



Report of FACCE-JPI Mapping and Foresight on

Mitigation of agricultural greenhouse gas-induced climate change

Options for strategic collaboration

**FACCE CSA Mapping Meeting 1
June 20-21, 2011
The Hague, The Netherlands**

A horizontal collage of four images: a variety of fresh vegetables (peppers, tomatoes, cucumbers), a person in a conical hat using a traditional wooden plow, a field of yellow flowers with hay bales, and a large-scale irrigation system in a field under a cloudy sky.

JPI Agriculture, Food Security and Climate Change

AGRICULTURE, FOOD SECURITY & CLIMATE CHANGE

The sectors of agriculture and forestry are highly exposed to climate change, since they directly depend on climatic conditions, while emissions from agriculture in the Union account for 14% of global greenhouse gas emissions. Climate change is also one of the main challenges to agriculture in feeding the world's population, which is expected to reach 9 billion by 2050. Global demand for food is expected to have increased by 50% by 2030 and to have doubled by 2050, at a time when demand for biomass for non-food purposes is predicted to grow strongly. Concerted actions are needed to prevent these combined risks from leading to irreversible damage, and to achieve sustainable food supply under changing climate conditions.

The Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) brings together 20 countries and aims to improve the collaboration in research policies and research effort of its member countries to tackle these global challenges for Europe by aligning research programmes among Member States.

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This report could not have been conceived without all efforts and dedication of all the participating Member States of FACCE-JPI and all participants to the first Mapping Meeting.

The report may be quoted provided that the source is acknowledged.

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Summary

Joint Programming is a member state-driven initiative to join forces in research and education to tackle societal changes of common interest. Agriculture, Food Security and Climate Change is such an area. In order to identify joint programming opportunities and activities *mapping meetings* are organized: meetings where researchers and policy makers meet to exchange information and views in order to identify joint programming opportunities and to create a common context. At mapping meetings *posters* are used describe research efforts and policy ambitions for each participating country.

This report describes the main results of the first mapping meeting. Forty-eight people from 19 countries participated in this meeting of one day and a half.

The prepared posters were evaluated and discussed in break out groups.

This report describes the conclusions of all the break-out groups and the general conclusions drawn, and gives the results from an additional desk study. The report ends with conclusions and recommendations to the Governing Board of the Agriculture, Food Security and Climate Change Joint Programming Initiative.

Research themes identified for joint action are:

- Mitigation options focusing on carbon sequestration in crop production:
 - soil nutrient management;
 - efficiency of crops, grasslands and forests as carbon sinks;
- Protocols and certification for methods to assess greenhouse gas emission;
- Reduction of emissions by livestock, in particular through nutrition and animal breeding;
- Carbon and nitrogen cycling in the ecosystems; common framework for Life Cycle Assessments (LCA) of livestock production systems and of crop production systems;
- Study of indirect emissions.

Tools identified for cooperative research are:

- Harmonization modelling systems and efforts;
- Optimization of cooperation between this initiative and others, like the Global Research Alliance;
- Identification of infrastructures to be shared;
- Development of adequate tools for judging integrated production systems.

The report also describes conclusions and recommendations concerning **the process for the mapping exercises** to come. In summary these are:

- Clearer guidelines for completing posters, and changing from a funding poster to a policy poster;
- More focus in the theme to be addressed at the mapping meeting;
- To provide sufficient time for poster preparation and maintain strict deadlines;
- To ensure that also the gaps are addressed, not only synergies and overlaps, in the discussions.

1. Introduction

FACCE JPI

The objective of the FACCE Coordination and Support Action (CSA) is to prepare and support the Joint Programming Initiative (JPI) "Food Security, Agriculture and Climate Change" (FACCE-JPI). One of the first outputs for proposing this JPI was the SCAR-CWG on Agriculture and Climate Change lead by Spain. Its aim is to contribute to the enhancement of cooperation and coordination of national research programs through the development of long-term collaborative actions. This topic is of global importance and fall within the scope of the Bio-economy concept in which Food Security and the impact of Climate Change on Agriculture as the primary source of biomass are key subjects.

Mapping and foresight for strategic collaboration

Within the Coordination and Support Action for the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE CSA), Work Package 2 is concerned with Mapping and Foresight for Strategic Collaboration. The goal of this work package is to support the FACCE-JPI in its development of the Strategic Research Agenda and the prioritisation by the GB of joint programming efforts. The objectives of WP2 are:

- Identification of complementarities, duplications, and gaps (in current and future research)
- Identification of areas for (improved) coordination, cooperation and exchange (information, people, practices)
- Creating a common context and opportunities for networking
- Identification of perspectives and possibilities for pooling research resources (funding, people and facilities)
- Propose joint programming activities

Approach mapping: mapping meetings

An overview of ongoing activities and infrastructures is a vital condition to identify possibilities for joint efforts. So mapping of policy ambitions, research efforts and infrastructures is needed. The approach normally used in many mapping exercises is to compile and analyse results obtained through a questionnaire. To produce an overview in this manner is very time consuming and the quality of the answers often prove to be disappointing. The result of mappings is thus not always that high.

Therefore FACCE CSA has chosen a different approach: well prepared mapping meetings, combined with desk studies and a bibliometric analysis. In mapping meetings, specialists from participating countries meet to discuss ongoing activities and ambitions in order to identify opportunities for better cooperation.

The mapping meetings, each one organized around a defined pillar identified by the SAB, are the heart of this work package and aim to bring together scientists, funders and policymakers to analyse the state and to identify opportunities for joint actions. The mapping meetings serve the intellectual, political and social process (networking and creating a common context). At the mapping meetings posters are to be used from research institutes and policy makers.

A total of five thematic meetings were planned. The series of meetings will be concluded with a broad-base mapping meeting aiming at connecting the main thematic areas of expertise and reaching final recommendations.

Mapping meetings are a novelty; it has not been done before. Therefore the aim of the first mapping meeting is besides identifying opportunities for joint actions also serving as a learning experience.

First mapping meeting

The theme of the first mapping meeting of FACCE CSA is Mitigation of Agricultural Greenhouse Gas-Induced Climate Change. It is the theme specified as Core Theme 5 of the Scientific Research Agenda developed by the Scientific Advisory Board (SAB) of FACCE JPI (<http://www.faccejpi.com/FACCE-JPI-Home/FACCE-JPI-News/Scientific-Research-Agenda>). The meeting was held on 20-21 June 2010 at the Ministry of Economic Affairs, Agriculture and Innovation in The Hague, the Netherlands. The meeting programme and the list of participants are included as Annex 1 and 2 of this report. The presentations are available for the FACCE-JPI members on the FACCE intranet.

Posters

In the mapping meeting we made use of well-prepared and structured posters. Therefore, each Member State was asked to complete two posters; one poster on science and one poster on policy. It has been decided by the GB that Member States themselves are responsible for (the quality of) the mapping of their national programmes (including infrastructures). Since there was only limited space on a poster, there was a need to prioritize. What is absolutely necessary regarding the mapping meetings? And what issues could be addressed in other ways, e.g. by the desk study? Therefore a standard format for the posters was used. Member States were asked to fill out this poster-format.

The policy poster format was designed to get sketches of the scene and have the countries providing background information on research policy, funders, research organisations, and programmes on mitigation. The science poster format was designed to provide the overview of programmes/projects structured according to a thematic structure for which the Scientific Advisory Board had been consulted.

Group discussions

The experts attending the mapping meeting had opportunity to request clarification to their counterparts and to highlight in a consensus manner the most important issues and conclusions. The organization of the group discussions is described later in this report (see page 7).

Desk Study

In addition to the information generated during the meeting, the information available in the posters was subjected to a desk study following the same approach used in conventional mapping exercises. This provided an additional insight in order to identify/verify complementarities and gaps. The analysis was done on the information provided in the posters from the 17 countries that participated to the mapping meeting (Austria, Belgium, Germany, Denmark, Estonia, France, Finland, Ireland, Israel, Italy, The Netherlands, Norway, Poland, Romania, Spain, Turkey and United Kingdom), complemented by information about European research within FP6 and 7.

2. Mapping Meeting

2.1 Preparation of the posters

In preparation of the mapping meeting each participating country delivered information in a common format presenting ongoing research, and policy ambitions and programmes foreseen. These posters are available for future reference for FACCE JPI members on the intranet.

2.2 Break-out sessions

During the two days of the mapping meeting the participants discussed in small working groups the content of the posters. The working groups tried to identify overlaps and gaps and elaborated possibilities for joint actions.

On Day 1, the Netherlands team (Christine Bunthof, Lorens Habing and Peter Keet) who were in charge of the logistics of the mapping meeting gave an introduction about the working process that consisted of:

- i) a visit (45 minutes) for a general overview of the posters by all the delegates (scientists and policy specialists of each of the participating countries) on a personal basis;
- ii) splitting up of the delegates into seven working groups to further elaborate and discuss on the content of selected posters (90 minutes). Each group was composed of randomly selected specialists of five countries that had the opportunity to undertake a deep discussion of the corresponding posters and the identification of overlaps, gaps and possibilities/topics for joint actions to be reported to the audience by a reporter selected within each group.

On day 2, the same process was followed by working groups that had been previously rearranged as to allow the discussion to proceed among different country representatives. In each case the outcome of the working group discussions was requested to be summarized into a general overview and the proposition of five putative joint actions.

The results achieved in the break-out sessions on Day 1 and Day 2 are presented in Annex 3.

