Agriculture Food Security and Climate Change

Report of

FACCE-JPI Mapping and Foresight

On

Adaptation of Agriculture to Climate Change

Options for strategic collaboration

FACCE CSA Mapping Meeting 2

February 22-23, 2012

Madrid, Spain

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 21 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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Report by FACCE CSA WP 2 team:

Christine Bunthof (Wageningen UR)

Pablo Aller, Mª José Delgado, Núria Duran, Jesús Jiménez, Paloma Melgarejo (INIA)

Lorens Habing, Louis Fliervoet (EL&I)

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

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Contents

Summary

Joint Programming is a member state-driven initiative to join forces in research and education to tackle societal challenges 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 organised: meetings where researchers, funders 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 to describe research efforts and policy framework for each participating country.

This report describes the main results of the second mapping meeting, which brought together almost 70 participants. Thirty-three country delegates from seventeen countries participated in moderated breakout sessions. Four members of the Scientific Advisory Board as well as speakers from CIRCLE2 ERA-NET, the JPI Water, research experts on adaptation from the Technical University of Madrid, and the Global Research Alliance on Greenhouse Gas Mitigation contributed to these discussions as well. The main aim of the break-out sessions and concluding plenary session was to identify gaps and overlaps, and opportunities for collaboration. One very specific and concrete opportunity in this respect was the request for recommendations with regard to a possible topic for an ERA-NET Plus in the remit of adaption research in the frame of FACCE-JPI.

Research themes identified for joint action are:

- The effect of climate change and the associated risks for **animal health**, adaptation of livestock systems, animal breeding for robustness, nutrition, release of greenhouse gases.
- Adaptation of **crop production**, through breeding, agronomy, water management for future climate changes in different regions, focussing on yields and their link with food security.
- Adaptation of **forestry** production to climate change.
- **Socio-economic aspects**; mechanisms and policies to raise awareness, financial incentives on environmental-friendly farming, increasing sustainability of consumers' behaviours as well as fostering the implementation of cost-benefit analysis and cross-sectorial approaches.
- **Water management for agriculture;** water stress, dryness (desertification), flooding, quantity and quality of water and water management, strategies for water capturing, storing, management.
- **Risk assessment and impacts of extremes** on agro-systems (resilience, production, sustainability).

These themes have to be set in a framework taking into account the regionalisation concept, the concepts of ecosystem services and biodiversity, and the concept of increasing resilience of farming systems.

Tools identified for cooperative research are:

- **Transnational programmes** with a real common pot, a distributed pot, or a mixed model.
- Strengthen tools that aim towards **cooperation and sharing** rather than competition, such as by sharing data, collections and infrastructures, long-term field trials, developing common protocols to obtain comparable data, using the same methodologies.
- Benefit from **regionalisation** e.g. by a two-layer approach: 1. region-specific groups; 2. share in an overarching European network.
- Strengthen the **policy-driven research** and research supporting regulation on adaptation (e.g. for a knowledge base underpinning the Common Agricultural Policy).
- Stimulate mobility in each joint action; connect to sharing infrastructures and training programmes.

The research themes emphasised when considering **topics for a new ERA-NET Plus** were: crop research, animal health and improved water management. Taking into account mitigation measures as part of adaptation to climate change and including socio-economic and regionalisation aspects, the challenge towards resilient agricultural systems is addressed in its full scope. It was also remarked that it is an opportunity to fund policy-driven research in a collaborative way. It was stressed the importance of find synergies with the FACCE-JPI pilot action, the Knowledge Hub 'Modelling European Agriculture with Climate Change for Food Security (FACCE MACSUR)', as it also deals with climate models. Regarding adaption and mitigation to climate change in agriculture (and taking into account regional challenges, the need for common data protocols and long-term field measurements), an ERA-NET Plus-driven joint research call would be highly welcomed. FACCE JPI mapping

meeting stressed the necessity of coordinated actions combining substantial commitment from many countries over Europe, as that will underpin the transition towards climate smart agriculture.

1. Introduction

Strategic collaboration between Member States

The Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) brings together 21 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.

Within the Coordination and Support Action for this JPI (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 an agenda for strategic collaboration between the Member States.

This report describes the aim of the mapping and foresight activities, the scope and boundaries for this mapping meeting on adaption of agriculture to climate change, the output of the break-out groups and the general conclusions drawn. It also gives a summary of the presentations at the meeting, and the results from an additional desk study. The report ends with conclusions and recommendations to the Governing Board of FACCE-JPI.

Mapping and foresight for strategic collaboration

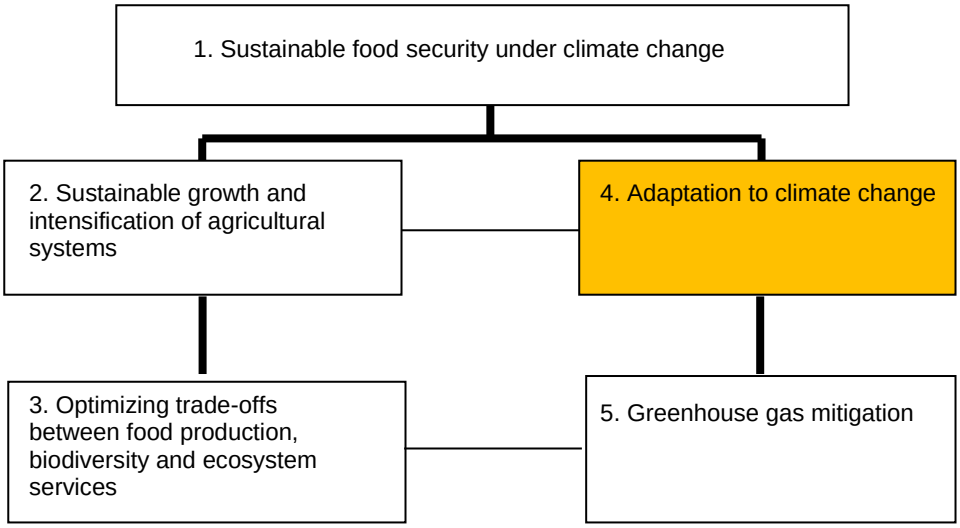
The objectives of WP2 are:

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

The mapping approach is based on the information provided by the participating countries which is discussed during the mapping meetings and additional desk studies (for additional information see report on mapping meeting 1) http://www.faccejpi.com/FACCE-JPI-Home/FACCE-JPI-News/First-mapping-meeting-report-on-climate-change-mitigation-is-available.

Five core themes; five mapping meetings

The five core themes developed by the Scientific Advisory Board (SAB) are the following:



The theme of the first mapping meeting was Mitigation of Agricultural Greenhouse Gas-Induced Climate Change. It is the theme specified as Core Theme 5 of the 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 report is available at http://www.faccejpi.com/FACCE-JPI-Home/FACCE-JPI-News/First-mapping-meeting-report-on-climate-change-mitigation-is-available.

This report describes the results of the second mapping meeting, on '*Adaptation to climate change* (CT4 of the ScRA), which took place at the National Institute of Agriculture and Food Research and Technology (INIA), in Madrid on 22-23 February 2012.

Posters

In the mapping meeting we made use of well-prepared and structured posters containing the requested information. To this end, each Member State was asked to complete two posters; one poster on science and one poster on research policy-funding on adaptation, including on-going programmes. 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).

Group discussions

The experts attending the mapping meeting had the opportunity to request clarification from their counterparts and to highlight in a consensual manner the most important issues and conclusions. The organisation of the group discussions is described in Annex 3.

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.

2. Second mapping meeting on "Adaptation to Climate Change"

2.1 Scope and boundaries

The thematic scope of the second mapping meeting was the Core Theme 4 of the Scientific Research Agenda, defined by the SAB: **Adaptation to Climate Change**.

This topic is defined as consisting of the following areas:

- Adaptation to climate change and increased climatic variability throughout the whole food chain, including market repercussions.
- Tailoring adapted regional production systems under climate change.
- Adapting seeds and breeds through conventional breeding and biotechnology to new combinations of environment and management: e.g. abiotic stresses elevated CO_2.
- Monitoring pests and diseases and developing climate-informed crop and animal protection.
- Adaptive water management in agriculture, watershed management, flood management, irrigation technologies, water re-use.
- Adapting food processing and retailing, markets and institutions to increased climatic variability and climatic change.

2.2 Conclusions

Issues on adaptation to climate change

It was observed generally in the small group discussions that information on Climate Change Adaptation was difficult to gather, because most countries don't have a direct focus on 'Adaptation' in their policy and research programmes, but instead it is integrated with other themes, such as agricultural infrastructure, water, spatial planning, nature management, and so on.

However, several common research and policy issues were identified in this mapping meeting, which are suitable for collaboration and joint activities:

- Regionalisation: needs to be solved at local, regional and European scale. This introduces a two-layer approach: 1. Groups that cooperate on local-regional level addressing peculiar problems, subjects and situations of this level and 2. Larger groups of EU countries that work together sharing an overarching European network about subjects of common interest (for example on methodology, protocols, research infrastructure, the science–policy relations, etc.).
- Water management in agriculture: this concerns droughts as well as floods.
- Socio-economic aspects: including social factors, human behaviour, innovative financial incentives (throughout the food chain from farmer to consumer).
- Plant and crop breeding research: in order to increase the resilience of agro-systems (both at crop and landscape level).
- Livestock diseases and animal health.
- Risk assessment studies: in order to develop and share new methods with useful indicators, which can be used in the science–policy relations and would show the impact of climate change on agricultural food production, bio-based resources and biodiversity, especially for middle and long term.
- Agro-ecosystems on landscape level: to increase the resilience of farming systems as a whole, and the adaptability to unexpected changes, a better understanding of the relationship between the farming systems and the functions of the agro-ecosystems (ecosystem services such as biodiversity, fertile soil and water creation capacity, natural resources, etc.) and the interrelations between the ecological and social systems (cultural habits/commodities) is required.

