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CLASSIFICATION OF  
EUROPEAN BIOMASS  
POTENTIAL FOR  
BIOENERGY USING  
TERRESTRIAL & EARTH  
OBSERVATIONS

CONTRACT №:

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Cross-Cutting Issues

**WP4 – COMBINATION AND HARMONIZATION  
OF EO AND TERRESTRIAL METHODS**

**DELIVERABLE D.4.1  
SUMMARY OF COUNTRY REPORTS OF  
REQUIREMENTS**

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## **Annex 1: Questionnaires**

Austria: 3 Questionnaires

Bosnia and Herzegovina: 4 Questionnaires

Bulgaria: 4 Questionnaires

Croatia: 3 Questionnaires

Czech Republic: 3 Questionnaires

Germany: 4 Questionnaires

Greece: 2 Questionnaires

Hungary: 1 Questionnaire

Italy: 3 Questionnaires

Macedonia: 3 Questionnaires

Poland: 2 Questionnaires

Romania: 3 Questionnaires

Slovakia: 3 Questionnaires

Slovenia: 2 (plus 1) Questionnaires

Ukraine: 3 Questionnaires

Questionnaire for the assessment of user requirements (template with examples)

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## 1. Introduction

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. The filled questionnaires are given in Annex 1.

All in all, 43 national users have been questioned mainly through personal interviews, sometimes through telephone interviews and in few cases through literature review. International and European users were also contacted however it turned out to be difficult to retrieve the required information without personal contact, which was not possible due to limited time and travelling budget. Instead, it was decided to invite some European users to our next meeting in Graz on October, 12-13, 2009 to comment or add to the results. Thus, although the current version of this deliverable is completed it should still be considered as a “working document” as additional material may be fed into it after the mentioned event. In addition, the user requirements from the BEE project should also be integrated into CEUBIOM and vice-versa. The mode of exchange is currently being discussed among the coordinators.

In the following chapters, the results of this national user requirement study are provided according to the main thematic topics.

## 2. Affiliation of the users

During the meetings in Graz (Jan. 2009) and the meeting in Budapest (March 2009), the target users were identified. Out of this discussion, possible users of the harmonized approach developed in CEUBIOM are:

- National agencies (energy agency, environment agency)
- National ministries (forest, agriculture, energy, transport, economy)
- Regional authorities
- EC
- Bodies of the EU like European Energy Agency, European Environment Agency
- International Energy Agency (IEA – Bioenergy)

It was further decided, that industry, though one of the main users of biomass, are left out for the time being, because

- a) the project is more aimed at the administrative level and
- b) industry would have a very varying need depending on the industry branch (biomass potential for timber, paper, heating, etc.).

Based on these decisions, the users were contacted and interviewed. Figure 1 shows the distribution of the user's affiliations. A certain difficulty to approach the right persons at the ministries was experienced in various countries. Sometimes the responsibilities did not seem to be clear: should the Ministry of Agriculture and Forestry be responsible or the Ministry of Economy – both dealing somehow with the topic ‘Renewable Energy’. Sometimes not even the persons mentioned as contact points in the ‘Biomass Action Plan’ felt responsible.

Therefore many national agencies (such as Energy Agencies) or regional authorities were interviewed in substitution for ministries.

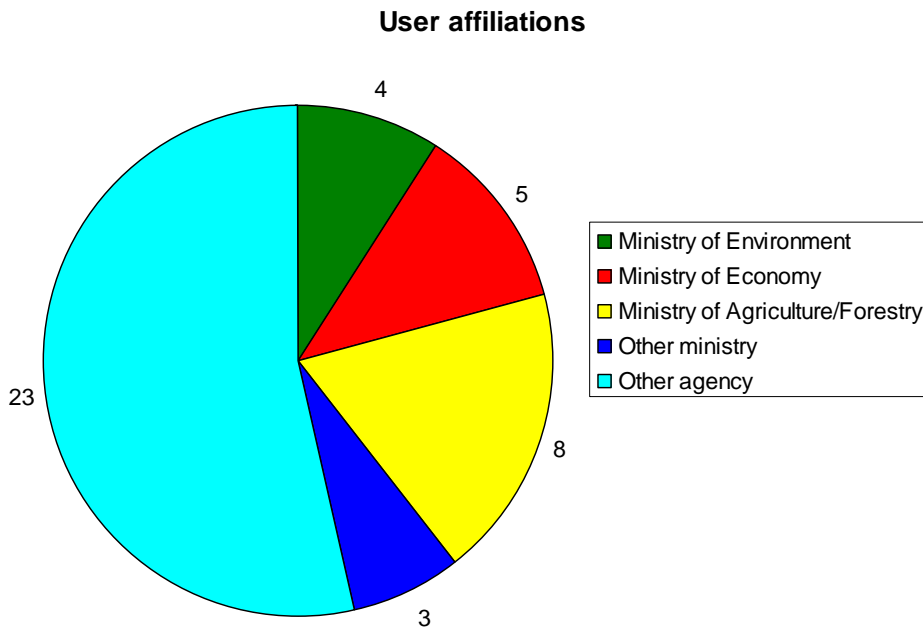


Figure 1: Distribution of user's affiliations

### 3. Past experience and current situation

Most users already have some experience in biomass potential assessment, although the level seems to differ significantly (see Figure 2). 14 % have no own experience with biomass potential assessments, about half on the users have been involved in studies or project-based assessments on a sub-national scale. About one third of the users already have experience in national assessments, many of them being the previously mentioned national agencies rather than ministries or administrations. It should also be mentioned, that most of these assessments have been purely statistical assessments.