2.3 Final discussion

Herman Eijsackers, chief scientific officer of the Ministry of Economic Affairs, Agriculture and Innovation of The Netherlands mastered the final discussion about the major issues identified by the different working groups. The moderator directed the discussion around four aspects: (i) Conceptual framework; (ii) Definition of sub-areas; (iii) Technical aspects to tackle; and (iv) Policy instruments.

Conceptual framework

It was underlined that the mapping meeting was designed as a learning process. In this regard, the discussion addressed the need to define the margins of the mapping objectives. There was a general agreement that the five Core Themes defined by the SAB do not have clear-cut margins. In this regard it was unclear which research activities belonged to the "Core" and which belonged to the margins of the "Core Theme". This was considered essential in order to establish the objectives for cooperation and to identify complementary fields. Among the "Core themes" without well-defined boundaries, Mitigation, the subject of this mapping exercise, is in many instances bound to studies that also address Adaptation issues. It seems essential to define the core as well as the functional margins.

Where do we have to define sub-areas?

Many groups observed that it was not desirable to favour Pan-European approaches versus Regional approaches. Different aspects of mitigation should be undertaken at regional level whereas others deserve global approaches. The differences between Northern versus Southern regions in terms of problems to be addressed and therefore research to be undertaken are linked to the differences in climate, soil composition, crops, livestock and the farming systems characteristic of these regions. Therefore different countries within Europe must look for other countries/regions with similar problems to address the questions in a cooperative way.

Technical and scientific aspects to tackle

The five thematic research challenges identified by most groups were ranked as follows:

1. Mitigation options focusing on carbon sequestration in crop production
 - i) soil management;
 - ii) efficiency of crops, grasslands, and forests as carbon sinks;
2. Protocols and certification for methods to assess greenhouse gas emission;
3. Reduction of emissions by livestock, in particular through nutrition and animal breeding;
4. Carbon and nitrogen cycling in agro-ecosystems, and a common LCA framework for assessment of livestock production systems and of crop production systems;
5. Study of indirect emissions.

The four approaches for better coordination and collaboration identified by the groups are the following:

1. Develop adequate tools for judging integrated production systems. There is a need to make adequate assessments in order to identify its components and understand their effect in space and time. In this regard it is important to define emission scenarios/balances in integrated systems that should be developed by working at "farm level". Working at "farm level" was considered crucial, but difficult to undertake without having good assessment methods. A life cycle assessment (LCA) should be developed and undertaken in order to define the impact associated with agricultural practices. Boundary issues for different EU farming systems should be taken into consideration.
2. Harmonize modelling systems and efforts. Models, e.g. for farm systems should be compatible with each other (compatible protocols). This subject should be addressed together with other stakeholders, e.g. the GRA. Harmonizing modelling systems and efforts will be addressed in the FACCE-JPI Pilot Action (Knowledge Hub).
3. Optimize cooperation between FACCE-JPI and the GRA. A need is indicated of coordination and cooperation with the Global Research Alliance (GRA). Activities of FACCE-JPI and the GRA should be complementary, using harmonized methods, common protocols, sharing of data and gearing of activities to one another.
4. Start an open process to identify relevant infrastructures to be shared. Identify infrastructures that are necessary to study mitigation in all relevant areas and taking into consideration the major topics related to mitigation. It is essential to know which and how many of the infrastructures are available and where are they located. It is also essential to know the usability and the costs/savings of sharing these infrastructures. It is crucial to build and share common databases.

Policy instruments and incentives to stimulate further cooperation

The moderator initiated a debate about the convenience or not to rely on "scientific excellence" and the need to develop supportive policies and experimental approaches. It was debated that through cooperative approaches (like networking) we can get "excellence" even without the input of "Excellence Centres". The debate covered the importance of developing common databases. It was necessary to take into consideration that common databases can only be produced when data is produced using compatible protocols and standards. The possibilities to stimulate cooperation through tools such as Conferences, workshops, etc... were also debated. In the general discussion two issues were brought up: (i) the need to define the topics to be addressed in the short (1 year), medium (5 years) and long term (20 years);

(ii) that the outcome and topics to be addressed relied mainly on overlaps but that gaps were poorly identified. In regards to this last aspect, the lack of adequate systems for transfer of knowledge and information was considered a major issue.

Concluding remarks

The group emphasized that it had been quite difficult and required a lot of work to fill in the posters.

In addition, the group sensed that in the discussions much effort had been placed on the identification of priority lines but that little had been done to identify gaps.

There was a general consent that the need of adequate policies and their implementation are crucial. These policies should be developed at production systems scale and be implemented at district/regional level.

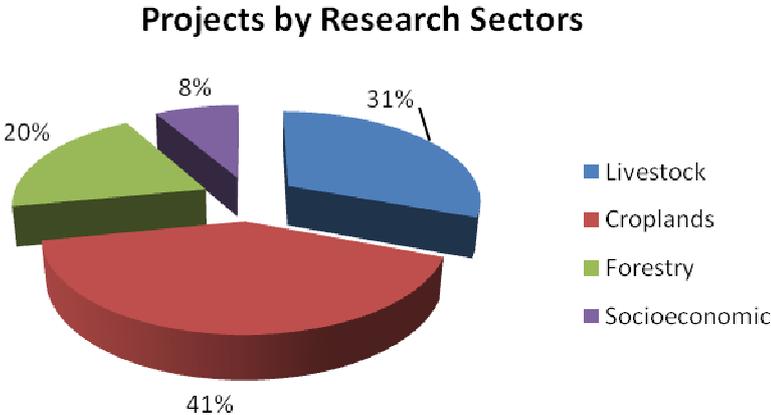


3. Additional information from desk study

In order to gain additional insight, the information provided in the posters was subjected to a desk analysis as an additional tool to identify/verify complementarities and gaps. The analysis is done on the information provided in the posters from the 17 countries that participated to the mapping meeting (Austria, Belgium, Germany, Denmark, Estonia, France, Finland, Ireland, Israel, Italy, The Netherlands, Norway, Poland, Romania, Spain, Turkey and United Kingdom), complemented by information about European research within FP6 and 7.

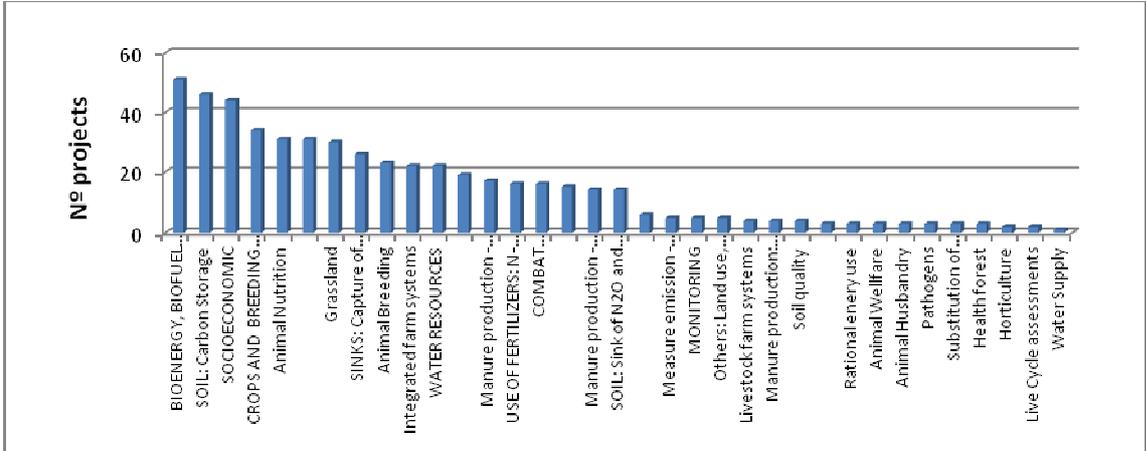
3.1 Identification of priorities

The 530 projects on Mitigation of Climate Change included the following sectors: livestock, croplands, forestry and socio-economic aspects. A large number of the projects (218 projects) were in the croplands sector, followed by the livestock sector (163 projects), forestry (105 projects) and finally the socio-economic aspects (44 projects¹).



The ranking of research areas within the different sectors shows that a total of 35 research areas were identified with major differences regarding the number of projects within each area. As already noted by the working groups of the mapping meeting, the Bioenergy and Biofuel areas were among the major ones even though in many instances the mitigation aspects were unclear.

