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Report on the policy and decision context of CAP reform in the context of climate change adaptation and sustainable resource management

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Executive Summary

This report elaborates on the adaptation efforts within the European Union's policy context, particularly the Common Agricultural Policy (CAP). The agricultural sector as one of the most vulnerable sectors to climate change in the EU is facing great challenges under climate change. The objective of this report is to demonstrate how the current CAP (2007-2012, post 2013) has addressed the adaptation challenges and how in the future CAP could further incorporate them in the policy design for the sake of sustainable rural development.

For this purpose, we analysed the incentives in the current CAP and compared with the various characteristics of adaptation options to identify the need for inclusion of other incentives in the future CAP reform. Particularly we inventoried different categories of adaptation options and examined whether the current incentive scheme enables farmers to make the choice of adaptation options.

The report identifies that the current CAP before 2014 has already considered the possibility of autonomous adaptation via the green payment. However, adaptations in some cases are more complicated than the single payments because there are market failures for the public goods property of the agricultural sector (e.g. the landscape). The payment scheme may not lead to desirable non-autonomous adaptation. This calls for even more specific policies for adapting to climate change under future CAP regimes.

Participants of the ECONADAPT workshop of June 1st 2015 showed a strong agreement that the CAP has an important role to play in climate adaptation in Europe, that it has a lot of potential to facilitate adaptation and that it should. Also that it is currently not living up to that potential and needs to be adjusted.

There is strong agreement that adaptation must take place at all levels from local, through national and regional to all of the EU and that the principle of subsidiarity should apply.

- The main strengths of the current CAP relate to direct and decoupled payments, which provide farmers with safety nets and the financial freedom to experiment with adaptations; as well as an overarching focus on the environment and sustainability.
- The main weaknesses of the CAP relate to maintenance and enhancement of diversity (in terms of crops, biodiversity and farming systems) as well as money going to large farmers rather than those that need it most. A major weakness from the adaptation perspective is a lack of long term, integrated perspectives and a lack of integration with other policies.

Adjustments to the CAP were discussed in the ECONADAPT workshop across two diverse future linked socio-economic and climate scenarios for Europe drawn from the cumulative work of the IPCC and the EU Climsave and Impressions programs. Adjustments to the CAP robust across the scenarios to support adaptation to future climate change are:

- Creation of new opportunities through cooperative approaches.
    - Support local networks and cooperatives.
- More community based and farmer based – bottom up approaches.

- Pillar 2 approaches by making contracts between farmers and authorities.
- Links between CAP and other environmental and social policies, on a national, regional or local level (short supply chains and co-operations).
- Learning network between farmers, knowledge building. Support context specific knowledge sharing.

General conclusions

Important challenges exist to mainstream adaptation under the current and future CAP. Although the current CAP already has several mechanisms to enhance adaptation and to pay more attention to sustainability and climate resilience, further strengthening of these mechanism can be considered. In particular it deserves careful monitoring of how in practice the CAP is reaching its objectives of enhancing a climate resilient and low carbon agricultural sector in Europe.

The set of options for mainstreaming climate adaption in the CAP ranges from simple provision of information on climate change and adaptation options in the context of the CAP policies, at one extreme, to a very fundamental revision of the systems, at the other extreme, as such that much larger shares of the CAP payments are directly related to environmental targets and investments in adaptation to ensure that the agricultural sectors in Europe will become more resilient to climate change.

Although the rural development and CAP policies aim at fostering a climate resilient agricultural sector in Europe, under the current system there still is a risk that despite the large amount of CAP subsidies, or even as a results of these CAP subsidies, the agricultural sector is still developing into a direction that makes it even more vulnerable to weather extremes that may occur under climate change. For instance, droughts in the Mediterranean regions may have severe impacts on the agricultural sector, and the investments in the agricultural sector that are currently taking place may lead to more risk in the future. Similarly the extension of the dairy and livestock sector, which is at least to some extent enabled by the agricultural support under the CAP, has the potential to lead to emissions of more greenhouse gases and larger environmental impacts. These sectors can also be more vulnerable for diseases under climate change.

