the Unit for Energy Efficiency within the Energy Department of the Ministry of Economy.
- Mr. Dragi Pop-Stojanov on June 9, 2009 made a presentation of the CEUBIOM project was for the Public Enterprise “Macedonian Forests”.
- Mr. Vlatko Andonovski presented the CEUBIOM project, its objectives and the work done on the Energy Week Macedonia 2009 that was held from October 13-17, 2009 in Skopje, Macedonia.
- Mr. Vlatko Andonovski presented the CEUBIOM Project during the International Forum on Energy Efficiency – Regional Cooperation of the Macedonian Energy Week that was held from December 11-17, 2009 in Skopje, Macedonia.
- Mr. Vlatko Andonovski gave a short presentation of the CEUBIOM Project during the first meeting of the Forest Energy Action (COST Action FP0902) - Development and harmonization of new operational research and assessment procedures for sustainable forest biomass supply, held on 27 □29, January 2010, at the Technical University of Applied Sciences in Berlin, Germany.
- Mr. Dragi Pop-Stojanov presented the CEUBIOM Project on the Workshop on Energy Efficiency and Renewable Energy Resources in Macedonia that was held on October 30, 2009, and organized by the University American College in Skopje. During this workshop BFSD distributed to the participants the CEUBIOM brochures translated into Macedonian language (attached).

Additionally, IGiK partner presented CEUBIOM project and results derived from WPs to the following meetings:

- 29th EARSeL Annual Symposium "Imagin[e,g] Europe"; Chania, Greece; June 15-18, 2009; organised by MAICh - Mediterranean Agronomic Institute of Chania & EARSeL. Poster presentation “Study on Synthetic Aperture Radar potential for direct biomass assessment”.

- V National Symposium on Spatial Data: “Geosciences for the Environment and Society - Research and Application”; Krakow, Poland; September 17-19, 2009; organised by PAU Commission on Geoinformation and Department of Geographical Information Systems, Cartography and Remote Sensing of Institute of Geography and Spatial Management, Jagiellonian University. Brochure distribution.

- International seminar “Energy Crops - Creating Markets for Heat and Electricity”; Pulawy, Poland; September 21-22, 2009; organised by Institute of Soil Science and Plant Cultivation, under the patronage of Minister of Economy, Minister of Agriculture, Minister of the Environment. Presentation on “Remote Sensing for Energy Crops Monitoring.

- Workshop for “Energy Crops in Water Management and Nutrient Circulation”; Turew, Poland; March 23-24, 2010; organised by the Institute for Agricultural and Forest Environment (IAFE) of Polish Academy of Sciences, Research Innovation Group Sp. z o.o. and Lantmännen Agroenergi AB. Presentation of our activities on CEUBIOM project.

A small and concise article on the methods of producing bioenergy from biomass and estimating biomass with the methods proposed by CEUBIOM, was also prepared and it was translated in the native languages of the partners participating in the project (D7.7). Each partner has taken the initiative to forward the article to any available means of publication, particularly energy- or science-related websites, newspapers and magazines. The process is still on going and likely to continue after

the end of the project, as popular press does not easily accept external contributions. A great number of on-line publications have already been made.

WP 7.3 Joint Dissemination Activities with BEE

The first meeting between the BEE and CEUBIOM Dissemination WP leaders was held during the kick-off event in Freiburg, March 2008 and the following common dissemination goals were set:

- Cross reference to the projects' websites.
- A small info-box in brochures and newsletters providing information about the other project.
- Co-operation in building up the stakeholder network for coordinated contacts and dissemination activities.
- When only one of the projects is represented in any conference or other event, also the other project's brochures, newsletters, posters, etc. are disseminated by the participating project.
- A separate dissemination meeting between Dissemination WP leaders during all common BEE-CEUBIOM meetings.

All of the above-mentioned objectives were accomplished and a truly meaningful collaboration has been established between the Coordinators of the two projects in relation to common dissemination efforts and the alignment of findings:

Common dissemination activities

- Joint news letter: Successfully implemented.
- Exchange of promotion material: Done.
- Joint public events: Successfully implemented on 4 occasions (Freiburg, Germany 13-14 March, 2008; 1 April 2009, Budapest, Hungary; 15 April 2010, Brussels, Belgium; 8 November 2010 Brussels, Belgium)

Alignment of findings:

- Exchange of deliverable documents: Done.
- Comparison of results based on desktop comparison and integration of cross references: Done
- Integration of cross references planned for the final issues of the major deliverables during the last project period: Done.