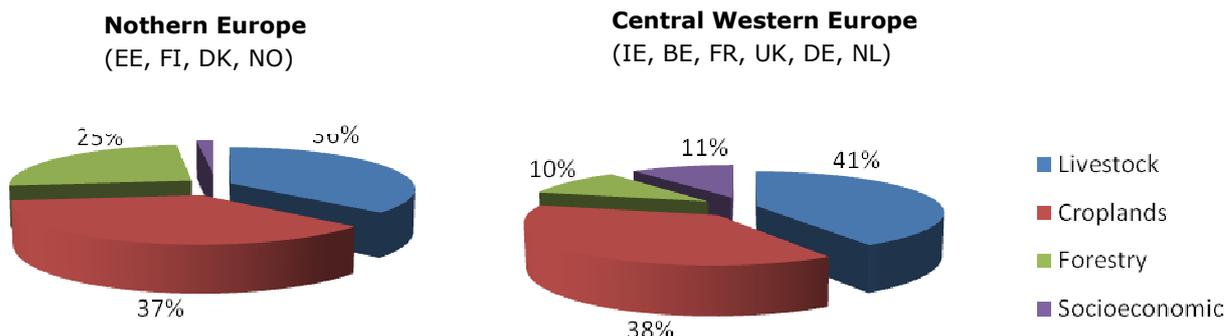
Ranking of the research areas identified



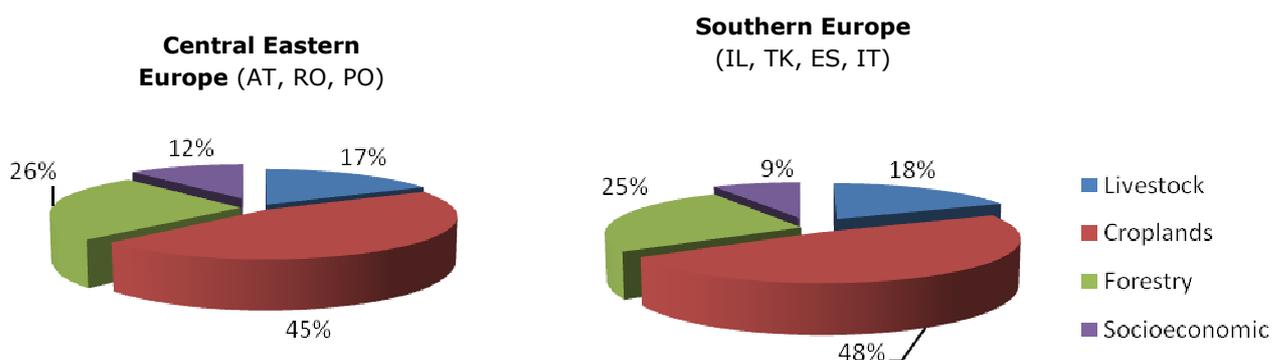
¹ It should be taken into consideration that many projects that were not considered within the socio-economic sector also contained objectives related to socio-economic aspects.

When the same information was analysed taking into consideration different regions (clusters of countries) within Europe, the following results were found:

(i) As illustrated below, in Northern and Central-Western Europe croplands and livestock sectors were similarly addressed (37% and 36% of the projects in Northern Europe; 38% and 41% of the projects in Central-Western Europe). However, forestry projects (25%) are very relevant in Northern Europe whereas the activity in this field seems to be less important in Central-Western European with only 10% of the ongoing projects. On the other hand, the on-going activities in socio-economic issues are more relevant in Central-Western Europe than in the Northern countries.



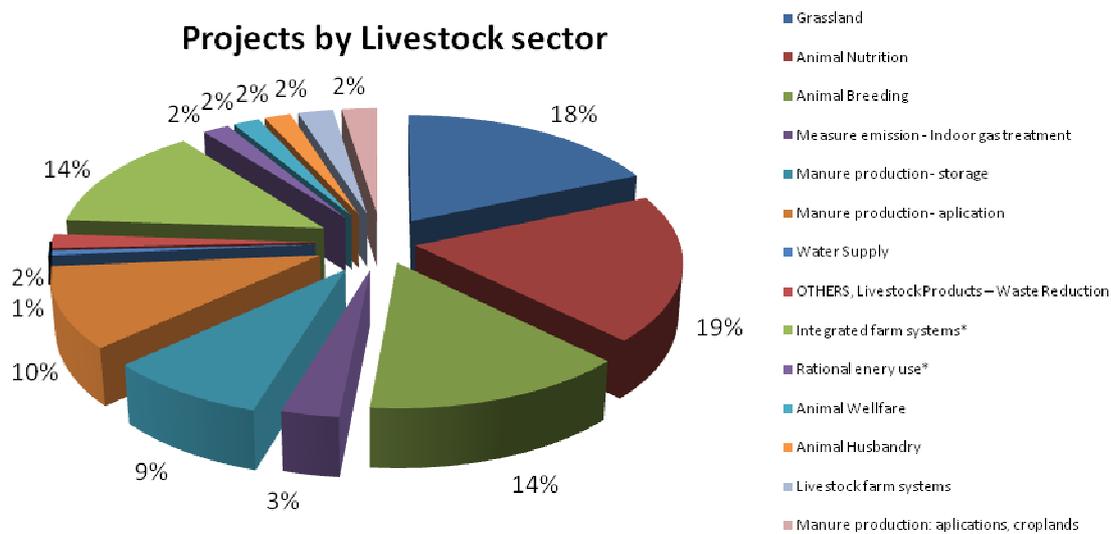
(ii) A quite different situation was found in the case of Central-Eastern and Southern Europe. As illustrated below, the on-going activities are strongly biased toward croplands issues (45% and 48% of the projects, respectively), with low activity on socio-economic aspects (12% and 9% of the projects) and an intermediate situation in the case of forestry (26% and 25% of the projects) and livestock (17% and 18% of the projects).



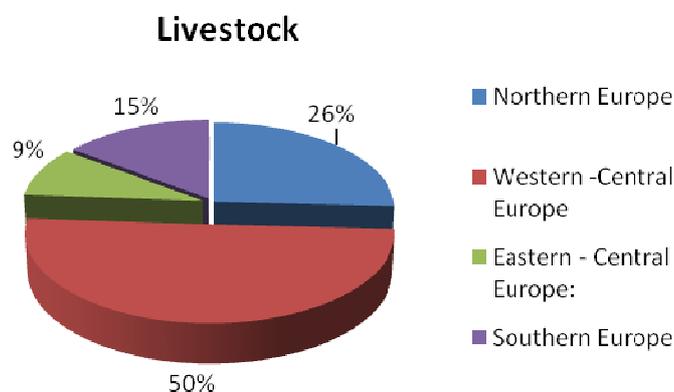
These differences should be taken into consideration because they probably reflect the relative importance of these sectors at the regional level. Therefore, as indicated in the general discussion held at the mapping meeting, different aspects of mitigation must be undertaken at the regional level through the cooperation among countries with different problems and therefore different research priorities.

3.2 The livestock sector

From the information provided in the posters, a total of 14 areas of research with 163 ongoing projects were identified within the livestock sector. As illustrated below, the major areas identified in the mapping exercise were **“grasslands”** and **“animal nutrition”** (31 and 30 projects, respectively), followed by **“animal breeding”** and **“integrated farming systems”** (23 and 22 projects, respectively) and **“manure production/application”** and **“manure production/storage”** (17 and 14 projects, respectively). Little ongoing activity has been identified in the remaining areas such as (animal welfare, animal husbandry, and livestock products waste reduction). It should be noted that the area of least activity was **“water supply”**, an important gap to be taken into consideration.

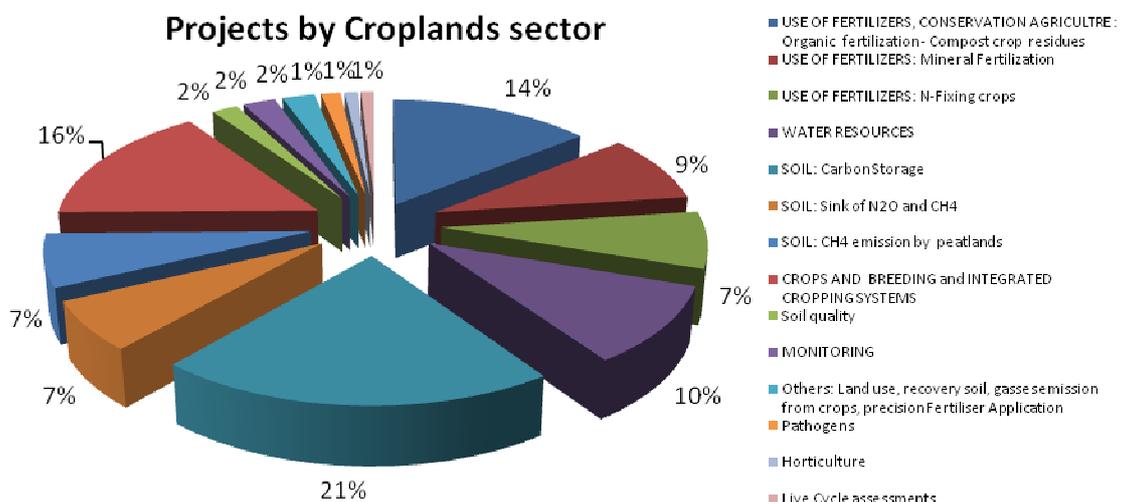


It should be also noted that most of the activity in the livestock sector in being undertaken in Western-Central countries (50%) followed by Northern countries (26%).

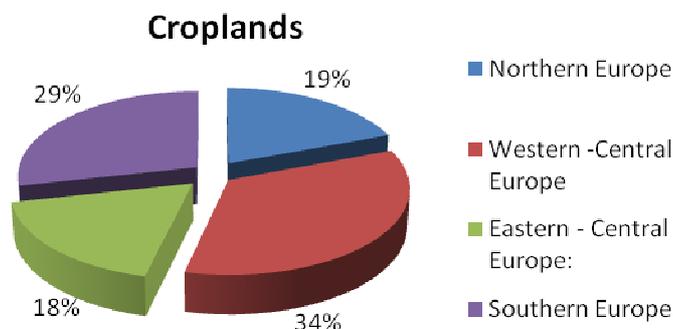


3.3 The croplands sector

From the information provided in the posters, a total of 14 areas of research with 218 projects were identified within the croplands sector. As illustrated below, the major areas identified in the mapping exercise were **"Soil: Carbon storage"** (46 projects), followed by **"Crops and breeding"** and **"Integrated Cropping Systems"** (34 projects), and **"Use of Fertilizers: Conservation Agriculture: Organic Fertilization-Compost crop residues"** (31 projects). An intermediate activity in terms of ongoing projects has been identified in **"Water resources"**, **"Use of Fertilizers: Mineral Fertilization"**, **"Use of fertilizers: N fixing crops"**, **"Soil: CH₄ emission by peatlands"** and **"Soil: Sink of N₂O and CH₄"** (22, 19, 16, 15 and 14 projects, respectively). The remaining 6 areas **"Monitoring"** (5 projects), **"Others: Land use, soil recovery, gas emissions from crops, precision fertilizer application"** (5 projects), **"Pathogens"** (3 projects), **"Horticulture"** (2 projects) and **"Live cycle assessment"** (2 projects) should be considered as gaps.