The 2014 CAP reform pays limited attention to practical mechanisms that deal with the behavioural barriers related to adaptation decisions under long time horizons and uncertainty. An important issue is, for example, how discounting should be used in adaptation decision-making as private sectors tend to use a high discount rate. In many cases adaptation to climate change requires a long term perspective that enables important investments in irrigation or improvements in water supply security, or changes in crops and cropping patterns over Europe. If high discount rates are applied these investments opportunities may not be selected and implemented, or they may only become viable if public private partnerships are established.

Other mechanisms can be used to stimulate and facilitate adaptation such as insurance, capacity building, networks and partnerships and this is certainly advocated under the CAP. However, currently it is not clear how the proposed measures are implemented in practice and whether the speed and intensity of the actions is sufficient to provide for the required resilience in the agricultural sector. To what extent the measures are adequate will also depend on the characteristics of future climate change and the stochastic development in the related weather patterns, both for the temporal and spatial dimension. This makes it very difficult to assess whether the measures to stimulate and facilitate adaptation are adequate.

In the context of water quality management the CAP support may currently lead to developments that have a tendency to aggravate the existing problems, e.g. with manure management, nitrogen leakage and eutrophication. This would not be in accordance with the water framework directive, and it produces counter-effective results. For this reason it is important to even further harmonize the impacts of the CAP system with important policy areas such as biodiversity conservation, protection of nature and landscape and water and air quality. Although the current CAP makes efforts through pillar II and cross-compliance to support sustainable management in the agricultural sector, a large part of the budget is simply allocated in terms of income support without providing strong incentives for sustainable development or climate resilience.

One might argue that the private actors in the agricultural sector are responsible for optimal adaptation to climate change. However, many of the farmers have imperfect information on what would be the challenges of climate change and what adaptation options are available and suitable to use. This implies that it certainly is worthwhile to consider whether the financial means that are involved in the current CAP arrangements can be used to provide stronger incentives to farmers to adapt to climate change and to make the agricultural sectors in Europe more climate resilient and less greenhouse gas intensive. With respect to carbon sequestration one might wonder whether the CAP support can be used to a larger extent than currently is the case to foster carbon sequestration in soils and forests.

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1 Introduction

General adaptation policies

The current European policy regarding adaptation to climate change is outlined in the White Paper on adaptation published, in 2009. This document is the follow up of the Green Paper adopted in 2007, which launched a consultation on the future direction of EU policy as regards to Europe's adaptation to climate change. The Green Paper stated why action had to be taken by the European institutions, and laid down the relevant guidelines. The White Paper built on the answers to the consultation and set a framework for action for the EU. The objective of the EU action is to reduce its vulnerability. It is based on the principle of subsidiarity and supports overarching EU objectives such as sustainable development. The action is organised in two phases. The first one, from 2009 to 2012 shall "lay the ground work for preparing a comprehensive EU adaptation strategy to be implemented during phase 2". Phase 2 starts in 2013. Phase one is based on four 'pillars'. The first one is the constitution of a solid knowledge base on the impact and consequences of climate change for the EU. The second one is the integration of adaptation into key EU policy areas. The third one is the combination of policy instruments to ensure effective delivery of adaptation. Finally, the fourth one is the intensification of international cooperation.

Many studies have shown that adaptation is required to help reduce Europe's vulnerability to climate change and to make the economic sectors more resilient to climate change (e.g. Berkhout et al., 2006; Biesbroek, et al., 2010; EC, 2009a). Adaptation to climate change has not just become a challenge by itself, but also poses new challenges for existing institutions and decision-making processes. Although a wide range of academic studies on impacts, vulnerability and adaptation have been conducted over the last decade (Agrawal, 2008; Folkr et al., 2010; Hallegatte, 2009; Heltberg et al., 2009; Hinkel, 2011), there is still much to learn. Adaptation policy in Europe is still at its beginning, but it increasingly shows up on the policy agenda. In particular, the question of how adaptation should be best tackled and integrated in various EU policies is still unsolved.