These subjects came up in different small group discussions and were confirmed in the final discussion. The most important ones are summarised in the recommendations presented in Chapter 5.

Proposed instruments for joint actions

In general, regionalisation (local–regional–European) needs to be addressed in joint actions. Here, collaboration in knowledge networks, in developing and sharing common methods and in mobility between countries, making common use of large research infrastructures (inventories, databases and laboratories) should be encouraged.

The following remarks should be taken into consideration:

- Collaboration should concern other European initiatives (JPIs, ERA-NETs) which are closely related to the themes of FACCE-JPI. Gathering available information on Adaptation to Climate Change enhances possibilities for common inventories and build-up of databases using the same protocols. In this context David Avelar made a demonstration on the INFOBASE on Climate Adaptation developed by the ERA-NET CIRCLE2. Opportunities for cooperation with the Water JPI were given by Enrique Playan (coordinator of the Water JPI). To effectively build up large European databases and to keep them operational, cooperation among countries is necessary to avoid overlapping and wasting funding grants. In this context working groups of different EU initiatives and scientists of the collaborating countries can obtain mutual benefits.
- Regarding the implementation of joint actions, an ERA-NET Plus-organised joint research call in the area of agricultural climate change adaption and mitigation would be highly welcomed. It should take also into account regional challenges, the need for common data protocols and long-term field measurements. Furthermore, a world-wide collaboration with the GRA, investigating the possibility for a joint action on mitigation, already exists. Such possibilities of collaboration need more investigation and perhaps can be expanded.
- The European policy and regulation on Adaptation need effective tools and a common consciousness of the impact of Climate Change on Agriculture and Food Security (basic knowledge for the EU Common Agricultural Policy). For a better understanding, experts on Adaptation, who can improve the dialogue among science, policy, farmers and social organisations, should be identified. Such dialogue can be facilitated by an interdisciplinary- and systems-based approach. Furthermore it is important to develop common indicators and measurement methods (for example risk assessment) as tools for mutual understanding. In this context, FACCE-JPI has made a first step by introducing the Knowledge Hub 'Modelling European Agriculture with Climate Change for Food Security" (FACCE MACSUR) which will assess models of Climate Change risk and impacts on agriculture and European food security.
- "Networking" becomes a more and more important way of collaboration. Various innovative techniques for communication and inventories are known and have to be used effectively in sharing information about scientific knowledge, gathering field data (in accordance with common protocols), building databases, from which different datasets can be linked and compared in order to reach a common approach to tackle the challenges of Climate Change.
- An increase of the mobility of researchers is recommended in order to enhance the opportunities of sharing large and expensive research facilities and infrastructures. A strong desire to have a network of long term field trials already exists. Exchanging of results of field experiments and carrying out experiments on common field locations can result in financial savings, and in avoiding overlaps and gaps between the research programmes of different countries. The goal is "cooperation and not just competition".

3. Additional information from a desk study on the poster information

In order to gain an additional insight, the information provided in the posters was subjected to a desk analysis in order to identify/verify complementarities and gaps. Therefore the desk analysis focused on two main objectives:

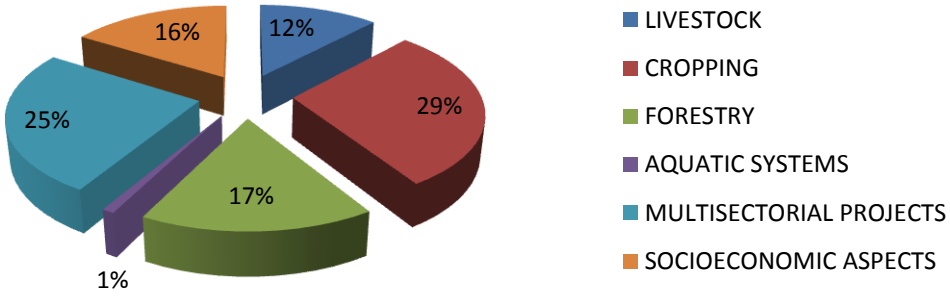
1. Identification of research priorities on *Adaptation to Climate Change* as well as gaps, overlaps and emerging research lines. Since this topic has a strong regional component, this was taken into consideration.
2. Identification of Financing Agencies and Research Programmes.

The analysis of the information provided in the posters from the 17 participating countries (Austria, Belgium, Germany, Denmark, Estonia, France, Finland, Ireland, Israel, Italy, The Netherlands, Norway, Romania, Spain, Sweden, Turkey and United Kingdom) can be summarised as follows.

3.1 Identification of priorities

The 445 projects on *Adaptation to Climate Change* included the following sectors (Graph 1): livestock, crops, forestry, aquatic systems, as well as multi-sector and socio-economic aspects. A large number of the projects (128 projects) were in the crop sector, followed by the forestry sector (75 projects), livestock (55 projects) and aquatic systems (4 projects). A large number of projects were included in the categories "multi-sectorial" (112 projects), and "socio-economic aspects" (71 projects).

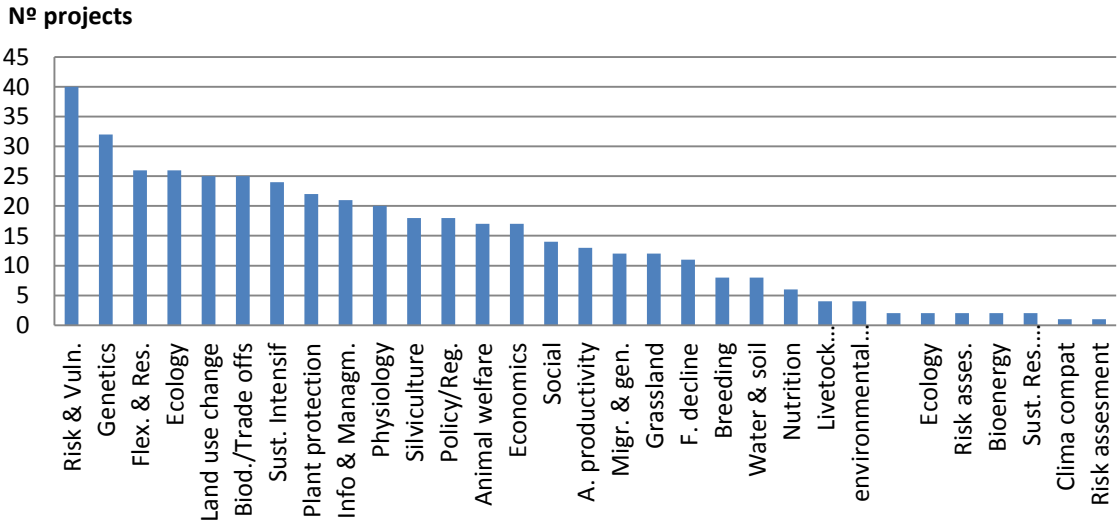
Graph 1: Projects by sector (Nº projects)



[1] It should be taken into consideration that the projects from Italy were not taken into consideration because the poster did not contain information regarding projects funded through national programmes.

The ranking of the main research areas within the different sectors shows that 31 research areas were relevant with major differences regarding the number of projects within each area. It should be noted that the largest number of projects are within the categories **"risk and vulnerability"** and **"genetics"** (Chart 1).

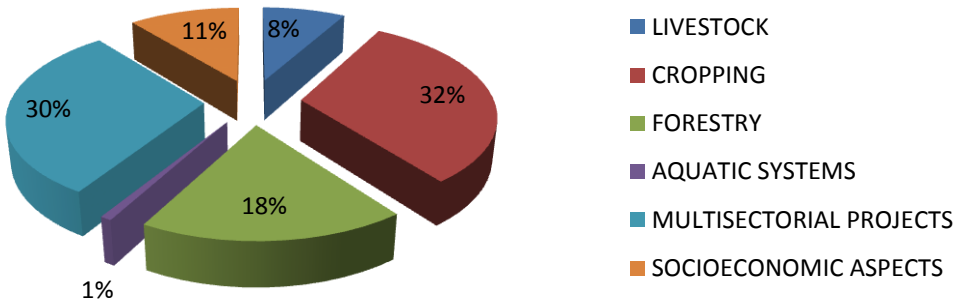
Chart 1: Ranking of research areas



The distribution of funds (Graph 2) follows the same trend as the number of projects (Graph 1) in these sectors.

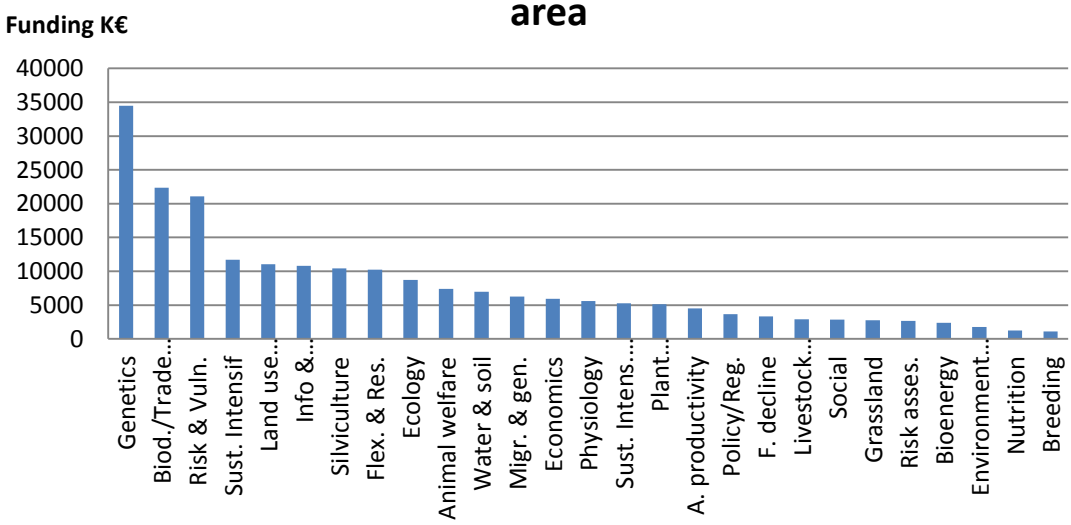
It should be noted that when comparing Charts 1 and 2, **"genetics"** received the highest percentage of funding.