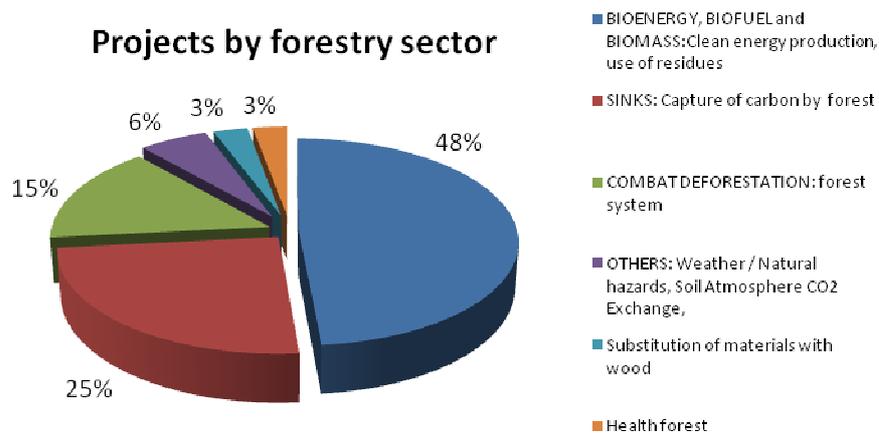


It should be also noted that the activity in the croplands sector appear to be rather balanced with slightly less activity in Eastern-Central and Northern Europe.

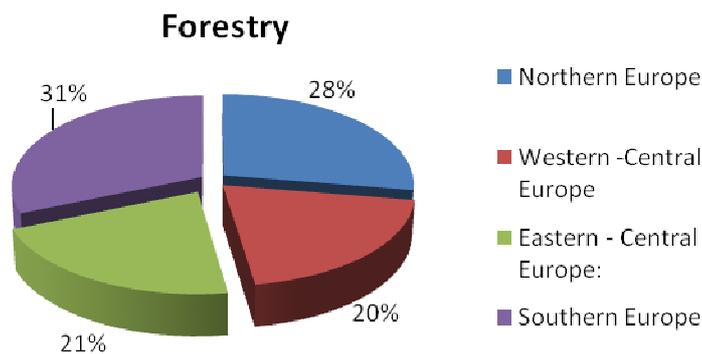


3.4 The forestry sector

A total of 6 areas of research with 105 ongoing projects were identified within the forestry sector. As illustrated below, the major areas identified in the mapping exercise were **"Bioenergy Biofuel and Biomass: Cleaning Energy"** and **"Production, use of residues and sinks: Capture of carbon by forests"** (49 and 25 projects, respectively), followed by **"Combat deforestation: Forest System"** (15 projects). Less activity was identified in **"Weather/Natural Hazards, soil atmosphere CO₂ Exchange"** (6 projects) and **"Substitution of materials with Wood"** and **"Health Forest"** (3 projects each).



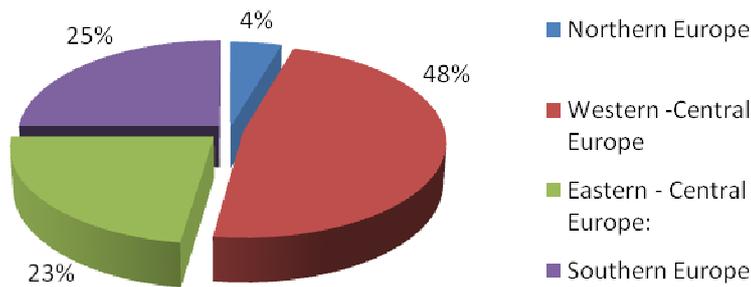
It should be also noted that the activity in the forestry sector appears to be rather balanced with slightly less activity in Eastern-Central and Western-Central Europe.



3.5 The socio-economic sector

The socio-economic aspects (sub-areas defined) are being covered in 44 projects with the highest activity in Western-Central Europe.

Socioeconomic



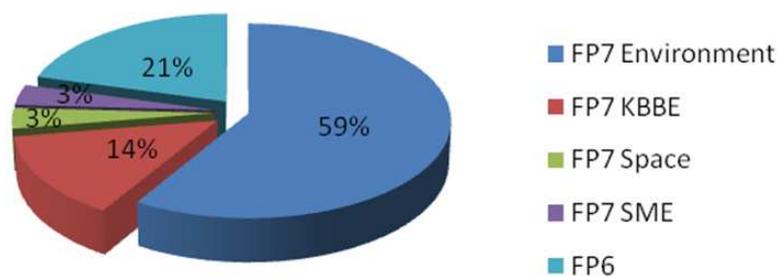
3.6 Additional remarks

The areas identified with a high priority in many countries are **Bioenergy, Biofuel and Biomass**, and **Soil Carbon Storage**. Nevertheless, to define the degree of overlapping it would be necessary to know the specific objectives within each project. In addition, certain projects appear in apparently unrelated areas, a situation that cannot be clarified unless the objectives are known and the projects’ relationship to Mitigation of Climate Change are well defined.

In order to evaluate the effort made by each country in specific areas, information regarding funding and/or persons per year was requested. Unfortunately, this kind of information was provided only by a few countries and when this was done, it was not suitable for comparison purposes. Given that costs of certain items and personnel in particular, vary from country to country, in the future it would be desirable to request the number of persons or person-months per year for comparison purposes. Attempts to identify/quantify the Financing Agencies and Research Programs were not successful given the heterogeneity of financing and accounting systems. As in the case of the conventional mapping exercises, attempts to evaluate financial efforts have been unsuccessful. In the future we should probably request only simple information such as: (i) Budget allocated to each project; (ii) Number of scientists (person-months) involved in each project.

The EC participated in the mapping meeting by providing information regarding the budget allocated to Climate Change related projects in each theme in FP6 and FP7. This represents a total of 29 projects funded with 171,32 M Euros. Again the relative weight of **Mitigation** in these projects was unclear; in many instances the projects addressed Climate Change as a general topic as well as **Adaptation** issues.

EU (FP)



The Mapping strategy based on mapping meetings analysing the information provided in a pre-designed poster format can be considered as positive because: (i) it allows discussion among participating countries; (ii) in contrast to questionnaires which are usually subjected to delays, information is provided as scheduled; (iii) synergies and gaps can be established during the discussion sessions.

4. Bibliometric analysis

A bibliometric analysis was carried out by Wageningen UR Library as part of the mapping exercise. The library was asked to use bibliometric tools to get a better view of the European research capacity in the field of Core Theme 5 of the FACCE JPI Scientific Research Agenda². At the Mapping Meeting the preliminary results of this study were presented. The full final results of the bibliometric analysis are available on FACCE JPI intranet.

The following questions are being addressed in these results:

Questions at institute level

- Which European institutes contribute and with which institutes do they cooperate?

Questions at country level

- Which European countries contribute most?
- Cooperation between countries

Questions at discipline level

- Which are the most important subject areas that contribute publications about the theme
- What are the most important keywords in the publications about the theme

Questions at publication level

- How did overall numbers develop over time?
- What are the most important document types?
- What are the most important journals?

It should be taken into consideration that bibliometric analysis should not be considered as an alternative to conventional mapping through questionnaires nor to the mapping approach described in this report. Bibliometric analysis (if performed accurately using the right data bases, key words, etc..) can provide an excellent insight regarding the results of activities performed in the past, and therefore can be a good complement to mapping exercises that intend to generate information on present day activities and future projects.

² Core Theme 5 of the FACCE JPI Scientific Research Agenda: "*Climate change mitigation / greenhouse gas mitigation: N₂O and CH₄ mitigation in the agriculture and forestry sector, carbon sequestration, fossil fuel substitution and mitigating GHG emissions induced by indirect land use change*"



5. Evaluation

The approach adopted for the FACCE mapping exercises is a new and innovative one. The first mapping meeting was in many aspects experimental. The process as well as the quality of the outcomes were therefore carefully evaluated. This was done to fine-tune the rest of the mapping and foresight exercises to be done within the scope of FACCE CSA, but also to make a comparison with previous experiences with mapping, and to learn from it for other future mapping and foresight studies.

The following steps were taken to evaluate the approach and success:

- A technical group consisting of the WP2 team (Netherlands and Spain) plus the Governing Board members of Denmark and Italy was established. This group met two months before the mapping meeting and reflected on their experiences with mapping and brainstormed about the aspects of evaluation of the mapping exercise in FACCE CSA.
- Two external guests from the Ministry EL&I, who are involved in other JPI and ERA-NET actions, were invited to attend the first mapping meeting and to make observations of the process, in addition to the Governing Board members from Denmark and Italy.
- At the mapping meeting, after the general discussion, a quick questionnaire was passed to the participants to evaluate the mapping experience.
- The evaluation of the process is an integral part of this report
- The lessons learned are used in the planning of the upcoming mapping and foresight exercises.