Most of the interviewed users (88 %) had partners in their activities, the partners mostly being universities, research centres, other ministries, chambers, national associations or international organizations.

Although the users have worked in these projects, three quarters of them are not satisfied with the resulting data. 72 % say they are not satisfied, 23 % are satisfied and 2 users could not answer the question, because the assessments are still in progress.

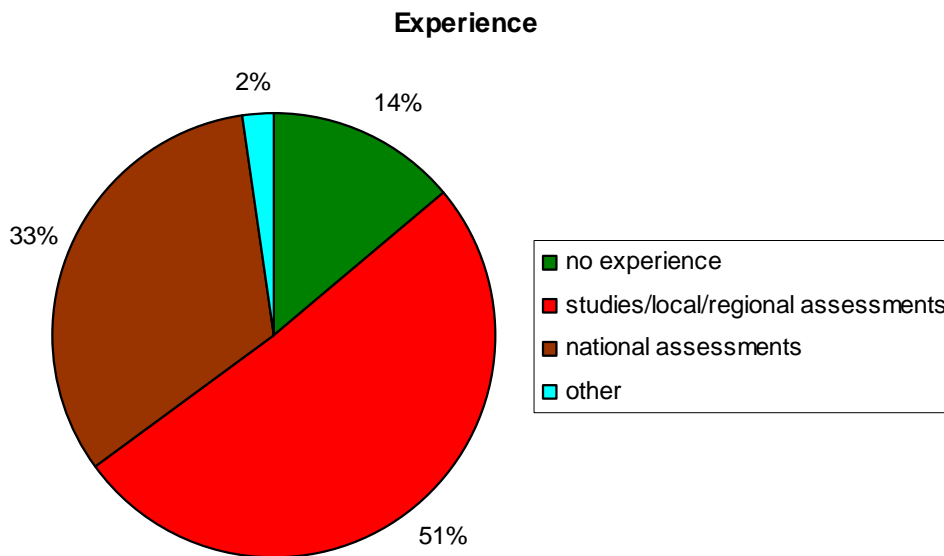


Figure 2: Experience of the users

#### 4. Type of potential needed

The next question regarding the type of potential needed by the users did not lead to a clear result. Sometimes it was as if the users haven't been aware of the different potential definitions. However, the two most often wanted potential types were 'Economic Potential' (35 %) and 'Technical Potential' (33 %) followed by the 'Theoretical Potential' with 20 % (see Figure 3). Multiple answers were allowed here because it is very frequent that not only one type of potential is assessed, but rather a series of different potentials building on the basic 'Theoretical Potential'.

### Type of potential (multiple answers possible)

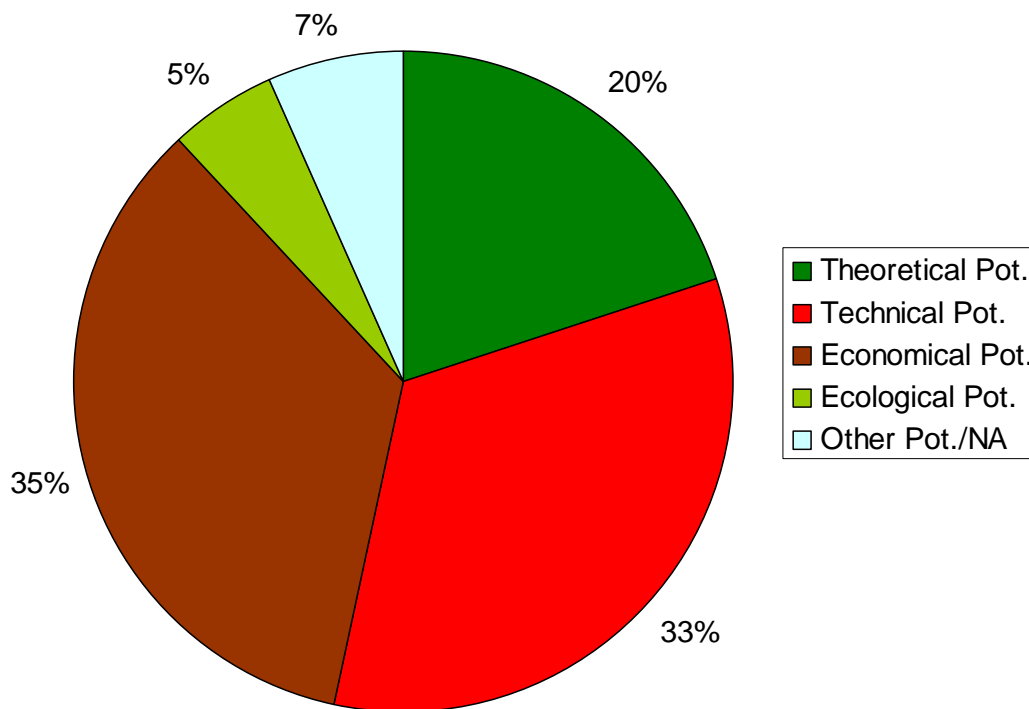


Figure 3: Type of potential needed

The users were also asked to give typical boundary conditions (i. e. the definition of their potential). The answers were very heterogeneous: sometimes very detailed, sometimes very general. The answers are summarized below:

#### Boundary conditions for:

##### Theoretical Potential:

- Forest management and inventory plans
- Protected areas (e.g. Natura 2000)
- Ecosystem yield / Percentage of sustainably harvestable amount

##### Technical Potential:

- Terrain, slope
- Ecological constraints
- Distance to roads
- Utilization technology (for harvesting, but also for e. g. combustion)
- No competition with food, fodder or material
- Availability and condition of service roads
- Possibilities to store biomass (e. g. potatoes)

##### Economical Potential

- Socio-economic boundary conditions (no competition with food, fodder or material)
- Ecological restrictions

- Size and amount of the expected harvest (if it is too small, harvest is not economically feasible)
- Distance to cogeneration plant
- Prizes for conventional energy sources
- Market prize for biomass
- Existence of biomass logistic centres
- Availability and prize of the needed infrastructure
- Potential for GHG reduction (additional benefit)
- Costs of harvesting
- Costs to store biomass (e. g. potatoes)
- Subsidies
- Expert knowledge

It can be seen from the repetitions in the different potentials, that harmonized definitions do not exist and there is confusion on which boundary condition should be considered at which step. However, this gives a good overview of the most pressing issues to be covered in the harmonized approach.

## **5. Temporal resolution needed**

The question regarding the temporal resolution (update of the assessment) gave a clear bi-modal distribution with the two main answers being 'annual' and '5-6 years'. This can be explained by the two main biomass groups: agriculture and forest. In agriculture, the crop types and yield vary annually, while in forestry, assessments are generally valid for a longer time period. This fact was also specifically mentioned several times with the recommendation of agricultural assessment updates of between 1 and 5 years and for forestry biomass updates of between 5 and 10 years.

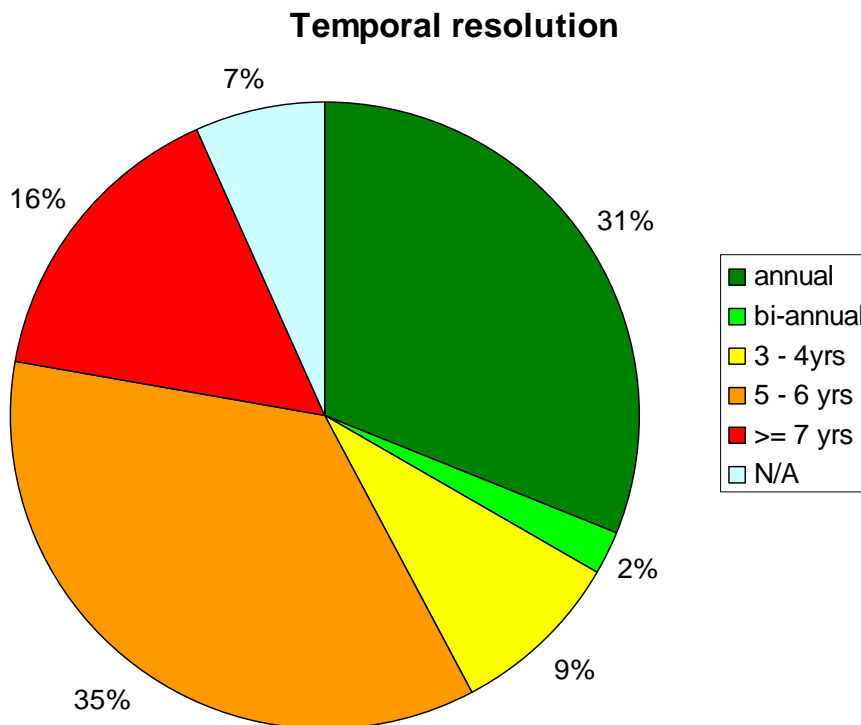


Figure 4: Temporal resolution (update) needed

## 6. Related costs

This is apparently a very sensitive question, which is also reflected by the large number of ‘not available (N/A)’ answers (42 %). Furthermore, it is difficult to interpret even the valid answers, because sometimes the costs were given for past projects, sometimes for future budgets, sometimes for statistical approaches and sometimes for spatial ones. In addition, if spatial assessments are considered, the area is not always known (national assessment versus test areas) further complicating the interpretation of the cost estimations. Despite these problems, a slight tendency can be observed towards a medium sized budget (between 20.000 and 200.000 €; 23 % of the answers).

## 7. Main uses of the biomass potential for energy assessment

Typically, multiple answers were given to the question regarding the use of biomass potential data. Many users see the use of a potential assessment in the area of policies and planning (40 %) followed by reporting obligations with 22 %. Third most often given answer is to use the generated information for internal decisions (15 %). Further mentioned were ‘funding, subsidy & subsidy control’, ‘dissemination’ and ‘investments’ as shown in Figure 5.