Graph 2: Funding of projects within each sector



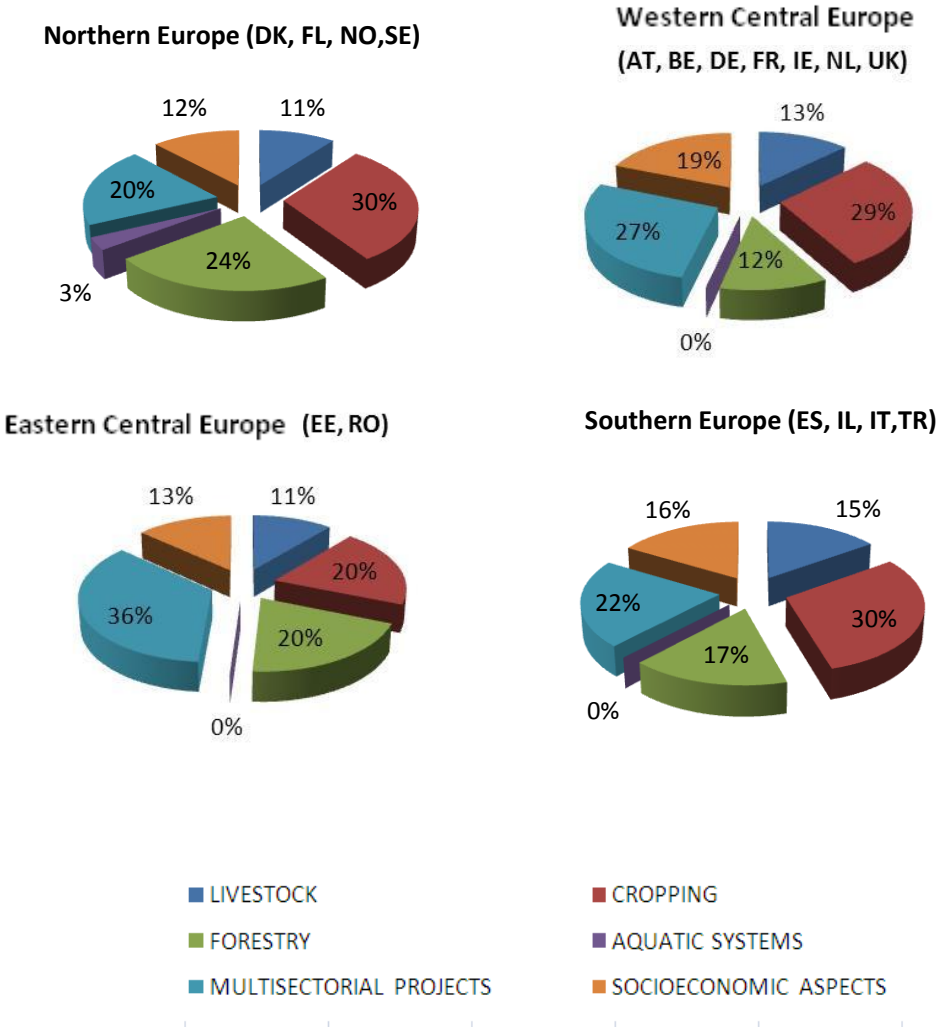
[1] It should be taken into consideration that funding data from Italy was not available.

Chart 2: Ranking of the funding in each research area



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

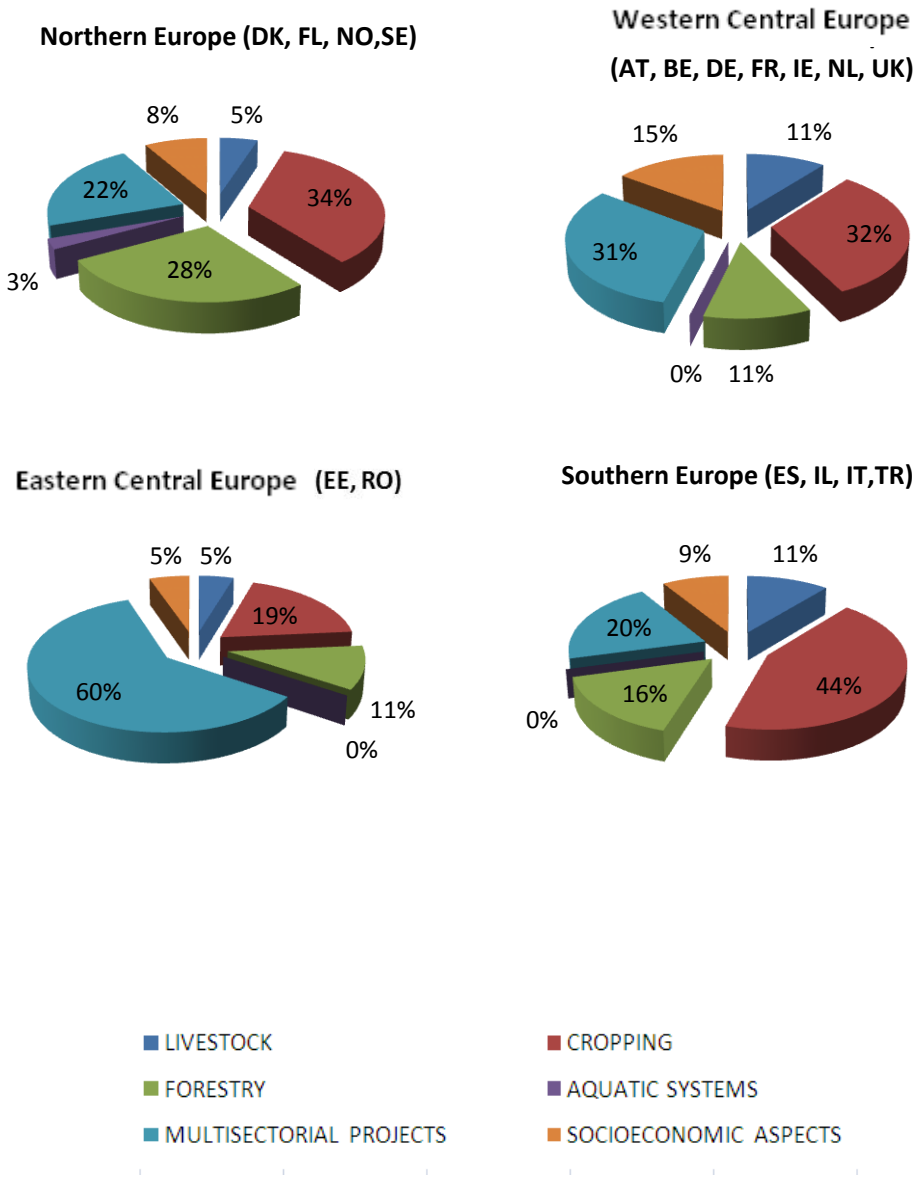
PROJECTS



The distribution of projects within the different sectors shows some differences in the four regions. Regarding multisectorial projects sector, it is more important in Central Easter Europe (36%) than in the other regions (Northern Europe 20%; Southern Europe 22% and Central Western Europe 27%).

There are a large number of projects devoted to Forestry in Northern Europe (24%) in relation with the other regions (20% in Central-eastern Europe; 17% in Southern Europe and 12% in Central-Western Europe). Only minor differences were found in Crops, Livestock and Socioeconomic Aspects.

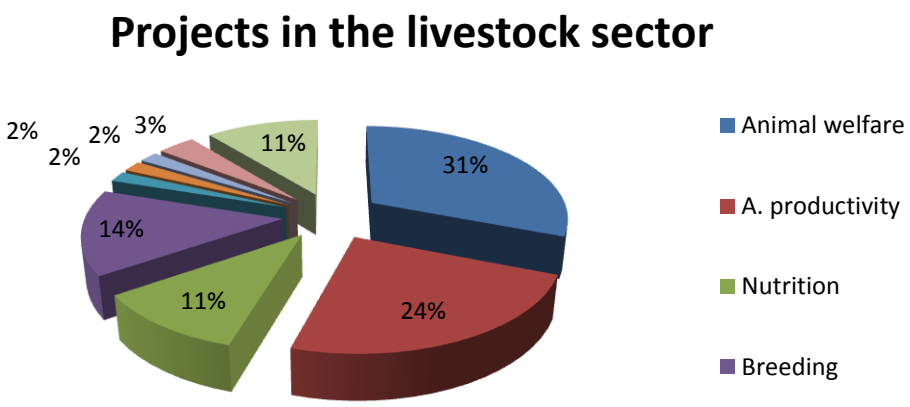
FUNDING



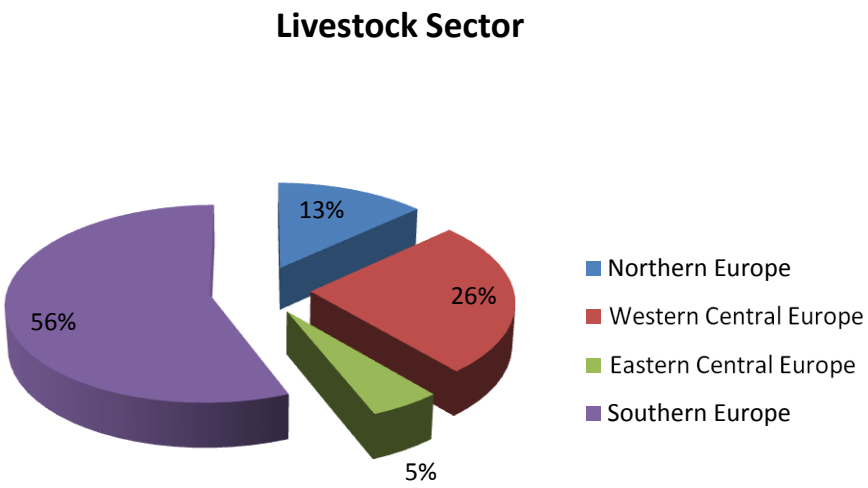
The graphs show that the funding allocated to each sector is directly related to their percentage of projects (as it is described above on projects figures). The large funding devoted to Multi-sector projects in Central Eastern Europe should be noted. However in this region only two countries (Estonia and Romania) made their information available, with Estonia having several projects funded in **"biodiversity trade-offs"** and **"risk assessment and vulnerability",** both considered under the area of Multi-sector projects.