The EU agricultural sector is considered as one of the most vulnerable sectors to climate change (EC, 2009a; Reidsma et al., 2010) and it needs to adapt to climate change. The adaptation to climate change is a shared responsibility of the private and the public sector, and the Common Agricultural Policy, as the most important EU agricultural policy, can shape the adaptation actions through various mechanisms, including its payment scheme. The CAP can not be considered in isolation. It needs to be studied with consideration of other policies that affect land use and other inputs such as water and energy. The Water framework directive and the EU energy policies need therefore to be considered, as well as other policies focusing on sustainability, social coherence and rural development.

In this context many questions arise, such as: Has the current CAP reform sufficiently considered the adaptation problems under given budget and uncertainty? What special attention should be given to the future CAP reform with respect to the challenges of climate change? How are the CAP policies harmonized with the requirements under the Water framework directive and the challenges to reduce the emissions of Greenhouse gases in Europe?

This report attempts to scope out the problems and needs that decision-makers are faced with when developing adaptation policies in the context of EU CAP reform in order the make the European agricultural sectors more climate resilient.

For this purpose, we will review the new CAP reform, analyse the effectiveness of adaptation options based on literature, and finally come up with suggestions for specific adjustments under the current CAP or possible remedies for future CAP reform. The study is based on a literature study and stakeholder consultation. In order to support the implementation and possible future revision of the CAP the needs of its users and other stakeholders have to be addressed. Therefore, a stakeholder consultation approach has been taken in the research. This is in line with work package 1 of the ECONADAPT prgramme "The framing of policy-focused economic analysis."

The report is organized as follows. Chapter 2 will elaborate the climate change impacts on EU agriculture and the EU agricultural policy. Chapter 3 is on the history of CAP reforms, how adaptation has been addressed in the various CAP reforms. Chapter 4 elaborates the future challenges for climate change adaptation in the context of CAP reform. Chapter 5 reports a case study on how the CAP 2007-2013 has supported adaptation measures to Climate Change in the East Midlands in England. Chapter 6 reports another case study on the potential and constraints of farm-level climate change adaptation in the Greek farming system. Chapter 7 is about the stakeholder perception for future policy design in the context of climate change adaptation and sustainable resource management based on stakeholder consultation. Finally, in Chapter 8 we summarize the main findings and provide recommendations to the policy makers for addressing adaptation problems under the current CAP and for potential future CAP reforms.

2 Climate change and adaptation in the agricultural sector in Europe

2.1 Climate change and agriculture

Climate change has many implications for the agricultural sector in Europe. Changes in precipitation may lead to excessive rainfall and flooding, or it may lead to prolongued periods of serious droughts. Water availability in the Mediterranean areas is most likely to be reduced substantially in summer, whereas in the Northern regions of Europe the potential for agricultural production may be improved under climate change. Changes in temperature will lead to changes in the cropping season and management practice in the agricultural sectors have to be adjusted to the prevailing climatic conditions, considering the changing risk patterns for the various crops and agricultural activities. Higher temperatures and increased CO_2 fertilization may be positive for some crops, but their impacts will depend on the specific characteristics of the varieties concerned. Both for arable farming and livestock the distribution of diseases might change under climate change, with major implications for the management and control of these diseases in the various regions of Europe.

Agriculture is directly dependent on climatic and bio-physical conditions, since heat, sunlight and water are the main drivers of crop growth and determinants of the living conditions of animals. Climate change has a clear impact on agricultural productivity and its variability, and the associated implications for prices and farmers' income (see e.g. Olesen and Bindi, 2002; Zilberman et al, 2004; Kelly et al., 2005; Olesen et al., 2011; Zilberman et al, 2012; Zhu et al., 2015). Climate change is a real concern for the sustainable development of agriculture within the EU. This has led to the adoption of the Green Paper titled "Adapting to climate change in Europe - options for EU action" by the European Commission (EC, 2007). The Green Paper clearly states: "The key objectives of adaptation for EU agriculture are to ensure resilience to climatic variations, socio-economic viability of agriculture and rural areas, and coherence with environmental protection objectives."