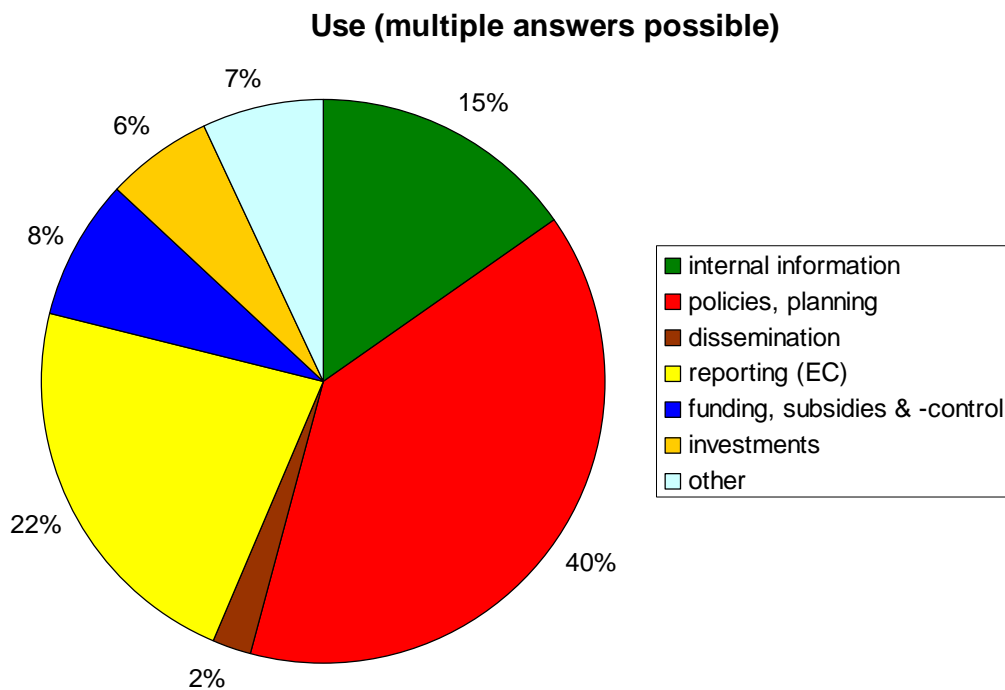


Figure 5: What do the users need the information about biomass potential for?

## 8. Acceptable accuracy level

Regarding the acceptable level of accuracy, it is important to bring to the users' attention that accuracy is generally linked to costs. Higher accuracies need

- a) more detailed input data, which are more costly to acquire and
- b) a more detailed analysis of boundary conditions, which also needs more time and thus more financial efforts.

Thus, the users were asked about the best compromise between the accuracy and the related costs. The result is quite clear: more than half of the users (55 %) see the best compromise in the range of 80 – 85 % accuracy. The one user asking for 100% accuracy has not been directly involved in potential assessment and was referring to statistical figures, which have been carefully estimated using a buffer of about 5 – 10%. From this comment, it can also be assumed, that in reality, the data is actually 90 - 95 % accurate. Another case demanding a high level of accuracy was connected to a very low level of thematic detail (see Chapter 9) and thus, higher accuracy is feasible because the error generally increases with the number of classes. The overall distribution of the accuracy needs is shown in Figure 6.

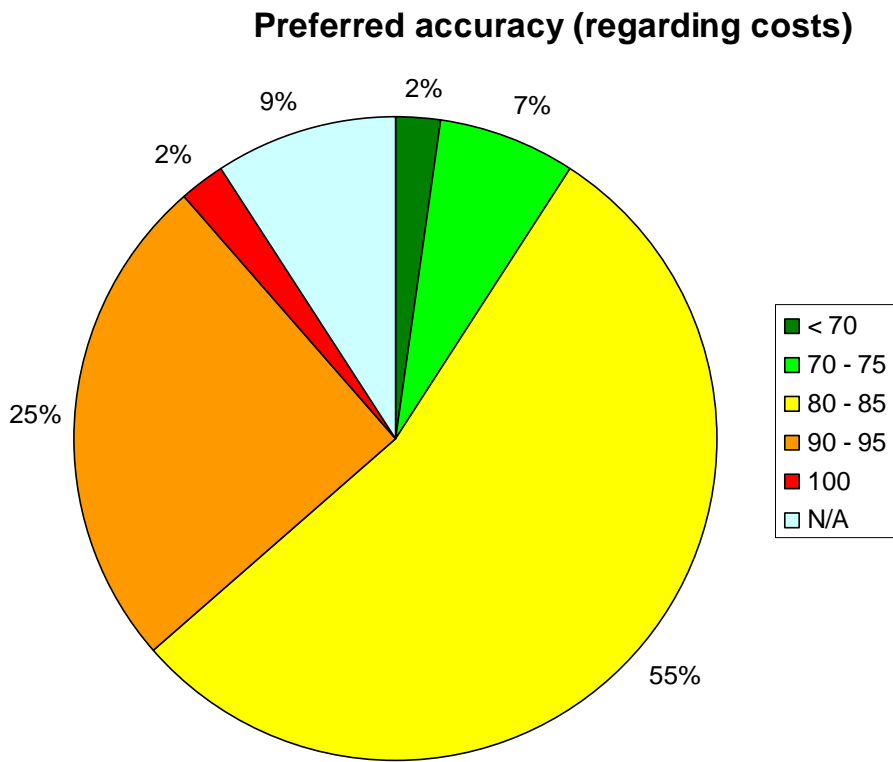


Figure 6: Preferred level of accuracy as a function of costs

## 9. Thematic detail needed

This is a very important topic, since it influences the whole concept of the harmonized approach to be developed in CEUBIOM. The issue is covered by three questions, formulated in a hierarchical way:

*Question:*

*Which level of thematic details do you need?*

*Total biomass for energy only?*  yes  no

*If no: Subdivision into forest – agricultural – other biomass sufficient?*

yes  no

*If no: Rank the following biomass types regarding their priority*

Type	Points
hardwood	
softwood	
wood general	
saw dust	
fine wood chip	
coarse wood chips	
corn	
sunflower	
rape	
oilseed	
wheat	
Sugar beet	
others (please name!)	

The first part gave a very clear result: for 86% of the interviewed users, information on the total biomass potential is not sufficient. Only a minority of 14% are satisfied with this kind of overall information.

The second part of the question did not give such a clear picture. For 59 %, so a bit more than half of the users, the thematic differentiation into the three main classes ‘forestry biomass’, ‘agricultural biomass’ and ‘other biomass’ would be sufficient. For the other 41 %, a further differentiation is needed.

The third part of this question is targeted at these users. Figure 7 shows the result of the prioritization. The highest priority was given to wood type differentiation (species, assortments) with 48% followed by sawmill material differentiation (22 %) and crop type differentiation (17 %). The remaining 13 % either had very specific need, such as residues; or they could not prioritize at all.

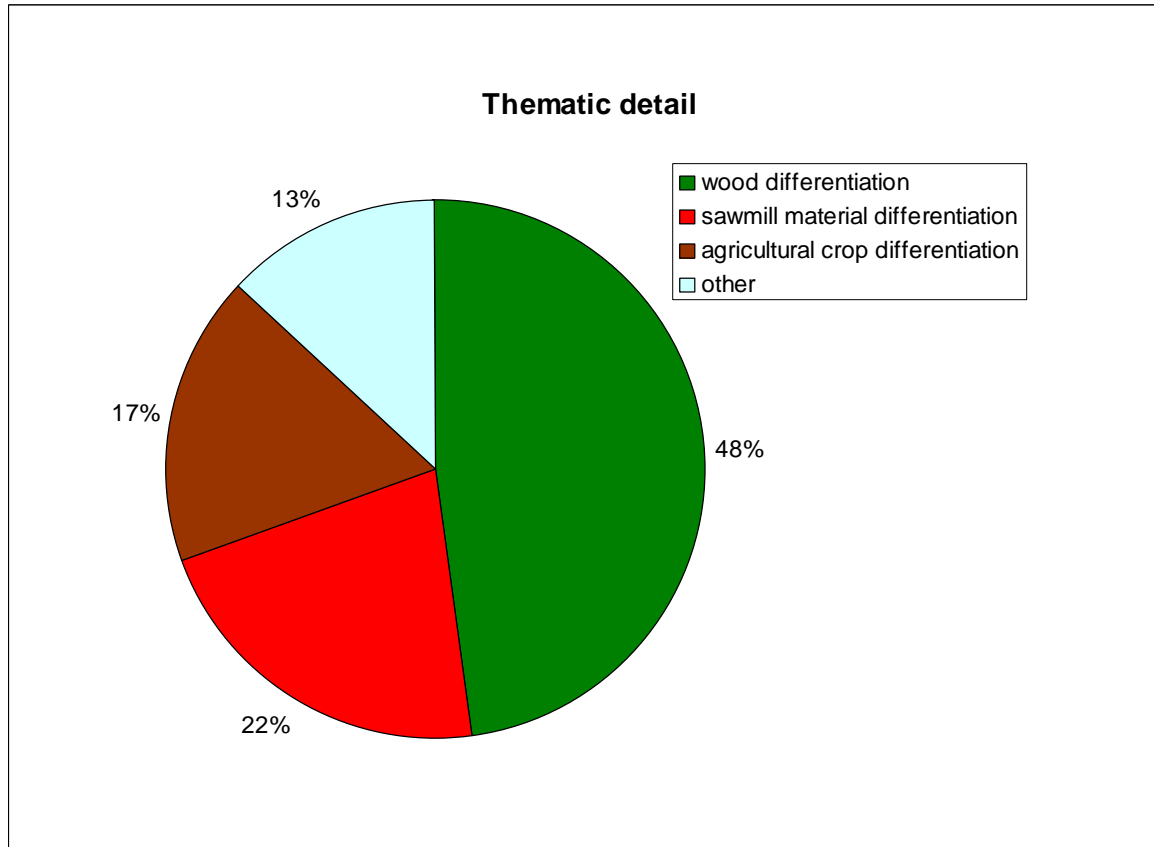


Figure 7: Priorities of thematic differentiation of biomass potential

## 10. Type and format of the data

The first question in this part was, if a spatial component (map) is needed at all. The result is very clear: 42 of 43 interview partners want and need spatially distributed information. Also the second question, whether they prefer the data as a continuous raster data set or data on an administrative level like NUTS or municipalities, gave a quite clear result. 60 % wants a continuous data set, followed by 14 %, who need data on municipality level (see Figure 8). It should be mentioned that a continuous map is not contradicting maps on the different NUTS levels or municipalities, because the pixels from the continuous map can easily be aggregated to larger entities.