3.2 The livestock sector

The results are described below:



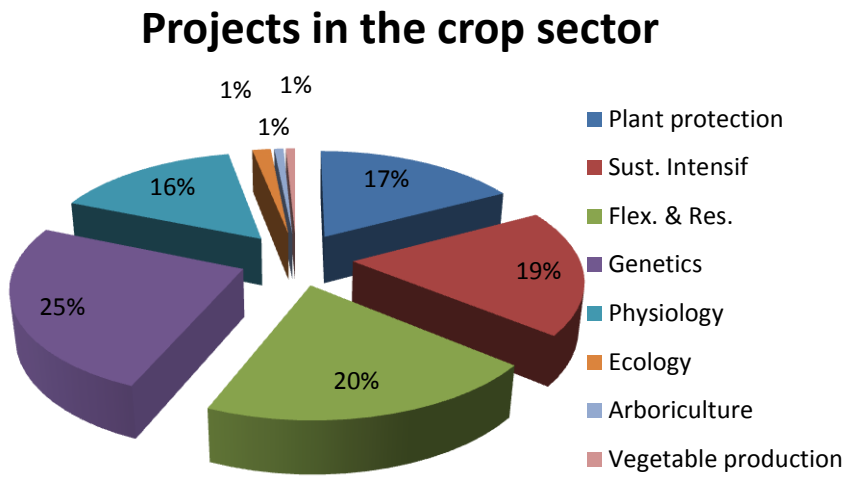
A total of 9 areas of research with 55 on-going projects were identified within the livestock sector. As illustrated below, the major areas identified in the mapping exercise were **"animal welfare"** and **"animal productivity"** (17 and 13 projects, respectively), followed by **"breeding"** and **"nutrition"** (8 and 6 projects, respectively). Little on-going activity was identified in the remaining areas such as **"livestock system management"**, and "**agricultural systems–integration of livestock and crop production"** (6 and 2 projects, respectively). It should be noted that the areas with the least activity were "**climate compatible livestock systems", "risk assessment and vulnerability" and "aquaculture"**, (one project each), important **gaps** to be taken into consideration.



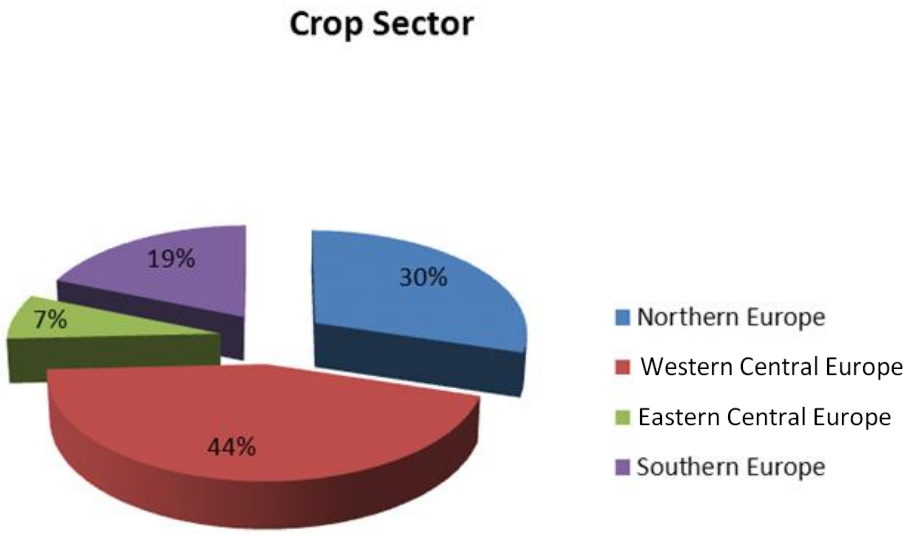
As seen above it should be also noted that most of the activity in the livestock sector is being undertaken in Southern countries (56%) followed by Central Western countries (26%).

3.3 The crop sector

The results are explained below:



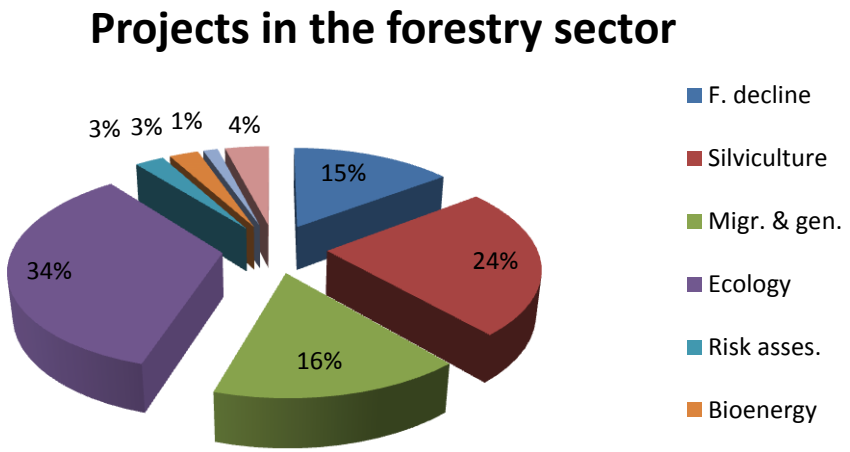
A total of 8 areas of research with 128 projects were identified within the crop sector. As illustrated below, the major areas identified in the mapping exercise were **"genetics"** (32 projects), followed by **"flexibility and resilience"** and "**sustainable intensification**" (26 and 24 projects, respectively), and **"plant protection" and "physiology"** (22 and 20 projects, respectively). There are three more areas with little activity: "**ecology", "arboriculture"** and **"vegetable production"** (2, 1, and 1 project, respectively**);** which should be considered as **gaps**.



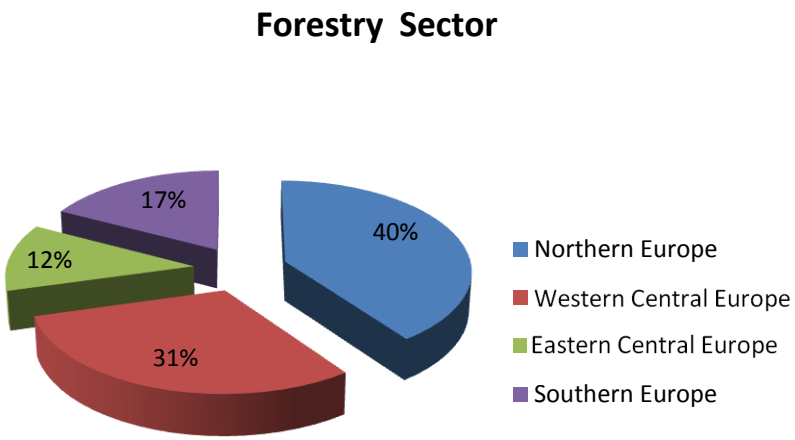
It should be also noted that the activity in the crop sector appears to be higher in Central-Western Europe (44%) followed by Northern countries (30%) with less activity in Southern (19%) and Eastern-Central (7%) countries.

3.4 The forestry sector

The results are described below:



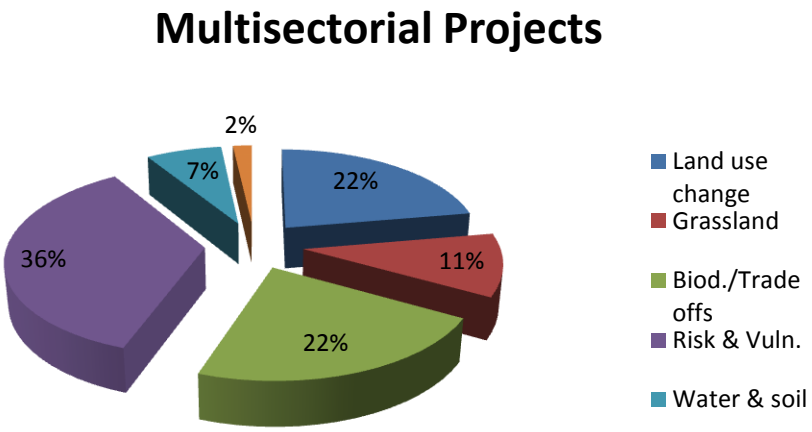
A total of 8 areas of research with 75 on-going projects were identified within the forestry sector. As illustrated below, the major areas identified in the mapping exercise were **"ecology"** and **"silviculture"** (26 and 18 projects, respectively), followed by **"migration and genetics",** and **"forestry decline"** (12 and 11 projects, respectively). The areas with less activity were **"sustainable intensification and management",** "**risk assessments**" "**bioenergy", "forest research**", and (3, 2, 2, and 1 project respectively). Therefore, the last four areas should be identified as **gaps**.



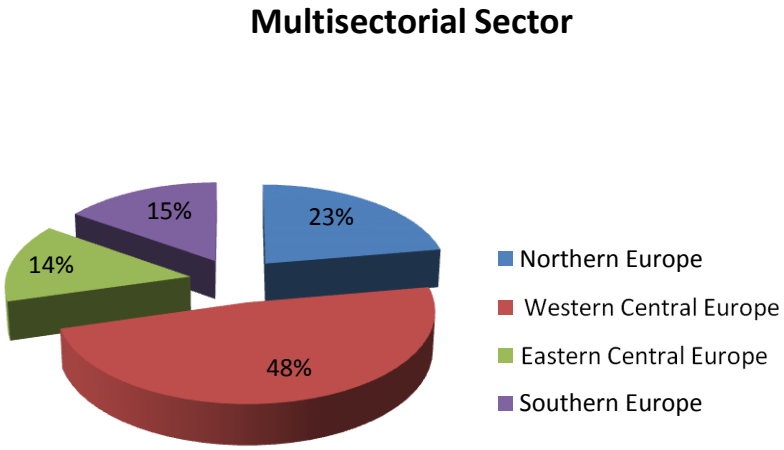
In the graph above, it can be seen that the activity in the forestry sector appears to be rather similar in Northern and Central Western Europe (40 and 31%, respectively). Nevertheless forestry shows less activity in Eastern-Central and Southern Europe (12% and 17% respectively).