5.1 The overall approach

The quick questionnaire that was passed to the participants evaluated the mapping experience from the viewpoint of participating countries. The results can be summarized as follows:

- 1) What did you appreciate most from this mapping meeting?
 - The possibility for interaction among participants and to be creative.
 - Good discussion among mixed groups
 - Nice venue
 - Exchange of information
- 2) What could be done to improve this type of meetings?
 - Better preparation and distribution of posters.
 - Better description on how to fill the posters.
 - Narrower scope of the requested information.
 - Clustering of topics.
 - Policy posters focusing on policy needs.
- 3) How much preparation time is needed for the information requested in the posters?
See 5.3
- 4) Have you organized mappings or contributed to mapping exercises before?
 - Most participants have little or no experience.
- 5) What is in your opinion the added value of mapping meetings?
 - Personal contact and commitment.
 - Easy to find common interests.
 - See and appreciate the overall picture of the Core Theme.
- 6) What are the drawbacks?
 - Some posters appear not to be completed.
 - The information provided is sometimes difficult to compare.
 - Difficulties in keeping the mapping adequately structured.

5.2 Content of the posters

A stocktake may bring a wealth of information and provide the basis for identifying gaps and overlaps, and, through discussion, come up with recommendations and plans. For the organisers it was a challenge to achieve an optimal balance between information richness and facilitating meaningful discussion at the mapping meeting.

The policy poster format was designed to get sketches of the scene and have the countries providing background information on research policy, funders, research organisations, and programmes on mitigation.

The science poster format was designed to provide the overview of programmes/projects structured according to a thematic structure for which the Scientific Advisory Board had been consulted.

The first format sent to the invitees was for some quite difficult to use; it was structured down to a level too deep and did not leave enough space to add themes. Therefore, the team prepared swiftly a simplified format, which was used by all participants.

It was clear from discussions in the break-out session, and from feedback that, considering the content of the topics, people were struggling with the boundaries of the topics. What was included in the discussion and what was off topic? In addition, the range of topics was very wide. This gave people even more the feeling that the task was heavy and complicated

The posters were considered interesting, but sometimes very difficult to grasp. There were differences in the way in which people had presented the information. In some posters, some of the information was missing. It turned out that in the discussions people referred mostly to the research poster. It was not clear how the information in the policy poster could be used best and these posters did not contribute much to the discussions. So they were just for gathering the policy information.

By using posters with a prescribed format in the mapping exercise the information was presented in a concise and structured way.

5.3 Time needed to prepare the posters

In the questionnaire after the general discussion, the participants were asked how much preparation time is needed for the information requested in the posters.

Filling in the posters took most of the countries between 3 and 10 working days. A few countries were able to complete the poster within a day, and some countries spent over 20 person-days. Some countries could draw heavily on information that was already gathered and thus could compile the information on the posters relatively fast. For example, with regard to the science poster, UK, Ireland and Netherlands made use of the recent stocktake by the Global Research Alliance.

In particular the countries in which the composers of the information needed to contact people from national institutes and universities to deliver information spent a lot of time.

5.4 The break-out sessions

The meeting brought a huge added value to the mapping process through the discussion on the posters and the brainstorming on recommendations and priorities.

During the break-out sessions two external observers walked around and observed the processes in the groups. The quotes below are their observations.

“There were seven groups. Each of them had a different approach. Some started with introducing everybody in the group, others started going deeply in one poster by one of the Member States, again

others were having a discussion in which two member states argued about the differences between their countries, others were addressing topic by topic going through Member States at the table.”

“Common to all the groups was the enthusiasm by which they worked. Everybody was actively involved, doing their best to deliver results. Despite that most people had travelled in the morning and we worked until 19.30! This amazing work spirit even lasted the next day, when we worked all morning and had a plenary after lunch.”

“Not everybody understood the assignment from the beginning. In the first quarter of the working in sub groups, some people were still puzzled and the facilitator needed time to explain this again.”

“Every facilitator worked by a different method. This does not need to be a problem. However, it appeared that the facilitators were also very much searching for their role and how to handle the process. I believe that the facilitators would be helped by a little more guidance about their role.”

“People enjoyed telling about what happens in their country and listening to others. This meeting was therefore a great opportunity to be informed about other countries. They were pleased to get to know each other better in this way.”

“They sometimes had difficulties in finding commonality in research / policy needs, because agriculture and climate change have huge regional differences in impact and solutions. Often people were confronted with all these regional differences. ”

“Every group managed to get to results for their presentation. Although the group discussions sometimes got focussed completely on one Member State, they all managed to produce answers to the questions. That made me question a little bit, if they really learned that from the discussion, or that what they presented was mainly the well informed opinion of one or two of the group members.”

“Time management was very good. Nobody complained about boring long sessions that got out of time. Quite the opposite, the group had such great energy that in all sessions time was used efficiently, which made it all very rewarding for the group.”



6. Conclusions on the approach and recommendations to the FACCE-JPI Governing Board

6.1 General conclusions regarding the approach

Conclusions and recommendations are drawn concerning the process in view of the upcoming mapping and foresight studies on other themes within FACCE-JPI. Overarching conclusions concerning the approach are drawn in this section. Section 6.2 focusses on the mapping meeting.

The big difference in the approach for mapping and foresight undertaken in FACCE, as compared to 'classical' mapping by conducting an inventory using questionnaires, is the use of a mapping meeting. The meeting is part of the process, furthermore consisting of a stock take by posters, an analysis of the information on the posters and a bibliometric analysis.

A classic mapping exercise may take very long, in particular the step to gather the information. Here the deadline for delivering the completed posters was relatively short. As a consequence some people felt they didn't have enough time and that their posters did not provide a comprehensive enough picture. Nevertheless the posters proved to give sufficient ground for the further process.

In addition to the Mapping Meeting committed in the CSA project, following the recommendation of the Governing Board, the results of a bibliometric analysis have also been taken into consideration. It should be kept in mind that the results achieved with the mapping meeting and with the bibliometric analysis are complementary. The bibliometric analysis provides good information from a scientific point of view, but only reflects the past. It does not take into account research that has started recently, neither can it provide information on future programmes. Put shortly: a bibliometric analysis is a complementary tool to a mapping meeting, not an alternative.

6.2 Conclusions concerning the mapping meeting

The mapping meeting made the involvement in a mapping exercise rewarding for the people that gathered and compiled the information. It was a very energetic meeting with lots of interaction. Through the sharing of information, elaboration on the posters, discussions and jointly drawing the conclusions and prioritizing the recommendations, the ownership of the outcomes of the mapping exercise is much more a shared thing than by classic questionnaires.

The approach served the political, scientific and social process.

From the feedback of participants and observers, and the evaluation by the organising team, some points for further improvement are noted. The most important point considers the limits of the topics to be addressed. The broadness of the theme made people struggle with preparing posters and with focussing in the break-out sessions and the plenary session. Furthermore, improvements can be made by setting restrictions on the depth that the topics need to be discussed. It is considered crucially important to have the input of specialists in order to ask the right questions and design the most appropriate poster format.

From a point of clearness and uniformity, the following recommendations were drawn. As some countries had some difficulties with completing the poster, they could be instructed in a better way by a more detailed guide on how to complete the posters. This would help in providing a stronger coherence among posters in future meetings. Also, a structure for facilitating the break-out sessions could be elaborated. This would help the facilitators in how to handle the process, and the processes in the different groups

would be harmonized. Before the mapping meeting a break out session could be simulated with a test group in order to practice the process and find out about the type of results that are generated.

Regarding the planning the schedule for the preparations of a meeting could be optimized for example by contacting SAB members in a very early phase and asking for confirmation of availability before fixing a date. Secondly, a bit more time for preparing the posters as well as distributing the posters to the participants one week before the meeting would be good. The organisational timeline for a mapping meeting would therefore need to start about four months before the mapping meeting and deadlines should be kept strictly. For example, posters that are sent too late will not be distributed to the participants and maybe not printed.

It is very important to have the right people involved in preparing the posters and in participating in the meetings. Participants need to bring a good overview of the thematic scope of the mapping exercise for their country. In addition, the policy representatives have to be knowledgeable about research policy, structures, programmes within their country but beyond their own organisation or own ministry.

In conclusion, in the first mapping meeting there was a good representation from both science and policy. To the participants and the organisers alike, the interactions gave a huge added value to a mapping exercise. The process was highly participative and productive regarding the delivery of recommendations. It was a very energetic meeting.

6.3 Recommendations to the FACCE JPI Governing Board towards joint actions.

The recommendations are based on the assessment of the information on the posters, the break-out sessions and the plenary discussion at the mapping meeting, and the complementary bibliometric analysis.

Recommendations for **research themes** for tackling by joint action

1. *Mitigation options focusing on carbon sequestration in crop production.* The first aspect in this regard is sequestration in soil. This includes biological processes and agronomical management practices concerning soil carbon dynamics and sequestration. The other sub-theme under this header is the efficiency of crops, grasslands and forests as carbon sinks are a topic for research. This concerns e.g. the potential of carbon sequestration potential of fruit trees in Southern Europe.
2. *Protocols and certification for methods to assess greenhouse gas emission.* Policy measures and (new) technologies should be based on sound evidence and the best knowledge available. Results from different research projects and trials should be comparable and available, including the underlying data. Harmonisation of assessment methods and working methodologies would not only contribute to the quality and comparability of the data, but also in a better judgement of the effects of (potential) measures to reduce emission of greenhouse gasses. Training and education courses were mentioned as a tool to stimulate methodology convergence.
3. *Reduction of emissions by livestock, in particular through nutrition and animal breeding.* CH₄ and N₂O emissions are dependent on: i) animal species and breeds; ii) the housing system; iii) manure treatment; iv) diet composition and feeding regimes; v) soil management. These factors are interrelated. Low emission production systems are needed. Livestock research is expensive, and measurement of greenhouse gas emission is difficult (individual animals, buildings, manure). Cheap and handy measurement tools are needed.