The most important tool in CEUBIOM-BEE cooperation has been the instrument of "joint public sessions" and events organized together.

- The first joint event was organized connected to the Kick-off meeting in Freiburg, Germany 13-14 March, 2008. This event was Session was organised with BEE consortium partners and other invited organisations with the Project Officer also present. On the second day WP2 and WP3 Parallel Workshops took place on the working procedure and strategy. Dissemination strategies were discussed together with BEE project partners.

- The second public joint session between BEE and CEUBIOM took place on 1 April 2009 connected to the progress meeting in Budapest. This public session was addressed to users of biomass resource assessments, as well as to scientists, experts and other stakeholders interested in and working on the development and harmonisation of the methodology for biomass resource assessment, with a specific focus on the use of biomass as energy resource. In order to achieve the objective of harmonisation, the two project teams seek and offer information exchange and interaction with third parties that are interested in an increase of the information quality in this field. The public session opened with short project

presentations by the coordinators of the twin projects CEUBIOM (Mr. Balazs Bodo) and BEE (Mr. Matthias Dees). During the joint public session, some other bioenergy related projects were presented, e.g. the IEE projects BIOENERGIS, BEN and MAKE-IT-BE (presented by Allessandro Chiesa from Cestec) and the projects AQUATERRE (Steinar Rafn Beck), RISE (Iztok Zlatar) and EuUwood. Additionally, the projects GENESIS, AGROSENSE and NoE Bioenergy were shortly presented by attendees of the public session. Another topic of the joint session was the presentation and discussion on work package level by Manuela Hirschmugl (CEUBIOM) and Edward Smeets and Martijn Vis (BEE).

- The third event in dissemination activities (D7.8) took place during the 3rd period of the project. On the 15th of April 2010 the "International Symposium on Biomass Assessment Methods" was organised by the CEUBIOM project, with the assistance of the BEE consortium, in the building of DG RESEARCH of the EC, in Brussels, Belgium. A total of 75 participants from countries around Europe attended the symposium, representing the academia, the industry and policy makers. The agenda included presentations of the two projects, CEUBIOM and BEE, preceded by presentations of Mr. Christopher Prins on the availability of wood for energy, Dr. Berien Elbersen on assessment of biomass potential from energy crops and an overseas perspective from Dr. Ralph Overend, on the physical resources and policy support for bioenergy and biofuels in the USA. Contributions from the participants were provided by Luis Esteban, Uwe Fritsche and Orjeta Jaupaj, presenting various European projects and national initiatives. The symposium was followed by the EC Workshop workshop on "Common view on biomass feedstock availability for the European industrial bioenergy initiative", organised by the EC at the same location on the 16th of April 2010. The CEUBIOM project was presented during that workshop as well.

- The fourth and final event was organised again in Brussels. On the 8th of November 2010, the BEE project organised a "Conference on Biomass Energy Potential Assessments" in Brussels, Belgium, with the assistance of the CEUBIOM consortium. This was an opportunity for the CEUBIOM project to present its final results, primarily on the harmonized biomass assessment method, the research road map and the e-learning module produced by the project.

Finally, the two Coordinators agreed to submit a joint recommendation towards harmonised assessment of biomass for bioenergy after the end of the project.

Work Package 7 was completed in month 33. The WP was implemented according to the Grant Agreement in terms of work content and the use of resources.

4.2 Use and dissemination of foreground

The aim of the CEUBIOM project has been to develop a public-domain (i.e. unpatented, open to everyone) harmonized approach for national level biomass assessments for energy by combining terrestrial methods with remote sensing based applications with an emphasis on South-Eastern European and Western Balkan countries. The underlying reason for this work has been the fact that national results of national surveys often provide incomparable and heterogeneous results that are difficult to be used for consolidated actions or political decisions. Thus the harmonization of the methods/work processes is essential especially on a national/European level.

Project results include publicly-accessible studies, documents and clear guidelines on how biomass potential assessment could be undertaken in terms of methodologies, input data, biomass types considered, area covered, assumptions and boundary conditions, etc. All these results (including the website, the e-learning course and the published Deliverables) are offered for use without restrictions to the professional community and the interested public.