3.5 The multisectorial projects

The results are explained below:



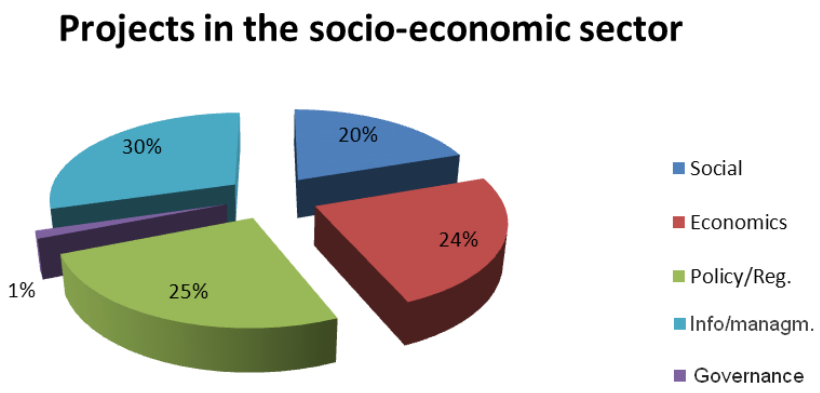
A total of 6 areas of research with 112 on-going projects were identified as multisectorial. As illustrated below, the major area identified in the mapping exercise was **"risk and vulnerability"** with 40 projects, followed by **"land use change"** and **"biodiversity trade-offs",** with 25 projects in each area. **"Grasslands and water soil"** had 12 and 8 projects, respectively. A limited number of projects (2 projects were identified in the area of **"sustainable research management"** which should thus be considered as a gap.



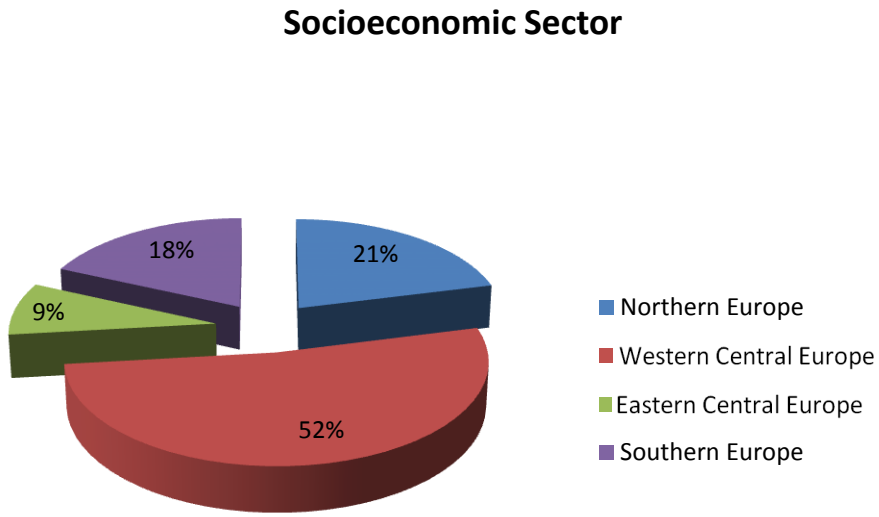
The percentage of multisectorial projects are the highest in Central Western Europe (40%), while the activity in the other regions is rather balanced.

3.6 The socio-economic sector

The results are described below:



A total of 5 areas of research with 71 on-going projects were identified within the socio-economic sector. As illustrated below, the major areas identified in the mapping exercise were **"information and management systems", "policy-regulation", "economics", and "social areas"** with 21, 18, 17 and 14 projects, respectively. There is an important gap in the area of **"governance"** with only one project.



It should be also noted that Western-Central Europe has the highest activity in the socio-economic aspects.

3.7 Additional remarks

Based on the current number of projects and/or funding, it can be summarised that the following areas are considered research priorities: : **"risk and vulnerability", "genetics", "flexibility and resilience", "ecology", "land use",** and **"biodiversity and trade-offs"** (more than 25 projects in the last 3 years). Nevertheless, regarding the funding, the areas receiving the most funds are **"genetics"** (approx. 35 K€), followed by **"biodiversity –trade off"** and **"risk and vulnerability"** (approx. 20 k€ in the last three years). The funding of the other areas is much smaller.

We should consider as **gaps** areas with low funding and/or a low number of projects: **"bioenergy"," risk assessment", and "environment".**

Nevertheless, in order to define the degree of **overlapping** it would be necessary to know the specific objectives within each project and this information is not available. In addition, certain projects appear in apparently unrelated areas, a situation that cannot be clarified unless the objectives are known as well as their relationship to Adaptation to Climate Change

In order to evaluate the effort made by each country in specific areas, information regarding funding and/or person-months 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. Given that the costs of certain items and personnel in particular vary from country to country, it would be desirable in the future to emphasise the importance of providing an estimate of such input (person-months per year of the projects provided) for comparison purposes.

As was already the case for the first Mapping Meeting, attempts to identify/quantify the Financing Agencies and Research Programmes were unsuccessful given the heterogeneity of financing and accounting systems. We would request country delegates more precise input in this regard when designing the new poster in order to assure that useful information will be available for further analysis.

4. Assessment of Mapping Meeting 2 on "Adaptation to Climate Change". Recommendations for future mapping meetings.

Mapping meetings are conceived as tools to support opportunities for networking. Mapping through **mapping meetings** was conceived under the scope of the FACCE-CSA as an innovative approach to consult representatives (funders, policy makers and scientists) of participating countries who can provide an overviewed of the core themes (CTs) previously defined by the SAB. This approach was tested for the first time to establish the scientific, political and financial possibilities and constraints regarding CT5 and proved to be a quick and participatory approach.

The same approach was undertaken for CT4 on *Adaptation to Climate Change.* The results confirmed its adequacy for obtaining results within a short period of time through the active participation of country delegates as well as other invited specialists and SAB members. However, some **weak points** were identified and should be improved in further mapping meetings. The following **recommendations** are made:

1. Since a period of 12 weeks was deemed necessary between the initial step (letter from the FACCE-JPI chair to the GB members to nominate country delegates) and the date of the meeting, **the deadline for nominating delegates and submitting the requested information should be carefully observed.** This was not the case for MM2.
2. Considering mapping meetings as a working tool, the input of delegates as well as other invited specialists in the small group discussions and the role of the chair in the general discussions is critical. Therefore, in the next mapping meetings, the delegates, invited specialists and the chair will be requested to stay during the whole process. **Their input in the final conclusions** is necessary.
3. Since moderators of the small group discussions have an important role in guiding the discussions, we produced a document including some guidelines. This needs further improvement (maybe through a meeting with the moderators before starting the mapping meeting) to help them **to keep the focus** during the small group discussions.
4. Participants have to **read policy and scientific posters** of the countries **and the Scientific Research Agenda** before the mapping meetings. Thus they will have the basis to provide much more valuable input in the break-out sessions.

5. Conclusions and recommendations to the FACCE-JPI Governing Board

5.1 Recommendations for research themes for joint actions

The recommendations are based on the assessment of the information provided in the posters, the break-out sessions and the plenary discussions at the mapping meeting.

- **Animal health.** This should address the effects of climate change and the associated risks for animal health (including existing and emerging diseases). Dealing with increased risks will be dependent on our efforts to adapt livestock systems, both in confined and pasture systems (the former also affected by climate change). Issues such as animal breeding for robustness, e.g. adaptation to heat and other extreme conditions, as well as breeding of fodder plants for better nutrient composition and higher production, also under abiotic stress conditions, should be taken into consideration. Changes in animal production may affect the release of greenhouse gases and therefore interact with mitigation efforts.
- **Crop Research.** Strengthening of the following aspects is crucial: development of strategies on climate change adaptation for different kinds of crop production systems, from a comprehensive point of view; integrated and sustainable use of modern agronomy; plant breeding; fertilisation; water, plant and disease management in relation with technological facilities; study of soil; development and improvement of science-based and environmentally friendly risk assessment-prevention-management systems and measures for climate change-driven pests on plants; adaptation measures for future climate changes in different regions, focusing on crop production and yields in relation with with food security.
- **Silviculture.** Adaptation of forestry to climate change includes aspects such as adaptation to longer growing seasons in the North, to changed ground water levels, to changed biodiversity potential, and to emerging diseases. Selection of species and varieties, tree breeding and forest management are areas for adaptation research.
- **Stress the importance of socio-economic aspects.** Societal factors play a critical role in the adaptation to climate change. Therefore it is necessary to foster the participation and involvement of all the stakeholders of society (especially farmers) on this topic. In order to do so, it is important to create different mechanisms and policies aiming to raise awareness on adaptation, foster financial incentives on environmentally friendly farming and increase the sustainability of consumer behaviours. On the economic side it is advisable to address adaptation matters using cost-benefit analysis and cross-sectorial approaches.
- **Water management for agriculture.** Research efforts should focus on: water stress, dryness (desertification), flooding, quantity and quality of water and water management. Moreover it is very important to strengthen the strategies including water capturing, storing, and management, increasing the efficient use of water for climate change adaptation. Socioeconomic aspects have to be considered as well. Finally it is critical to underline regional aspects.
- **Risk Assessment and Extremes.** To achieve climate smart agro-systems in Europe, supported by all partners in the Food Chain (farmers to consumers), we need a clear survey of the effects of extremes in climate changes on agro-systems. They influence the resilience, and therefore the production, and finally the economic benefits of agro-systems (e.g. especially for the middle and long term period). Moreover we need more specific research on risk assessment in order to qualify and to quantify the impact of climate change on our agro-systems, as this is crucial if we want to have tools and proofs to stress climate change and climate adaptation as an urgent topic on the political agendas of the EU and their Member States.