4. *Carbon and nitrogen cycling in the agro-ecosystems.* Toward a common framework for Life Cycle Analysis (LCA) of livestock production systems and of crop production systems. Investigate how farming practices should be modified in order to optimise the management of crop residues and soils, and to increase plant root and other biomass in soils. Assess manure and its role on climate change.
5. *Study of indirect emissions.* This concerns quantification of indirect emissions (NO_3^- , NH_3), including N leaching into the LCA's, and exploring the potential of precision agriculture to reduce N losses and increase N_2O mitigation.

Recommendations for **tools** to undertake cooperative research

1. *Harmonize modelling systems and efforts.* Models, e.g. for farm systems should be compatible with each other (compatible protocols). This subject should be addressed together with other stakeholders, e.g. GRA. Harmonizing modelling systems and efforts will be addressed in the FACCE JPI Pilot Action (Knowledge Hub).
2. *Optimize cooperation between FACCE JPI and the GRA.* A need is indicated of coordination and cooperation with the Global Research Alliance (GRA). Activities of FACCE JPI and the GRA should be complementary, using harmonized methods, common protocols, sharing of data and gearing of activities to one another.
3. *Start an open process to identify relevant infrastructures to be shared.* Identify infrastructures that are necessary to study mitigation in all relevant areas and taking into consideration the major topics. It is essential to know which and how many infrastructures are available and where they are located. It is also essential to know the usability and the costs/savings of sharing these infrastructures. It is crucial to build and share common databases.
4. *Develop adequate tools for judging integrated production systems.* There is a need to make adequate assessments in order to understand its components in space and time. In this regard it is important to define emission scenarios/balances in integrated systems that should be developed by working at "farm level". Working at "farm level" was considered crucial, but difficult to undertake without having good assessment methods. A life cycle assessment (LCA) should be developed and undertaken in order to define the impact associated with agricultural practices. Boundary issues for different EU farming systems should be taken into consideration.

7. Annexes

Annex 1. Programme of the mapping meeting, 20-21 June 2012,
The Hague

Programme

FACCE JPI Mapping Meeting on Core Theme 5: *Mitigation of Climate Change (or Mitigation of Greenhouse Gases)*

June 20 – 21, The Hague, The Netherlands

Chairperson

The Mapping Meeting will be chaired by Mr prof. Herman Eijsackers, Chief Scientific Officer of the Ministry of Economic Affairs, Agriculture and Innovation, The Netherlands.

Monday June 20		
Time	Activity	Location
13:00 – 14:00	Registration	Entrance of Ministry (EL&I)
14:00	Welcome	Weerribben
14:10	Introduction FACCE JPI - Isabelle Albouy (JPI FACCE CSA coordinator)	Weerribben
14:20	Introduction on core theme 5 <i>Mitigation of climate change</i> - Jean-François Soussana (chair JPI FACCE Scientific Advisory Board)	Weerribben
14:30	Results bibliometric analysis - Wouter Gerritsma (Wageningen UR)	Weerribben
14:40	Relation with the Global Research Alliance - Jac Meijs (Wageningen UR / Global Research Alliance)	Weerribben
14:50	Scope and aim of mapping exercises and this mapping meeting - Peter Keet (JPI FACCE CSA WP2)	Weerribben
15:20	Programme of today and tomorrow - Peter Keet (JPI FACCE CSA WP2)	Weerribben
15:30	Coffee break	Foyer
16:00 – 19:00	Poster session 1	
16:00	Introduction (working process)	Foyer

16:15	Studying posters	Foyer
17:00	Dividing into groups <i>Around 17:00 h drinks and snacks will be served</i>	Foyer
17:10	Going (deeply) into the posters: questions	Foyer
17:40	Identifying possibilities for joint actions	Foyer
18:20	Reports / short presentations from groups	Weerribben
19:00	Wrap-up day 1, looking forward on day 2	Weerribben
19:30 – 21:45	Dinner	Restaurant EL&I

Tuesday June 21		
Time	Activity	Location
08:30 – 09:00	Registration	Entrance of Ministry
09:00	Welcome	Weerribben
09:15 - 12:30	Poster session 2	
09:15	Introduction (working process)	Weerribben
09:30	Dividing into groups	Weerribben
09:40	Going (deeply) into the posters: questions	Foyer
10:20	Identifying possibilities for joint actions	Foyer
11:10	Reports/ short presentations from groups	Weerribben
12:00	Seeing suggestions of day 1 and day 2 together	Weerribben
12:30	Lunch	Dakterras (terrace)
13:30	Discussion	Weerribben
14:45	Overall conclusions	Weerribben
15:10	Evaluation	Weerribben
15:25	Closure	Weerribben
15:30	Drinks	Foyer

Annex 2. List of participants

	Country	Last Name	First name	Organisation	Science /Policy delegate
Country delegates					
1	AUSTRIA	KEUSCHNIGG	Maria	Federal Ministry of Agriculture, Forestry, Environment and Water Management	Policy delegate
		MARKART	Gerhard	Department of Natural Hazards and Alpine Timberline	Science delegate
2	BELGIUM	DEMEYER	Peter	Instituut voor Landbouw- en Visserijonderzoek, Eenheid Technologie en Voeding	Science delegate
3	DENMARK	GØTKE	Niels	Danish Agency for Science and Innovation	Policy delegate
		OLESON	Jorgen E.	University of Aarhus	Science delegate
4	ESTONIA	MALM	Maarja	Ministry of Agriculture, Research and Development Department	Policy delegate
		LOIT	Evelin	Estonian University of Life Sciences (head of the Department of Field Crop and Grassland Husbandry)	Science delegate
5	FINLAND	PELTONEN	Mikko	Ministry of Agriculture and Forestry	Policy delegate
		TUBB	Roy	MTT Agrifood Research Finland	Science delegate
6	FRANCE	HERAL	Maurice	Agence Nationale de la Recherche	Policy delegate
		PELLERIN	Sylvain	INRA, Centre de Bordeaux-Aquitaine	Science delegate
7	GERMANY	TINOIS	Nicolas	Project Management Group Juelich, Forschungszentrum Jülich GmbH	Policy delegate
		KUHRAU	Timotheus	BMELV/BLE	Policy delegate
		PLASSMANN	Katharina	Institute of Agricultural Climate Research, Johann Heinrich von Thunen Institute	Science delegate
8	IRELAND	LANIGAN	Gary	Teagasc – Environmental Research Centre	Policy delegate
		CRAMMOND	Dale	Dept. Agriculture, Fisheries & Food	Science delegate
9	ISRAEL	LEVY	Guy		Policy+Science delegate
10	ITALY	MARZETTI	Annamaria	Ministero delle Politiche Agricole Alimentari e Forestali	Policy delegate
		ROGGERO	Pier Paolo	Ministero delle Politiche Agricole Alimentari e Forestali	Science delegate
11	NETHERLANDS	MEIJS	Jac	Wageningen UR (ASG)	Science delegate
		SMIT	Harm	Ministerie van Economische Zaken, Landbouw en Innovatie	Policy delegate
12	NORWAY	OYGARDEN	Lilian	Bioforsk (The Norwegian Institute for Agricultural and Environmental Research)	Science delegate
		ANKER-NILSEN	Kirsti	Research Council of Norway	Policy delegate

13	POLAND	RZEPECKA	Monika	Ministry of Science and Higher Education	Policy delegate
		KUNDZEWICZ	Zbigniew	Institute for Agricultural and Forest Environment of Polish Academy of Sciences	Science delegate
14	ROMANIA	POPESCU	Antoaneta	Ministry of Education, Research, Youth and Sport, National Authority for Scientific Research	Policy delegate
		STAIKU	Monica	Ministry of Agriculture and Rural Development	Policy delegate
		CHIRU	Sorin	National Institute of Research and Development for Potato and Sugar Beet	Science delegate
15	SPAIN	DURAN	Nuria	Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)	Policy delegate
		MELGAREJO	Paloma	Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)	Policy delegate
		IGLESIAS	Domingo	Instituto Valenciano de Investigaciones Agrarias (IVIA)	Science delegate
		DEL PRADO	Agustin	BC3-Basque Centre for Climate Change-Klima Aldaketa Ikergai	Science delegate
16	SWEDEN	SVENSSON	Jan	JPI FACCE gov.board	Policy delegate
17	TURKEY	TOPCU	Sevilay	Cukurova University	Science delegate
18	UNITED KINGDOM	SPADAVECCHIA	Luke	DEFRA (FFG-EKB)	Policy+Science delegate
		ROPER	Mike	DEFRA (FFG-EKB)	Policy+Science delegate
Organisers: CSA WP 2 team					
SPAIN		DURAN	Núria	INIA. Also country representative	
SPAIN	MELGAREJO	Paloma	INIA. Also country representative		
SPAIN	DELGADO	Ma José	INIA		
NETHERLANDS	BUNTHOF	Christine	Wageningen UR		
NETHERLANDS	KEET	Peter	Ministerie van Economische Zaken, Landbouw en Innovatie		
NETHERLANDS	HABING	Lorens	Ministerie van Economische Zaken, Landbouw en Innovatie		
NETHERLANDS	DEN DULK	Wil	Ministerie van Economische Zaken, Landbouw en Innovatie		
Other participants					
JPI FACCE - CSA WP 1	PASTORI	Gabriela	Secretariat JPI FACCE		
Chair	EIJSACKERS	Herman	Ministerie van Economische Zaken, Landbouw en Innovatie		
Speaker; SAB - JPI FACCE	SOUSSANA	Jean François	SAB - JPI FACCE		
Speaker; JPI FACCE CSA Coordinator	ALBOUY	Isabelle	JPI FACCE CSA Coordinator		
Speaker; (bibliometric analysis)	GERRITSMAN	Wouter	Wageningen UR Library		
Observer from EL&I / ERA-NET SUSFOOD	VAN DUIJNE	Freija	Ministerie van Economische Zaken, Landbouw en Innovatie		
Observer from JPI Water	BIERENS	Bart Jeroen	Ministerie van Economische Zaken, Landbouw en Innovatie		

Annex 3. Outcomes of the break-out sessions

The arrangement of participants in groups is shown in Annex 6. On Day 2 the groups were different than on Day 1 and different persons acted as reporter for the groups.