Section A (public)

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
NO.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers[4] (if available)	Is/Will open access[5] provided to this publication?
1	CURRENT TERRESTRIAL METHODS AND ACTIVITIES FOR BIOMASS POTENTIAL ASSESSMENT IN EUROPE	*M. Lauer*	*Biomass Conference Hamburg June 2009*	*Proceedings, ISBN978-88-890407-57-3*	*ETA Florence*	*Florence*	*2009*	*n.a (DVD)*	*ISBN978-88-890407-57-3*	yes
2	*Current State of Biomass-for-Energy-Potential Assesment in Bulgaria*	*Nikolay Kakanakov*	*Scientific Research of the Union of Scientists, Plovdiv,*	*Vol.XII, 18 – 19 June 2009, 3-rd INTERNATIONAL CONFERENCE OF YOUNG SCIENTISTS*	*Union of Scientists*	*Bulgaria, Plovdiv*	2009	*pp.38-41*		yes
3	*Harmonization of Methods for Information Collection about Biomass for Energy in European Union.*	*Anna Aladjadjiyan*	*Scientific works of the Agricultural University*	*No.2, Vol.LV 14-17 October 2010*	*Academic publishing House of the Agricultural University*	*Bulgaria, Plovdiv*	2010	*pp.315-320*		yes

[4] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

[5] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES

NO.	Type of activities[6]	Main leader	Title	Date	Place	Type of audience[7]	Size of audience	Countries addressed
1	*Web*	MAICh	*Project Website*	March 2008				
2	*Flyers*	MAICh	*1st Brochure*	April 2008				
3	*Flyers*	MAICh	*1st Newsletter*	June 2008				
4	*Poster*	MAICh	*28th symposium of the European Association of Remote Sensing Laboratories (EARSeL)*	2-5 June 2008	Istanbul, Turkey	Scientific Community	200	All European Countries
5	*Workshop*	JR	*6th Biennial International Workshop Advances in Energy Studies*	29 June - 2 July 2008	Graz, Austria	Scientific Community	50	Austria
6	*Flyers*	MAICh	*2nd Newsletter*	December 2008				
7	*Presentation*	GEONARDO	*Geospatial Hungary*	12 March 2009	Nagykanizna, Hungary	Scientific Community, Industry, Policy Makers	50	Hungary
8	*Meeting*	GEONARDO	*Joint information day, public session and discussions*	31 March 2009	Budapest, Hungary	Scientific Community	50	All European Countries
9	*Presentation*	MAICh	*Research Connection (EC)*	8 May 2009	Prague, Czech Republic	Scientific Community	100	All European Countries
10	*Poster*	MAICh, IGIK	*29th symposium of the European Association of Remote Sensing Laboratories (EARSeL)*	15-16 June 2009	Chania, Greece	Scientific Community	200	All European Countries

[6] A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

[7] A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias ('multiple choices' is possible.

11	*Poster*	BGBIOM	*International Conference of Young Scientists*	18-19 June 2009	Plovdiv, Bulgaria	Scientific Community	50	Balkan Countries
12	*Flyers*	EFI, MAICh	*Joint Newsletter with BEE project*	September 2009				
13	*Conference*	FER	*Climate Change in South-Eastern European Countries IV: Adaptation Strategies for Economy and Society*	19-20 October 2009	Zagreb, Croatia	Scientific Community	50	Balkan Countries
14	*Poster*	GEONARDO	*3rd FP7 Untold Stories*	3-4 December 2009	Budapest, Hungary	Scientific Community	50	Hungary
15	*Workshop*	JR	*Biomass Contractors' Meeting*	8-9 December 2009	Brussels, Belgium	Scientific Community, Industry, Policy Makers	100	All European Countries
16	*Flyers*	MAICh	*2nd Project Brochure*	March 2010				
17	*Flyers*	MAICh	*3rd Newsletter*	March 2010				
18	*Conference*	MAICh	*International Conference on Biomass Assessment Methods*	15 April 2010	Brussels, Belgium	Scientific Community, Industry, Policy Makers	80	All European Countries
19	*Workshop*	GEONARDO	*Workshop: Common View on Biomass Feedstock Availability for the European Industrial Bioenergy Initiative*	16 April 2010	Brussels, Belgium	Scientific Community, Industry, Policy Makers	80	All European Countries
20	*Poster*	MAICh, IGIK	*30th symposium of the European Association of Remote Sensing Laboratories (EARSeL)*	31 May – 3 June 2010	Paris, France	Scientific Community	200	All European Countries
21	*Flyers*	MAICh	*3rd Project Brochure*	July 2010				
22	*Conference*	JR	*1st Forum Carpaticum*	15-17 September 2010	Krakow, Poland	Scientific Community	100	Carpathian Region
23	*Conference*	GEONARDO	*Conference on Biomass Energy Potential Assessments*	8 November 2010	Brussels, Belgium	Scientific Community, Industry, Policy Makers	50	All European Countries
24	*Flyers*	EFI, MAICh	*2nd Joint Newsletter with BEE project*	January 2011				
25	*Conference*	SIEA	*International Conference ENEF*	14 October 2010	Banska Bystrica, Slovakia	Scientific Community, Industry, Policy	80	Balkan Countries