In order to understand and apply recommendations in the best way, the themes have to be set in a framework taking into account the following concepts:

- Regionalisation (measures have to be adapted to the special characteristics of each area. European regions, with their own topographic and geographic characteristics, demand different

assessments on vulnerability of natural ecosystems, biodiversity, hydrology and water supply and socio-economic sectors in relation to climate change);

- Ecosystem framework and use of biodiversity (in order not to damage them and to create synergies within those systems, as it is widely recognised that climate change and biodiversity are interconnected);
- Resilience of farming systems (to increase their efficiency and adaptability to unexpected changes, focusing on the better understanding of the interrelations between ecological and social systems).

5.2 Recommendations for tools to undertake cooperative research

Cooperative research can be funded by pooling financial resources within transnational programmes. The funding pot model can be a real common pot, a distributed pot, or a mixed model. Cooperation can also be built without pooling money. The following recommendations are given for cooperative research in which a broader scope was taken into account.

- ***Use tools which are based on cooperation rather than on competition***, and based on a network approach. Within this network, take the following into account:
  - Sharing *methodologies* on adaptation.
  - Using *common protocols* (e.g. data collections and data sharing).
  - Benefiting from *regionalisation* e.g. by a two-layer approach:
    1. region-specific groups,
    2. share in an overarching European network.
  - Sustaining *long-term field trials* and extend the use for climate change impact studies and effects of regionalisation.
  - Identifying *adaptation experts* and at the same time use an *interdisciplinary- and systems-based* approach.

- ***Strengthen the policy-driven research*** and research supporting regulation on adaptation (e.g. for a knowledge base underpinning the Common Agricultural Policy).

- ***Sharing infrastructures*** e.g. on plant phenomics.

- ***Mobility*****:**
  - Encourage mobility through stimulation actions in each joint action.
  - Fostering sharing of large research infrastructures.
  - Training programmes.

- ***Common use and set-up of databases***. Another tool discussed is the common use and set-up of databases. It is advised to be very careful with setting up common databases, as the objectives are not well fulfilled when there is a lack of maintenance and/or lack of compliance to, or absence of, common protocols. If you set up a common database, either do it well (often requires major investment) or don't do it. Development of common protocols is easier to realise. This is a requirement for obtaining comparable data and a first critical step towards common databases.

5.3 Input to the topic suggestion for an ERA-NET Plus

The ambition to work in collaboration rather than competition is a prerequisite for transnational joint research. The research themes identified for joint actions were iterated when considering themes for an ERA-NET plus;

- Crop research (breeds, agronomy, plant pests and diseases),
- Animal health and welfare (combating zoonosis, improving nutrition and breeding)
- Improved water management to deal with regional challenges of too much, too little, or too salty water for agriculture.

It was stressed that with mitigation measures considered part of adaptation to climate change, and an integrative approach including also socio-economic aspects, the challenge towards resilient agricultural systems is addressed in its full scope. This is needed to come up with the solutions European agriculture requires.

The topic for an ERA-NET Plus should take into account regionalisation (local approach to regional climate challenges) and the need for common data protocols, in order to facilitate large scale modelling in an overarching European network. An ERA-NET Plus-organised call would also be an opportunity to fund policy-driven research in a collaborative way, i.e. building a knowledge base for the revised Common Agricultural Policy. Regarding the relation between JPIs and ERA-NETs it was remarked that overlaps and duplications should be avoided, moreover fostering coordination. In this respect it has to be underlined the importance of finding synergies with the FACCE-JPI pilot action, the Knowledge Hub 'Modelling European Agriculture with Climate Change for Food Security (FACCE MACSUR)', as it also deals with climate models.

It was stressed the importance of find synergies with the FACCE-JPI pilot action, the Knowledge Hub 'Modelling European Agriculture with Climate Change for Food Security (FACCE MACSUR)', as it also deals with climate models.

In the area of agricultural climate change adaption and mitigation (taking into account regional challenges, the need for common data protocols and long-term field measurements) an ERA-NET Plus-organised joint research call would be highly welcomed. FACCE JPI mapping meeting stressed the necessity of coordinated actions combining substantial commitment from many countries over Europe, as that will underpin the transition towards climate smart agriculture.

Annex 1. Programme of the mapping meeting

Programme

FACCE JPI Mapping Meeting on Core Theme 4: *Adaptation to Climate Change*

February 22 – 23, Madrid, Spain

Meeting venue: INIA premises (Crta. de la Coruña, km 7,5, Exit Hipódromo - 28040 Madrid, Spain).
Chairperson: The Mapping Meeting was chaired by Prof. Elías Fereres, Instituto de Agricultura Sostenible, Córdoba, Spain.

Wednesday February 22		
Time	**Activity**	**Location**
11.00	Pick up at hotel (Bus to INIA)	-Hotel Agumar -NH Nacional
11:30	Registration and coffee	Hall
12:00	**Welcome** Paloma Melgarejo (Deputy Director of INIA, Spain) Elías Fereres (CSIC, Spain. SAB member) **Presentation of WP2 team** Christine Bunthof (Wageningen UR, Netherlands. JPI FACCE CSA WP2) **Practical information** Pablo Aller (INIA, Spain. JPI FACCE CSA WP2)	Conference room
12:40	**Introduction FACCE JPI** Isabelle Albouy (JPI FACCE CSA coordinator)	Conference room
12:50	**Introduction on the theme of the meeting: *Adaptation to the climate change*** Jean-François Soussana (INRA. Chair of SAB)	Conference room
13:00	**Regional aspects for southern Europe** Inés Mínguez (Deputy Chancellor of Technical University of Madrid, Spain)	Conference room
13:10	**Relation with Water JPI** Enrique Playán (CSIC, Spain. Coordinator of Water JPI)	Conference room
13:20	**Information on CIRCLE (ERA-NET) Mapping results** David Avelar (CIRCLE)	Conference room
13:50	**Scope and aim of mapping exercises and this mapping meeting** Lorens Habing (EL&I, Netherlands. JPI FACCE CSA WP2) **Programme for today and tomorrow** Núria Duran-Vila and Pablo Aller (INIA, Spain. JPI FACCE CSA WP2)	Conference room

14:00 – 15:30	**Break**	
15:30 – 19:15	**Poster session 1:** – 15:30 - Studying posters – 16:30 – Break out into groups – 16:40 - Going (deeply) into the posters (scientific and funding): questions. – 17:10 - Identifying gaps, overlaps and possibilities for joint actions. Identification of funding available and funding needed. – 18:00 - Reports / short presentations from groups	Fernando Orozco room SGPCP rooms Conference room
19:15	**Wrap-up day 1, looking ahead into day 2**	Conference room
19:30	Bus to hotel	Main entrance

Thursday February 23		
Time	**Activity**	**Location**
08:00	Pick up at hotel (Bus to INIA)	-Hotel Agumar -NH Nacional
08:30	Registration	Hall
09:30	**Relation with the Global Research Alliance** Antonio Fernández y García de Vinuesa (Deputy Director, Ministry of Agriculture, Food and Environment. Spanish national contact point for GRA)	Conference room
09:45 - 12:30	**Poster session 2** 09:45 – Introduction to working process. Lorens Habing (JPI FACCE CSA WP2) 09:50 – Break out into groups. 09:55 - Going (deeply) into the posters (scientific and funding): questions. 10:20 - Identifying gaps, overlaps and possibilities for joint actions. Identification of funding available and funding needed. - Reports/ short presentations from groups.	Conference room SGPCP rooms Conference room
12:30 – 13:30	**Break**	
13:30	**Discussion** Seeing suggestions of day 1 and day 2 together	Conference room
15:00	**Overall conclusions**	Conference room
15:25	**Closing + Toast**	Conference room
15:30	Bus to hotel	Main entrance

Annex 2. List of participants

Nº	COUNTRY DELEGATES		
	Country	**Name**	**Representative**
1	Austria	Maria Keuschnigg	Policy
2	Austria	Andreas Baumgarten	Science
3	Belgium	Michael Van Zeebroeck	Policy
4	Belgium	Marie-France Destain	Science
5	Denmark	Floor ten Hoopen	Policy
6	Denmark	Jørgen E. Olesen	Science
7	Estonia	Külli Kaare	Policy
8	Estonia	EvelinLoit	Science
9	Finland	Mikko Peltonen	Policy
10	Finland	Roy Tubb	Science
11	France	Maurice Héral	Policy
12	France	Guy Richard	Science
13	Germany	Timo Kuhrau	Policy
14	Germany	Nicolas Tinois	Policy
15	Germany	Horst Gömann	Science
16	Ireland	Gary Lanigan	Science
17	Ireland	Margaret Desmond	Policy
18	Israel	Anat Lowengart-Aycicegi	Science/ Policy
19	Israel	Rivka Barg	Science/ Policy
20	Italy	Marina Montedoro	Policy
21	Italy	Pier Paolo Roggero	Science
22	Netherlands	Martijn Plantinga	Policy
23	Netherlands	Jeroen Veraart	Science
24	Norway	Kirsti Anker-Nilssen	Policy
25	Norway	Odd Arne Rognli	Science
26	Romania	Mihai Nicoluescu	Science
27	Spain	Paloma Melgarejo	Policy
28	Spain	Margarita Ruiz-Ramos	Science
29	Sweden	Jan Svensson	Policy
30	Sweden	Ingrid Oborn	Science
31	Turkey	Murat Turkes	Science
32	United Kingdom	Bruno Viegas	Science/ Policy
33	United Kingdom	Jerry Knox	Science
Nº	**OTHER PARTICIPANTS**		
	Organisation	**Name**	
34	CSIC (MINECO,SPAIN),SAB	Elias Fereres	
35	SAB	Pirjo Peltonen-Sainio	
36	SAB	Thomas Rooswall	
37	SAB	Jean-Francois Soussana	
38	BBRSC	Gabriela Pastori	
39	INRA	Isabelle Albouy	
40	BBRSC	Paul Wiley	
41	SCAR delegate	Mike Collins	