Outcomes of the break-out session on Day 1

Group 1:

Agustin del Prado (ES) [reporter], Jorgen Oleson (DK), Maarja Malm (EE), Gary Lanigan (IE), Timotheus Kuhrau (DE), Christine Bunthof (NL) [moderator].

- 1.1. Joint efforts in modelling was found to be an area of common interest.
- 1.2. The availability of infrastructures for modelling in Europe taking into consideration different scales and purposes (multi-pollutants and socioeconomics).
- 1.3.-Verification of GHG emissions was also found to be of interest. Emphasis was placed on the need to have certified protocols (like for NH₃) and inventories.
- 1.4. Identification of the whole mitigation gradient with regard to different sites and agricultural systems. Study of indirect emissions (NO₃⁻, NH₃, ..)

Group 2:

Mikko Peltonen (FI) [reporter], Antoaneta Popescu (RO), Michael Van Zeebroeck (BE), Sylvain Pellerin (FR), Jac Meijs (NL) Isabell Albouy (FR) [moderator].

This group remarked that the information provided in the posters provided little information on the specific mitigation topic.

- 2.1. Common conceptual framework and holistic approach to GHG emissions and cycles.
- 2.2. Meta-analysis of experiments dealing with minimum tillage.
- 2.3. Indirect GHG emissions (N leaching)
- 2.4. Aquaculture and mitigation as a topic to be considered in the future.
- 2.5. Impact assessment of mitigation policy options.

Group 3:

Mike Rop (UK) [reporter] Niels Gotke (DK), Zbigniew Kundzewicz (PL), Mike Roper (UK), Gerhard Markart (AT), Guy Levi (IL). Peter Keet (NL) [moderator].

This group remarked the differences between North and South regarding funding of research activities. Northern and Southern countries differ in their recognition of the need to develop mitigation measures with Northern European countries placing more emphasis on adaptation strategies, therefore resulting in differences in policy priorities, availability of funds and interest in establishing collaborations.

- 3.1. Gas mitigation (CH₄) of livestock systems was identified as an important gap that deserves attentions. The importance of genetics, breeding nutrition, and feed additives were considered as important areas of research.
- 3.2. Carbon sequestration and storage including (i) carbon capture as consequence of land use changes that include the associated afforestation, the growth of bioenergy crops, inorganic C capture (CO₂); (ii) grassland, pastures and CH₄ abatement options; and (iii) ecosystem analysis.
- 3.3. Precision agriculture in order to: (i) reduce N losses; (ii) increase N₂O mitigation possibilities. The precision agriculture should be the driver for economic gains and improved food security. The group proposed the ERA-Net system as a strategy to develop and test precision agriculture systems.
- 3.4. Improvement of inventories at national levels by enhancing the exchange of information and data on emission factors and increasing the uniformity of inventory measurements among participating countries.

Group 4:

Roy Tubb (FI) [reporter], Sevilay Topcu (TR), Peter Demeyer (BE), Maurice Heral (FR), Harm Smith (NL), Gabriela Pastori (UK) [moderator].

This group also remarked that the information in the posters provided scarce information on mitigation. This group highlighted the importance of work at the farm level and identified gaps in issues such as (i)

photo-respiration; (ii) Increased photosynthetic efficiency as a means for CO₂ fixation; and (iii) changes in land use.

4.1. Grasslands. The group remarked the importance of grasslands even though the posters revealed low interest in this topic in contrast with other topics like "Bioenergy" and "N-cycle" and specially their link to resource efficiency.

4.2. Animal nutrition linked to animal genetics. Animal nutrition was revealed as a topic of interest for many countries that were undertaking activities in this field and specifically on: (i) CH₄ emissions and their relationship to genetics and nutrition; (ii) probiotics for ruminants; (iii) feeding regimes; (iv) need for adequate infrastructures as experimental facilities as well as common working methodologies. Such issues are interlinked to Animal genetics with an interest shared by many countries which however focused their activities in different species. In this regards metagenomics and phenomics were identified as areas of general interest.

4.3. Manure and its role on Climate Change were also identified as a topic of interest. The group indicated that this was an issue more difficult to study than for example the more standardized issue of GHG. The group also highlighted the need to reduce energy inputs as a means to accomplish mitigation measures.

4.4. Assessment of emissions, sequestrations and re-cycling. The group highlighted the need to make adequate assessments in order to understand its components in space and time. In this regard it was found important to define emission scenarios/balances in integrated systems that should be developed by working at "farm level". Working at "farm level" was considered crucial but difficult to undertake without having good assessment methods. A life cycle assessment (LCA) should be developed/undertaken in order to define the impact associated with agricultural practices.

4.5. Soil and carbon storage was also brought up as an area of interest.

Group 5:

Luke Spadavecchia (UK) [reporter], Lilian Oygarden (NO), Evelin Loit (EE), L (UK), Katharina Plassman (DE), Annamaria Marzetti (IT), M^a José Delgado (ES) [moderator].

The group considered the general objectives outlined in the posters as attempts to modify agricultural practices within our existing farming systems. They proposed to undertake the mitigation issue in terms of thinking of new systems integrating food, energy and biodiversity using an "Ecosystem service approach".

5.1. Peat lands and mitigation. Study of emissions from drained and fertilized peat lands kept under arable conditions as well as emissions after restoration of GHG balance.

5.2. N₂O fluxes. There has to be measurement and modelling systems for N₂O fluxes. Such measurements/models should be able to be up-scaled from microenvironments to continental systems (microenvironment, plot, field, landscape, national level, continental level,.....).

5.3. Soil carbon dynamics and sequestration. Study the growth of alternative crop (crop rotation) to enhance C sequestration.

5.4. Livestock. Integrated approaches based on nutrition and genetics to reduce gas emissions.

5.5. Anaerobic digestion and biogas-feedstock mixes. To develop integrated systems avoiding diversion of food and forage crops.

Group 6:

Dale Crammond (IE) [reporter] Kirsti Anker-Nielsen (NO), Monika Rzepecka (PL), Maria Keuschnigg (AT), Domingo Iglesias (ES), Paloma Melgarejo (ES) [moderator].

The group complained about the difficulty/work necessary to fill up the posters. In addition, the group sensed that much effort had been placed on the identification of priority lines but that little had been done to identify gaps. In addition, the group suggested improving the attempts to provide more uniform information and a better way to evaluate the efforts provided by different countries either through the budget invested or the personnel devoted to specific topics.

6.1. C storage in perennial fruit crops.

6.2. Evergreen fruit trees grown in Southern/Mediterranean countries are probably playing the double role of food production and CO₂ sinks. This was especially important in the case of perennial evergreen fruit trees at the Mediterranean basin (i.e. citrus crops).

6.3. Coordination among small groups to undertake collaborations of common interest. As examples, Southern countries may not share the same problems/priorities than Northern countries. In this regard, they identify countries with high research investments in livestock whereas others do not.

6.4. N fixing crops (legumes) were proposed as interesting in terms of rotation to avoid over fertilization. In addition it was proposed to study their potential as biofuel sources.

Group 7:

Pier Paolo Roggero (IT) [reporter] Jan Svensson (SE), Srin Chiru (RO), Monica Staicu (RO), Nicolas Tinois (DE), Núria Duran-Vila [moderator].

The group found difficulties in identifying topics of common/general interest.

7.1. Land use. Land use was identified as an important issue to be considered to develop mitigation measures. Intensification of land use versus abandonment promotes important changes in terms of C balance. The need for adequate policies and their implementation are crucial. These policies should be developed at production systems scale and be implemented at district/regional level.

7.2. Definition of life cycle analysis taking into consideration boundary issues (network of close loops) for different EU farming systems.

7.3. Biofuel and Bioenergy were identified as issues of common interest but their link to mitigation was difficult to establish.

7.4. Water management (irrigation systems and hydrological issues) is crucial for proper farming systems.

7.5. Science-policy-stakeholding interfaces should be effectively addressed at case-study level by using mediating objects for joint learning.

At the end of the exercise there was a general feeling of how enriching the discussion had been. Nonetheless, in spite of the efforts devoted by the working groups, there was a concern as to whether the effort would allow the identification of issues/topics for cooperation that would be suitable to provide concrete recommendations to the GB and SAB. However, the second discussion exercise that took place on day 2 turned out to be a success in terms of providing more standardized recommendations.

Outcomes of the break-out session on Day 2

Group 1':

Gary Lanigan (IE) [reporter], Jorgen Oleson (DK), Maarja Malm (EE), GaKirsti Anker-Nielsen (NO), Monika Rzepecka (PL). Christine Bunthof (NL) [moderator].

The group presented interesting observations regarding the relationship between FACCE-JPI and the Global Research Alliance (GRA) indicating that their activities should be complementary. In addition, the group indicated that: (i) financial contributions should precede any proposal of FACCE-JPI; (ii) FACCE-JPI should be flexible in terms of scale because whereas some topics should be undertaken at a pan-European level, others should be run at regional level.