Regarding the question, what scale such a raster file should have, the results were much less clear. Most of the users (58 %) couldn't give a scale at all, while the remaining answers differ from between 10 m and 1000 m pixel size. Thus, no very clear information can be gained from this analysis, though there seems to be a slight tendency towards a scale of between 1:50.000 and 1:200.000 (i. e. about 20 – 60 m pixel size); the detailed distribution is depicted in Figure 9.

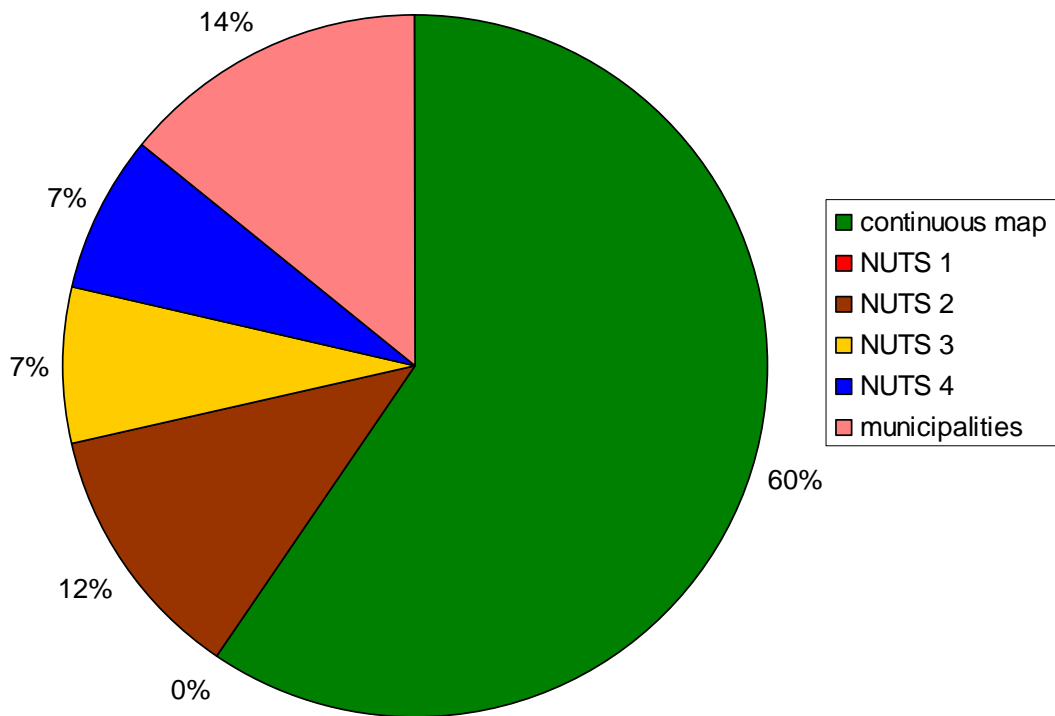


Figure 8: Continuous raster or administrative units

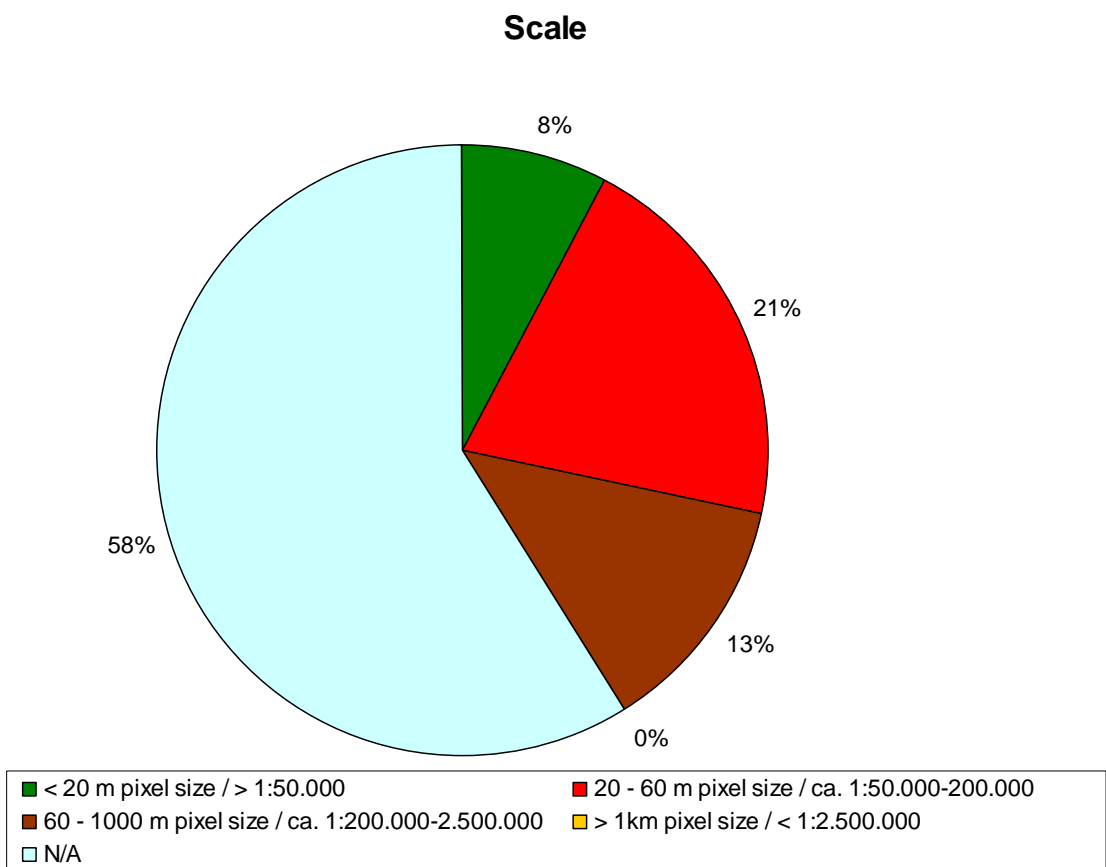


Figure 9: Preferred scale of the output map

The final question on this issue was on the preferred format. Here the clear message was that GIS data is needed, either vector- (44 %) or raster-based (35 %). A few users (13 %) would also like to see a web-solution, but it didn't turn out to be a mayor need. In addition, data can easily be converted, if the main principles of transparency, standards and interoperability are considered already in the data generation phase.

## **11. Processing issues (methods, time)**

Surprisingly many of the interviewed users are interested in integrating the biomass potential assessments into their own institution. One reason for these results could be the rather large share of national agencies, which, in contrast to the ministries, often have a mandate to do such assessments. But apparently even ministries consider this option, since 47 % of the users are from ministries and only 21 % can not imagine integrating the assessment into their institution.

With regard to the eLearning tool to be developed in WP 6 of CEUBIOM, a question on the acceptable complexity of the method was posed. From the users, who can imagine integrating the procedure of biomass potential assessment, 35 % are comfortable with any level of complexity and 3 % can only handle low level complexity. The large majority of 59 % states to have the ability to deal with methods of an intermediate level of complexity.