42	Organisation	Domingo Iglesias	
43	Organisation	Agustín del Prado	
44	MINECO	Rosa Rodriguez Bernabé	
45	DGResearch	Tim Hall	
46	CIEMAT (Spain, MINECO)	Begoña Artiñano	
47	CSIC (Spain, MINECO)	Enrique Playán	
48	CIRCLE	David Avelar	
49	UPM (Madrid, Spain)	Inés Mínguez	
50	MARM	Antonio Fernández y García de Vinuesa	
51	Oficina Española de Cambio Climático	Cristina García Díaz	
52	i2c2	MªJose Sanz	
53	MARM	Adela Palomino Sánchez	
54	MARM	Carmen Criado Fernández	
55	MARM	Omar del Río Fernández	
56	INIA	Pablo Vázquez	
57	INIA	María Herrero	
58	MARM	José Ramón Picatoste	
59	MARM	Andrés Montero	
60	MINECO	Rocío Lansac	
61	Animal Taskforce	Jac Meijs	
Nº	**ORGANISERS**		
61	FACCE CSA WP2	Mª José Delgado	
62	FACCE CSA WP2	Christine Bunthof	
63	FACCE CSA WP2	Louis Fliervoet	
64	FACCE CSA WP2	Lorens Habing	
65	FACCE CSA WP2	Núria Duran	
66	FACCE CSA WP2	Paloma Melgarejo	
67	FACCE CSA WP2	Jésus Jiménez	
68	FACCE CSA WP2	Pablo Aller	

Annex 3. Break-out sessions

Approach

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. The distribution in groups was such that 4-5 countries were represented, and that each group included science delegates as well as policy delegates. To enhance interaction within the whole group of participants and the exchange of information between countries, the distribution in groups on the second day was different from the first day.

The groups were moderated by members of the organising team, the FACCE CSA coordinator and two additional moderators with participation experience from the first Mapping Meeting. Through the guidance of these moderators, people in the groups discussed the content of the posters (mainly focusing on their own countries) trying to reach a series of objectives: a better understanding of the information provided on the posters; identification of gaps and overlaps on the addressed areas; and discussion on possibilities for joint actions. As a result of this process, every group came up with 3-5 suggestions**.** All this information was collected by one reporter per group. These reporters gave a report/presentation of these results in the plenary session that immediately followed the break-out session. The same approach was applied on the second day break-out plus reporting plenary.

Outcomes of the break-out session on Day 1

Group 1. *Jorgen E. Oleson (DK), Kùlli Kaare (EE), Margaret Desmond (IE), Timo Kuhrau (DE), Nicolas Tinois (DE), Elias Fereres (ES), Louis Fliervoet [moderator].*

The discussion started with a comment on the separation between mitigation and adaptation. Many research posters show an integration of both themes. In reality this integration exists and should be more taken into account the approach of climate smart agriculture.

Further points of discussion were: 1. Farming is very diverse in Europe and corresponds to local climate. This asks for a regional approach. Clusters of climate regions and farming practices should be a basic activity, after which similarities can be determined as a base for joint actions (e.g. modelling, risk analyses, data sharing, etc.). 2. In our communication on climate change we have to focus on major climate issues such as extremes in water shortage and abundance (drought and flooding) and their consequences for the current agro-ecosystems. 3. In the policy posters two approaches emerge: a "soft way" which will invest in behaviour and cultural changes (socio-economic aspects), and a "hard way", which looks for solutions in technological options. In the discussion with the food-producers, first of all farmers, policy-makers show a great need for common risk analyses in the middle and long term period, so that a distinction can be made between a year with bad weather and the effects of real climate changes.

Research gaps mentioned: 1. Climate change (higher temperature) and its influence on the health of livestock and indirectly on human beings and 2 Aqua-cultures.

Important instruments for joint actions are "clustering" and "data-sharing"

Group 2. *Jeroen Veraart (NL), Guy Richard (FR), Michael Van Zeebroeck (BE), Mikko Peltonen (FI), Enrique Playán, Isabelle Albouy [moderator].*

Following the exchange of information taking into account also the general overview of the posters, the group remarked that there were more projects on crops than on livestock.

The group identified the following needs and opportunities.

2.1 A need to increase research on economic aspects of adaptation, such as cost-benefit analysis.
2.2 Opportunities to work together on multi-stress impacts, combining expertise from different countries
2.3 Using biodiversity to adapt agriculture for climate change. Examples mentioned were to tap into the richness of plant – soil organism relations for increased resilience, agronomical measures such as crop rotation, growing different species on the same field at the same time, and mixed farming (crops, grass, livestock)
2.4 A multi-criteria approach, such as by including a broad range of ecosystem services in an assessment. Such research requires combining data from different types and sources, and sharing infrastructures
2.5 Risk assessment at regional scale

Group 3. *Floor ten Hoopen (DK), Jerry Knox (UK), Andreas Baumgarten (AT), Ingrid Oborn (SE), Anat Lowengart-Aycicegi (IL), Jean François Soussana (FR), Lorens Habing [moderator].*

3.1. Educate stakeholders: farmers, politicians, decision makers. Define the characteristics of different farming systems in order to provide the best solutions for them.
3.2. Integrate of different disciplines by implementation of research communities.
3.3. Strengthen socio-economic aspects and multi-sectorial approaches.
3.4. Define the framework and boundaries of adaptation at short and long term.
3.5. Use of the same terminology and tools within Europe.
3.6. Take into account the broad variety of climatic conditions in Europe. Experiments on these bases.
3.7. Knowledge transfer, benefiting from each other's experiments.
3.8. Plant and animal protection and breeding.

Group 4. *Roy Tubb (FI), Murat Turkes (TR), Marie-France Destain (BE), Martijn Plantinga (NL), Domingo Iglesias [moderator].*

4.1. Water management: addressing specific problems and needs of the regions.
4.2. Risk assessment: development of scenario forecasts (analyzing variability; specific, generic and ecological crops.
4.3. Plant health risks.
4.4. Fostering integrated models (using crop + climate models).
4.5. Data sharing and collaboration between regions with similar needs.

Group 5. *Odd Arne Rognli (NO), Evelin Loit (EE), Bruno Viegas (UK), Marina Montedoro (IT), Horst Gömann (DE), Thomas Rosswall (SE), Christine Bunthof [moderator].*

The group started by making a tour de table in which the participants briefly explained the funding and research information as shown on their countries posters. They briefly explained the national funding schemes and mentioned the most important programmes through which climate change adaptation research is funded, and the larger research projects. There was a good contribution from all to the discussion. For some of the topics regionalisation is to be taken into account, as the challenge is a different between e.g. the North and the South of Europe. It was also stressed that data and infrastructure sharing as well as bringing excellent researchers together in multidisciplinary collaborative setting, can boost discoveries. Research topics listed were:

5.1 Spread of animal diseases
5.2 Animal welfare (including under heat stress and other extreme weather conditions)
5.3 plant pests and diseases
5.4 Genetic improvement – a lot of activity is going on, but it is key to adaptation, thus priority for continued investment
5.5 Research to inform the reform of the Common Agricultural Policy
5.6 Scope for farmers to reduce their impact on the environment in the changing climate. To inform cross-compliance
5.7 Effects of carbon enrichment on crops and natural vegetation. (Conditioned research)
5.8 Decision support systems for farmers to deal with impacts of climate change on crops
5.9 Water management. Taking into account geographic variation (flood/drainage versus shortage)

Group 6. *Kirsti Anker-Nielsen (NO), Maria Keuschnigg (AT), Gary Lanigan (IE), Elias Fereres (ES), Margarita Ruiz-Ramos (ES) & Paloma Melgarejo (ES) [moderators].*

The group discussions involved three main areas: research, joint initiatives, and funding. Therefore they summarised their conclusions using these points.

6.1 Research gaps are due poorly-identified priorities, the lack of accessibility to common databases and the variety of definitions. Some underrated areas are crop rotation, pest management and humus research, socio-economic aspects of climate change, spatial planning approaches and CO2 barriers. Some solutions for that would be the use of common protocols, methodological frameworks and holistic approaches.
6.2 Research overlaps: mainly in the studies on wheat and animal diseases.
6.3 Joint initiatives: have to focus on the support of networks and mobility, database exchange and workshops and seminars with scientific experts and policy makers. Some topics where to apply this are wheat adaptation, knowledge transfer from science to decision makers and identification of barriers on climate change impacts, vulnerability and adaptation (CCIVA).
6.4 Funding: regionalisation has to be present in the new policies and funding instruments because adaptation is local and there are many differences between countries. On the other hand research nowadays mitigation is more policy and financially supported than adaptation.

Group 7. *Rivka Barg (IL), Pirjo Peltonen (FI), Mihai Nicoluescu (RO), Jan Svensson (SE), Pier Paolo Roggero (IT), Agustin del Prado [moderator].*

The discussion of the group concluded that the mapping process proposed by Mapping Meeting 2 has to be improved to make it easier and more effective; therefore this is one of the first challenges to tackle.

On the other hand, it was underlined that it is very necessary to set up a common framework for adaptation and research, underpinning multidisciplinary aspects.