1'.1. Reducing uncertainties associated with N emissions.

1'.2. Additional quantification for C sequestration.

1'.3. Inclusion of measurements/data into inventories.

1'.4. Assessment of regional and ubiquitous measures.

Group 2':

Mikko Peltonen (FI) [reporter], Antoaneta Popescu (RO), Timotheus Kuhrau (DE), Agustin del Prado (ES), Jac Meijs (NL) [moderator].

The group highlighted the need to have a dedicated program on mitigation by pooling the existing national resources and activities. They also indicated the need of coordination with the GRA.

2'.1. Common conceptual framework to be developed with the GRA using a holistic approach to establish: (i) land use and trade-offs regarding mitigation; (ii) integrated farm systems; (iii) socioeconomic aspects; (iv) system tools.

2'.2. Indirect emissions and the associated uncertainties regarding leaching, and energy use.

2'.3. Meta-analysis of soil carbon sequestration taking into consideration aspects such as tillage, and covers and any results available in the literature.

2'.4. Model development and harmonization which will partially covered within the FACCE pilot action (Knowledge Hub).

2'.5. Inventories of GHG emissions and sinks to be undertaken with GRA using harmonized methods.

Group 3':

Guy Levi (IL) [reporter], Michael Van Zeebroeck (BE), Zbigniew Kundzewicz (PL), Mike Roper (UK), Sylvain Pellerin (FR), Peter Keet (NL) [moderator].

3'.1. Methane emission mitigation in livestock systems. This topic appears in most posters and therefore it is a potential issue for cooperation in Research and Development.

3'.2. Review of EC funded projects (FP7 programs) before commissioning new work.

3'.3. Encouraging collaboration on monitoring of soils to evaluate carbon accounts in relation to farm management activities to mitigate GHG emissions. As an example, the French monitoring program has evaluated more than 2000 farms.

3'.4. Cooperation in terms of harmonization of ecosystem approaches in order to optimize production and at the same time to minimize GHG emissions.

3'.5. Development of (high-tech) innovative practices in livestock and crop production systems to minimize GHG emissions (design of mega dairy units, GM crops, and sophisticated organic systems).

Group 4':

Harm Smith (NL) [reporter], Nicolas Tinois (DE), Sevilay Topcu (TR), Niels Gotke (DK), Gerhard Markart (AT), Gabriela Pastori (UK) [moderator].

4'.1. Climate change. The group elaborated on the suitability of undertaking mitigation and adaptation as two issues to be considered together or separately.

4'.2. Knowledge transfer. This was considered a key issue in terms of: (i) having adequate infrastructures to build excellent data; (ii) building networks for transfer of technology to the farmers; (iii) undertake jointly energy saving and production of bio-energy issues.

4'.3. Animal nutrition and breeding. This issue was consistently brought up in day 1 exercise.

4'.4. Grassland. The group observed little if any EU coordination regarding this issue and suggested the need for North/South clustering.

4'.5. Carbon storage. This issue was consistently brought up in day 1 exercise and the group indicated the need for more coordination in spite of the broadness of the issue that involves forestry, cropland and grassland.

Group 5':

Annamaria Marzetti (IT) [reporter], Roy Tubb (FI), Evelin Loit (EE), Luke Spadavecchia (UK), Peter Demeyer (BE),) M^a José Delgado (ES) [moderator].

The group discussion focussed the difficulties encountered due to the fact that in the information provided in the poster mitigation is considered in a more general context and linked to adaptation. They identified uncertainties in the evaluation of climate change issues and therefore difficulties to orient research policies. The group considers essential to share experiences and pursue integrated approaches. In the short and medium term the group encourages networking and knowledge sharing through existing networks of excellence, building new networking instruments and platforms and training. When evaluating the outputs of the mapping exercise, the input of stakeholders should be entertained.

5'.1. Cross cutting activities for methodology convergence, standardization and sharing of protocols and data. This should aim to a life cycle assessment (LCA) in collaboration with the GRA.

5'.2. Livestock breeding and nutrition are key issues that should be undertaken in an integrated farming system approach. A critical issue is manure management but it is critical to look for the best and feasible techniques available leading to energy-sufficient farm systems. Within the livestock research sector there is a need to share data, infrastructures and experiences on gas emissions, N balance and CO₂ capture taking into consideration that the methodologies used for these measurements must be compatible.

5'.3. Biofuels were identified as an issue with research being undertaken in many countries. However, the group indicated the need for sharing information and strengthening integrated processes at a level of energy efficient and sustainable farming systems.

5'.4. Soil management was identified as an important issue. Unfortunately, more information on fluxes of N and CO₂ in different situations is required. Soil mapping and databases are critical issues to be worked out.

Group 6':

Jan Svensson (SE) [reporter], Pier Paolo Roggero (IT), Dale Crammond (IE), Maria Keuschnigg (AT), Domingo Iglesias (ES), Paloma Melgarejo (ES) [moderator].

6'.1. Harmonization of modelling efforts. The group suggested the suitability of developing an on-line portal and organize training/education courses.

6'.2. Life cycle analysis. This topic also identified in day 1 was considered critical in order to define boundaries. The need to organize training/education courses was also considered.

6'.3. Integration of social dimensions into research policy.

6'.4. Increase the knowledge on Carbon storage in food and non-food crops and forestry systems. A regional approach taking into account the relative importance of crops and forests along the North-South gradient would be desirable (ie. major Mediterranean crops in the South, forests in the North)

6'.5. Open process to identify relevant infrastructures to be shared.

Group 7':

Lilian Oygarden (NO) [reporter], Maurice Heral (FR), Srin Chiru (RO), Monica Staicu (RO), Katharina Plassman (DE), Núria Duran-Vila (ES) [moderator].

7'.1. Development of farm system models using common protocols to be undertaken in collaboration with the GRA. For the development of farm system is essential: (i) To compare different protocols/models in order to choose the best of those that are compatible with each other; (ii) To have common databases based on the experimental results achieved with compatible protocols.

7'.2. Identify infrastructures that are necessary to study mitigation in the areas and taking into consideration the major topics. It is essential to know which and, how many infrastructures are available and where they are located. It is also essential to know the usability and cost of sharing these infrastructures.

7'.3. Need to develop regional approaches/clusters to study regional issues. The group provided as examples of issues to be undertaken by clusters the interest/need of Nordic countries in measuring peat-land emissions and potential input of Mediterranean countries in studying the role of evergreen perennial fruit trees in C-capture. On the other hand, issues such as: (i) Management of integrated fish farming and vegetable greenhouses for reduction of gas emissions and efficient use of nutrients; (ii) Fundamental research on genomics; (iii) Inventory of the most suitable crops to reduce gas emissions, should be undertaken at a global level.

7'.4. Develop better genotypes (breeding) in terms of: (i) lower gas emissions; (ii) efficient use of soil nutrients (including input of plant physiologists in order to go from C3 to C4 crops); (iii) selecting and breeding crops that had been identified/inventoried as suitable to reduce gas emissions, therefore increasing their mitigation capacity.

7'.5. Encourage changes in diet in order to achieve food security. Such changes impose a switch from meat proteins to fish and plant proteins and will require additional breeding programs with the subsequent effect on gas emissions and global mitigation. A changing diet will require the input of education, social impact, medical input, and a global approach of several disciplines.

Annex 4. List of documents from *FACCE-JPI Mapping and Foresight on Mitigation of agricultural greenhouse gases induced climate change* available on the intranet.

- A. Report “JPI FACCE Mapping and Foresight on Mitigation of agricultural greenhouse gases induced climate change - Options for strategic collaboration - FACCE CSA Mapping Meeting 1, June 20-21, 2011, The Hague, The Netherlands”
- B. Letter to Governing Board members inviting them to delegate country representatives
- C. Detailed information provided to the Governing Board members and meeting participants
- D. Presentations
 - D1. Programme – Herman Eijsackers (Meeting chair)
 - D2. Introduction FACCE JPI - Isabelle Albouy (JPI FACCE CSA coordinator)
 - D3. Introduction CT5 Mitigation – Jean François Soussana (Chair of FACCE SAB)
 - D4. Bibliometric analysis results – Wouter Gerritsma (Wageningen UR Library)
 - D5. Global Research Alliance on agricultural greenhouse gases – Jac Meijs (GRA stocktake group)
 - D6. Scope and aim of the Mapping Meeting – Peter Keet (FACCE CSA WP2)
 - D7. Wrap up of discussion at the end of the meeting – Herman Eijsackers (Meeting chair)
- E. Results bibliometric analysis on FACCE JPI CT 5
- F. Appendices bibliometric analysis on FACCE JPI CT 5
- G. Posters

Austria	Funding Poster	Science Poster
Belgium	Funding Poster	Science Poster
Germany	Funding Poster	Science Poster
Denmark	-	Science Poster
Estonia	Funding Poster	Science Poster
France	Funding Poster	Science Poster
Finland	Funding Poster	Science Poster
Ireland	Funding Poster	Science Poster
Israel	Funding Poster	Science Poster
Italy	Funding Poster	Science Poster
The Netherlands	Funding Poster	Science Poster
Norway	Funding Poster	Science Poster
Poland	Funding Poster	Science Poster
Romania	Funding Poster	Science Poster
Spain	Funding Poster	Science Poster
Turkey	Funding Poster	Science Poster
United Kingdom	Funding Poster	Science Poster
European Commission	-	Science Posters (set of 2 on FP6/7 research)
- H. Photos and caricatures