Finally, the users were asked on acceptable time delays for processing from basic data availability to the final results. For many users (82 %), the time between available data and result should not exceed 12 months. Only 11 % would accept longer processing times. Figure 10 shows the detailed results of this question. Based on this figure, a large majority (85 %) of the users would be satisfied with a processing time of about 6 – 9 months (or more), only 15 % want a very fast processing of about 3 months. It was also mentioned that the current processing takes more time than what the users would like to see. Thus, there is still a bit of flexibility in this requirement.

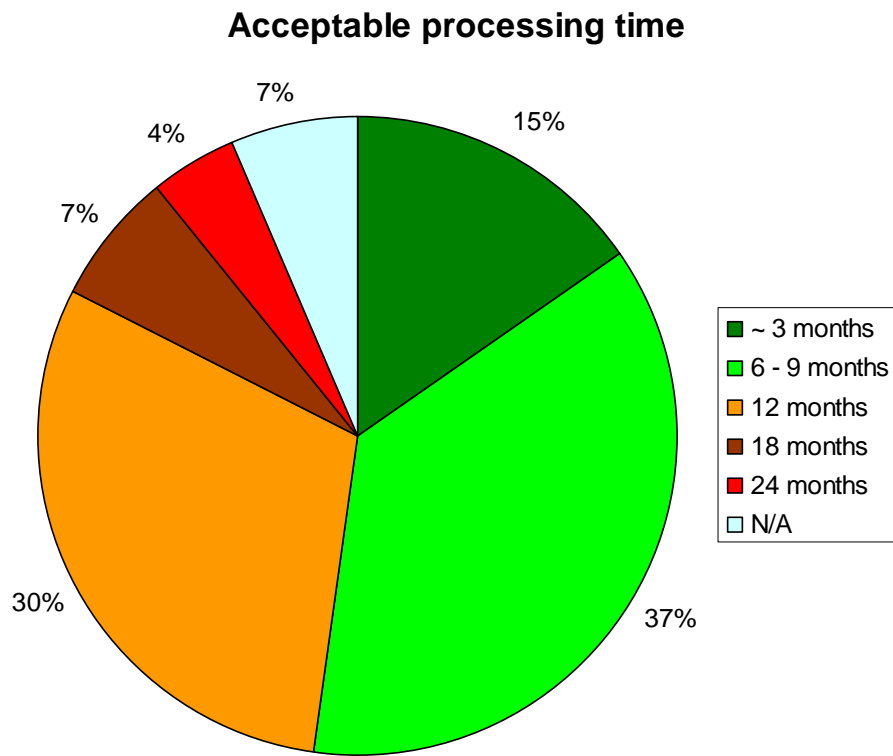


Figure 10: Acceptable processing time (from data availability to end result)

## 12. Summary & interpretation of the results

In order to satisfy all national user requirements as given in the questionnaires, the CEUBIOM approach would have to look like this (= theoretical requirements):

1. It should deliver all types of biomass potential for energy (including technical, economic, ecologic, etc. restrictions)
2. It should be annually updated
3. It should be available at no cost
4. It should be suitable for different purposes including policies and reporting, but also very specific ones like the assessment of new investments
5. The accuracy should be near 100 %
6. The biomass potential should be split into individual types of potential (crop types, wood types, sawmill product types, waste types)
7. The data should be available as a GIS or WEB-based continuous map at a scale of around 1:50.000 aggregable to municipalities and different NUTS levels
8. The method to reach this goal should be of low complexity, so it can easily be implemented in existing institutions and it should allow fast processing

In addition, International and European users probably still have different views. Thus, it is clearly not feasible to come up with a method fulfilling all these requirements, especially considering also the limitations in terms of remote sensing data and -processing. In the following table, a first attempt is made to generate an acceptable compromise of user requirements and main technical limitations.