Summary of day 1

Before starting the Day 2 break-out sessions, the participants' minds were refreshed with a summary of the day before. The day 1 outputs from the break-out session were clustered as follows:

Topics
- 1 Regional aspects
  - 1A Risk assessment
  - 1B extremes in agro-systems
  - 1C water management
  - 1D multi stress impacts research, combining expertise of different regions
- 2 Economic aspects (Cross sectorial approach, cost – benefit analysis, ecosystem services)
- 3 live stock research (diseases)
- 4 Using biodiversity to adapt agriculture
- 5 Gathering crop research.
  - Wheat adaptation

Instruments
- 6 Sharing infrastructures
- 7 Databases
- 8 Mobility

In the frame of the topic of this mapping meeting, climate change adaptation, the request to provide input to the development of a topic to be proposed for an ERA-NET plus was brought to mind again. Isabelle Albouy explained that this concerns short- to mid-term actions addressing the FP7 Cooperation programme theme 2 (Food, Agriculture and Fisheries, and Biotechnologies). An ERA-NET Plus project develops a transnational call for research by pooling resources and with a top-up from the Commission of maximally 50% of the budget pooled by the countries (so 33% of the total call budget).

Outcomes of the break-out session on Day 2

Group 1'. *Külli Kaare (EE), Margaret Desmond (IE), Floor ten Hoopen (DK), Odd Arne Rognli (IL), Jeroen Veraart (NL), Agustin del Prado [moderator].*

1.1' Plants and animals: It is necessary to establish a broader scope for livestock aspects. Foster studies on breeding and genetic diversity of plants and animals.
1.2' Regional aspects: foster and combine existing cooperation within European countries and countries outside Europe.
1.3' Economic aspects have to be taken into account, especially cost of adaptation and ecosystem services for decision makers, long term cost-benefit analysis and forecast of market-climate scenarios.
1.4' Knowledge exchange: on crop production, genetics and biodiversity. Decisions at field scale (user level); Increase resolution of information; use of practical knowledge in crop models; combine long term policy with short term actions.
1.5' Synergies between adaptation and mitigation: on policies, regions and food chain.
1.6' Avoid overlaps with other JPIs (climate) and ERA-NETs.

Group 2'. *Roy Tubb (FI), Ingrid Oborn (SE), Timo Kuhrau (DE), Pier Paolo Roggero (IT), Pirjo Peltonen (FI), Domingo Iglesias [moderator].*

2.1' Establish a common framework taking regional aspects into account (biophysical, socioeconomic, implementation, risk assessment) and analysing stakeholders needs (fostering policy research and governance at these levels).
2.2' Climate change adaptation: from common rules to adapted actions and support (learn from environmental sector, more innovation and responsibility). Design robust systems for crop and livestock production.
2.3' Recognizing ecosystem services as indicators for climate change adaptation and identification of trade-offs.
2.4' Livestock production: identification of new risks on animal health and welfare, such as heat stress and housing. Traditional *versus* modern breeding, diversity *versus* intensification. Analyse of grazing systems.
2.5' Cropping systems: Use of long term experiments and data sharing. New use of infrastructures and equipment. Modelling of a wide range of crops. New adapted cropping systems (to soils dynamics, climate, light). Special attention to forestry.

Group 3'. *Michael Van Zeebroeck (BE), Bruno Viegas (UK), Guy Richard (FR), Anat Lowengart-Aycicegi (IS), Jan Svensson (SE), Louis Fliervoet [moderator].*

Based on the information of the posters, 5 priorities were discussed.

3.1' Regional aspects are very important, but common goals are critical for collaboration and joint actions. I.e. farmers pay a lot of attention to short-term socioeconomic pressures (fluctuations of prices and markets), thus it is important to raise their awareness on mid-long term climate change effects.

3.2' Economic aspects: involving the behaviour of consumers and the role of retailers in the food chain.

3.3' Livestock diseases in relation to climate adaptation needs more attention,

3.4' Crop research has to be stimulated, as the adaptation of wheat is handled.

3.5' Impact of functional biodiversity, as a tool of adaptation, has to be studied form plant to landscape scale.

Gaps are: little or no attention to forests and forest ecosystems, or in a broader context the strong growing importance of the bio based-economy in relation to food security and climate adaptation. Further, how the resilience of the agro-ecosystem can be increased. This theme in combination with the use of biodiversity on landscape scale is also recommended as a topic for an ERA-NET plus on adaptation of agricultural systems in Europe.

Group 4'. *Murat Turkes (TK), Andreas Baumgarten (AT), Jørgen E. Olesen (DK), Martijn Plantinga (NL), David Avelar (PT), Isabelle Albouy [moderator].*

The group remarked that the discussions on the second day went faster and more targeted. They summarised their conclusions in a list of four important issues and three mechanisms.

<u>Important issues</u>
4.1' Biodiversity (role in climate proof agricultural areas) / Ecosystems / Soil / Plant
4.2' Food safety – new aspects (climate change)
4.3' Water quality and quantity
4.4' Innovative incentives for adaptation (e.g. insurance or other financial incentives)
<u>Mechanisms</u>
4.5' Sharing data (databases)
4.6' Sharing methodologies on adaptation
4.7' Sharing information on farming systems

Group 5'. *Mikko Peltonen (FI), Evelin Loit (EE), Marie-France Destain (BE), Gary Lanigan (IE), Marina Montedoro (IT), Jean François Soussana (FR), Christine Bunthof [moderator].*

The group first considered subjects and tools for joint activities and then spent time discussing the possible topics and approaches within an ERA-NET plus. Among the subjects, they stressed climate change and diseases (both animal and plant) . They iterated the need for research to support policy regulation on adaptation (CAP) and the need to include social aspects. The idea to bring researchers physically together created enthusiasm. Examples were told of how this worked in the US. A working title for such an integrating approach actually bringing people together in one location to work on multidisciplinary and focussed joint research within FACCE was proposed : 'FACCE centre of synthesis'.

<u>Subjects</u>
5.1' Policy regulation on adaptation (CAP)

5.2' Include social aspects, the human factor, farmers as well as consumers
5.3' climate change and diseases (animal, plant) !
5.4' Risk assessment tools
5.5' methodologies for better database sharing
Tools
5.6' agricultural phenological data monitoring and organizing
5.7' climate adaptation database
5.8' make more use of inventories and tools that are done by other initiatives (e.g. CIRCLE database)
5.9' FACCE centre of synthesis. A concept of bringing researchers physically together (data synthesis etc)
Suggestions regarding an ERA-NET plus
- Larger scale data collection / Synthesis reports
  Taking into account the regional variation
- Local, Interdisciplinary
- Proving adaptation. How to convince farmers?
  Developing indicators for resilience
- Link with the FACCE Knowledge Hub MASCUR to cover these gaps

Group 6'. *Rivka Barg (IL), Maria Keuschnigg (AT), Jerry Knox (UK), Thomas Rosswall (SE), Margarita Ruiz-Ramos (ES) & Paloma Melgarejo (ES) [moderators].*

6.1' Strengthen the links between socioeconomic and technical issues, especially in areas like water management.
6.2' Increase research on pest and disease management (both for plants and animals).
6.3' Possible topic for ERA-NET+: Flexibility and resilience linked to regionalisation.
6.4' Foster collaboration with knowledge hub.

Group 7'. *Mihai Nicoluescu (RO), Horst Gömann (DE), Kirsti Anker-Nilssen (NO), Lorens Habing [moderator].*

7.1' Study the effects of increased CO^2 on plant and animal health. Research on plant and animal adaptation (i.e. overwintering plants)
7.2' Holistic approach to problems, including economic systems.
7.3' Address specific subjects at regional level, but using EU networks and common methodologies.
7.4' Increase mobility of researchers and sharing of infrastructures.
7.5' Foster the creation and use of common databases.

Summary of Day 2

Subjects addressed:

- Plant and animal adaptation and health.
- Forestry
- Food safety
- Socio-economic aspects (Innovative financial incentives, especially for end users and farmers; include social factors and human aspects, opinion from inhabitants and farmers; modify consumers' behaviours).

Instruments proposed:

- Identify experts on adaptation.
- Sharing methodologies on adaptation:
  - Use inventories and tools developed by other initiatives.
  - Local-regional-European cooperation.
- Policy and regulation on adaptation.
- Implement common databases.
- Mobility of researchers and sharing of large infrastructures.

Annex 4. List of documents from *FACCE-JPI Mapping and Foresight on Adaption of Agriculture to Climate Change,* available on the intranet.

A. Summary of Conclusions and Recommendations. FACCE JPI Mapping Meeting on Core Theme 4 of the Scientific Research Agenda: Adaptation to Climate Change Summary (this document is also published on the website of FACCE-JPI

B. Report "FACCE-JPI Mapping and Foresight on Adaption of Agriculture to Climate Change - Options for strategic collaboration – FACCE-CSA Mapping Meeting 2, February 22-23, 2012, Madrid, Spain"

C. Presentations
   1. Welcome and Presentation of INIA– Paloma Melgarejo (Deputy director INIA)
   2. Introduction FACCE JPI - Isabelle Albouy (JPI FACCE CSA coordinator)
   3. Introduction CT4 Adaptation – Jean François Soussana (Chair of FACCE SAB)
   4. Regional aspects of Southern Europe - Inés Minguéz –(Deputy Chancellor of the Technical University of Madrid)
   5. Relation with Water JPI - Enrique Playán (coordinator of Water JPI)
   6. Information on CIRCLE (ERA-NET) Mapping results – David Avelar (CIRCLE coordinator)
   7. Scope and aim of mapping exercises and this mapping meeting – Lorens Habing (FACCE CSA WP2)
   8. Relation with the Global Research Alliance on Agricultural Greenhouse Gasses (Antonio Fernández y García Vinuesa (Deputy director Ministry of Agriculture, Food and Environment; Spanish national contact point for GRA)

D. Posters

Austria	Funding Poster	Science Poster
Belgium	Funding Poster	Science Poster
Denmark	Funding Poster	Science Poster
Estonia	Funding Poster	Science Poster
Finland	Funding Poster	Science Poster
France	Funding Poster	Science Poster
Germany	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
Romania	Funding Poster	Science Poster
Spain	Funding Poster	Science Poster
Sweden		Science Poster
Turkey	Funding Poster	Science Poster
United Kingdom	Funding Poster	Science Poster
European Commission	-	2 Science Posters on Adaptions and Mitigation research funded by FP6 and FP7