						Makers		
26	*Web*	All partners, BFSD, SIEA, FASA, FER, XCZ, GEONARDO,	*Online publication of Popular Science Publication article in each partners' language, at various websites*	November 2010 – January 2011				

Section B (Confidential[8] or public: confidential information to be marked clearly)

Not applicable.

[8] Note to be confused with the "EU CONFIDENTIAL" classification for some security research projects.

4.3 Report on societal implications

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when **Grant Agreement number** is entered.*

Grant Agreement Number:	213634
Title of Project:	Classification of European Biomass Potential for Bioenergy Using
Name and Title of Coordinator:	Mr Balazs Bodo

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	***0Yes 0No***
2. Please indicate whether your project involved any of the following issues (tick box) :	***NO***
RESEARCH ON HUMANS	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	
• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	

• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	
DUAL USE	
• Research having direct military use	0 Yes 0 No
• Research having the potential for terrorist abuse	

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator		1
Work package leaders	3	4
Experienced researchers (i.e. PhD holders)	7	9
PhD Students	1	2
Other	3	5

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	0
Of which, indicate the number of men:	0

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project?

○ Yes
○ No

6. Which of the following actions did you carry out and how effective were they?

	Not at all effective			Very effective
❑ Design and implement an equal opportunity policy	N/A	○	○	○ ○
❑ Set targets to achieve a gender balance in the workforce	N/A	○	○	○ ○
❑ Organise conferences and workshops on gender	N/A	○	○	○ ○
❑ Actions to improve work-life balance	N/A	○	○	○ ○

○ Other:

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

x No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

○ Yes- please specify

E-learning program was created, accessible to anyone

○ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

○ Yes- please specify

DVD was published that contains the e-learning + other materials produced during the project

○ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

○ Main discipline[9]: 1.4

○ Associated discipline[9]: 4.1

○ Associated discipline[9]: 2.3

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)*

x Yes
○ No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

○ No
○ Yes- in determining what research should be performed
○ Yes - in implementing the research
x Yes, in communicating /disseminating / using the results of the project

[9] Insert number from list below (Frascati Manual).

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ x	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ○ No
- ○ Yes- in framing the research agenda
- x Yes - in implementing the research agenda
- ○ Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- ○ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- x Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- ○ No

13b If Yes, in which fields?

x Agriculture		x Energy		Human rights	
Audiovisual and Media		Enlargement		Information Society	
Budget		Enterprise		Institutional affairs	
Competition		x Environment		Internal Market	
Consumers		External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	
Customs		Fisheries and Maritime Affairs		Regional Policy	
Development Economic and Monetary Affairs		Food Safety		x Research and Innovation	
x Education, Training, Youth		Foreign and Security Policy		x Space	
Employment and Social Affairs		Fraud		Taxation	
		Humanitarian aid		Transport	

13c If Yes, at which level?

- ○ Local / regional levels
- ○ National level
- x European level
- ○ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**3**
To how many of these is open access[10] provided?	**3**
How many of these are published in open access journals?	
How many of these are published in open repositories?	
To how many of these is open access not provided?	
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[11]: ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		**-**
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	**-**
	Registered design	**-**
	Other	**-**
17. How many spin-off companies were created / are planned as a direct result of the project?		**-**
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑ Increase in employment, or	❑ In small & medium-sized enterprises
❑ Safeguard employment, or	❑ In large companies
❑ Decrease in employment,	❑ None of the above / not relevant to the project
❑ Difficult to estimate / not possible to quantify	

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:* *9*

[10] Open Access is defined as free of charge access for anyone via Internet.
[11] For instance: classification for security project.

Difficult to estimate / not possible to quantify	❑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Yes ○ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes ○ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

❑	Press Release	❑	Coverage in specialist press
❑	Media briefing	❑	Coverage in general (non-specialist) press
❑	TV coverage / report	❑	Coverage in national press
❑	Radio coverage / report	❑	Coverage in international press
❑	Brochures /posters / flyers	❑	Website for the general public / internet
❑	DVD /Film /Multimedia	❑	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

❑	Language of the coordinator	❑	English
❑	Other language(s)		

***Question F-10*:** Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as

geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]