**Recommended (= realistic ?) requirements:**

<b>Theoretical requirement</b>	<b>Comments</b>	<b>Recommended (= realistic ?) requirement</b>
1. It should deliver all types of biomass potential for energy (including technical, economic, ecologic, etc. restrictions)	A harmonized method to be used over all European countries cannot easily take into account all of these restrictions. One reason is that the restrictions are sometimes contradictory. So, one option would be to harmonize the boundary conditions over Europe (which is probably not acceptable for many national users) or to generate a common basic potential with fixed and well defined boundary condition to form the base for further (nationally different) potentials.	1. 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, but not be done in the frame of the harmonized approach.
2. It should be annually updated	Annual updates are very costly and in addition, many users even only need an assessment every 3 – 6 years or more. Furthermore, forest biomass potential is generally less prone to short time fluctuations than agricultural potential. Thus, an update every 3 years with maybe a yearly statistical update based on the prize development (economic boundary condition) seems to be a good compromise. Another question in this regard is the availability of spatially updated information. In WP 2 the use of core service products has been recommended – here the future availability of this type of data is a limiting factor.	2. Full update every 3 - 6 years, whenever spatial data, e.g. core service products, are available. In addition, a statistical update of the economical potential (maybe only for agricultural biomass) can be done annually.

3. It should be available at no cost	Available at no costs does generally mean that someone else should pay for it. This issue cannot be assessed within this project, because it is subject to political decisions (should or could the potential assessment be financed through European or through national funds?). However, there are two main points to consider. First, when using core service products, the cost for data is kept small, since it is already available and paid for. Second, many of the interviewed users had or will have at least a small or medium sized budget for biomass potential assessment available.	3. Costs should be kept as low as possible
4. It should be suitable for different purposes including policies and reporting, but also very specific ones like the assessment of new investments	This is an important point, especially with regard to avoid duplication of efforts. Most of the mentioned user needs are congruent, however, if user needs are very specific to one single type of potential and for one single use (e. g. rape for biofuels), this might need additional calculations and cannot be tackled in the frame of a harmonized method.	4. The resulting potential should be 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.
5. The accuracy should be near 100 %	This requirement is unrealistic and even to get near an accuracy of 100% would result in very high costs. However, only very few users even requested this, while a quite clear majority understands the contradiction with cost issues. Most of the users vote for an accuracy level of about 80 – 85 % as the best cost-benefit-compromise. This is, considering all the errors from remote sensing data acquisition and -classification, accuracy of boundary conditions and quality of auxiliary data, already challenging.	5. The resulting accuracy should be in the range of 80 – 85 % and the errors should be transparently documented and traceable wherever possible.

<p>6. The biomass potential should be split into individual types of potential (crop types, wood types, sawmill product types, waste types)</p>	<p>86 % of the interview partners need thematic differentiation and not only the total biomass potential. For more than half of the interview partners, a differentiation into forest biomass, agriculture biomass and other biomass sources is sufficient. Among those who need further differentiation, a majority ranked the wood differentiation highest.</p> <p>At this point also the interrelation between the different requirements should be stressed: more different thematic classes generally lead to a higher error per class. Alternatively, to keep the error down for all (detailed) classes, either the costs or processing time and/or complexity of the method would explode.</p>	<p>6. It can be recommended to at least generate 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).</p>
<p>7. The data should be available as a GIS or WEB-based continuous map at a scale of around 1:50.000 aggregable to municipalities and different NUTS levels</p>	<p>WEB based applications are welcome but for most users not needed. A continuous map is needed and possible, since EO data is per se continuous. The scale of 1:50.000 seems to be too detailed considering a product for whole Europe. With regard to WP 2 recommending medium resolution data (20 – 30 m), the respective scale would be around 1:75.000 -1:100.000. The core service products are also in about the same range.</p>	<p>7. The product should be 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.</p>
<p>8. The method to reach this goal should be of low complexity, so it can easily be implemented in existing institutions and it should allow fast processing</p>	<p>This is again the same problem with interrelation between the requirements. However, only few users requested low level, most of the users can cope with at least intermediate complexity levels. The implementation should be facilitated, which is already foreseen with the eLearning tool of CEUBIOM. Fast processing is a more difficult point, because it might interfere with the accuracy requirements. However, when assuming that the method builds on existing core service products, a 6 – 9 month processing time seems feasible.</p>	<p>8. The method should be of intermediate complexity and be accompanied by training. The processing time (without EO data pre-processing) should be around 6 – 9 months.</p>