2.2 CAP and adaptation

"The present CAP provides a basic level of income security to farmers as well as a frameworkfor sustainable management of the natural environment in which agricultural activity takes place. The shift from support linked to production to decoupled aid enables farmers to respond to external requirements, to market signals as well as to developments resulting from climate change. Rural development policy offers the Member States a range of measures through which they can provide targeted support to activities that contribute to adaptation to climatic changes" (EC, 2009).

In 2009 the Commision Staff working document "Adapting to climate change: the challenge for European agriculture and rural areas", accompanying the EU White paper on Climate Change, described the potential impacts of climate change on agriculture in detail (EC, 2009). It also contains a detailed description of CAP measures favouring adaptation.

Under ”Income support”, it is argued that “decoupling of agricultural support from production allows farmers to be more responsive to various external forces, including market signals. Decoupling also helps farmers to irent their production according to the biophysical environment evolving with climate change” (EC, 2009: 13). It is also stated that “Decoupled support is accompanied by requirements to manage farming activities in a sustainable way. Cross-compliance links the full receipt of CAP payments, including also some rural development payments, to the respect of EU legislation on environment, public, animal and plant health and animal welfare, and the maintenance of permanent pastures and specific soil practices to avoid erosion and to keep organic matter contribute to the sustainable use of resources and to adaptation”. Furthermore the Farm Advisory System is also considered as an effective tool for sustaining adaptation, whereas “facilitating farmers’ access to risk management, such as insurance schemes or mutual funds, also helps them to cope with the economic consequences of greater fluctuations in crop yields or animal diseases” (EC, 2009:14).

Under ”rural development support” to farmers’ adaptation efforts several instruments are discussed that enable rural development and adaptation to climate change (see also Chapter 3).

Accompanying the EU communication “An EU strategy on adaptation to climate change”, the Commission staff working document “Principles and recommendations for integrating climate change adaptation considerations under the 2014-2020 rural development programmes (EC, 2013) describes the key actions to incorporate adaptation in the RDPs strategic objectives. These objectives are defined as:

- “Assemble and/or develop a robust evidence base on expected climate impacts and how these can affect agriculture and forestry. Where uncertainties remain, this is no good reason for inaction as the cost of inaction may be greater. This can be assessed on a case by case basis;
- Gather information for a range of sources, combining formal research with feedback from land managers and other actors and stakeholders who have practical experience;
- On the basis of the evidence base, articulate clearly what is needed to be achieved by 2020 to increase the resilience of agriculture, forests and rural areas, and where it is appropriate to make use of public support through the European Agricultural Fund for Rural Development (EAFRD).” (EC, 2013: 4).

And the key actions are summarized as:

- “Ensure that information collected at the previous stage is fed into a needs’ assessment by priority in the SWOT, in particular for the priorities 4 and 5;
- Identify the measures available under the EAFRD that can be used to deliver these priorities;
- Identify the multiple benefits that can be achieved through the measures identified to respond to climate adaptation needs, for example economic, social and environmental benefits;
- Identify activities that are not deemed appropriate for funding because they would act counter to climate adaptation needs;

- Identify safeguards that need to be put in place to ensure that all supported activities are resilient to climate change;
- Design measures sufficiently flexible to allow adjustements reflecting evolving predictions about climatic change over time;
- Ensure coherence with other elements of the CAP, such as cross compliance, greening and farm advisory service.”(EC, 2013: 5).

3 Development of the CAP

3.1 The CAP before 2003

The CAP has been present in the EU policy domain since 1962. The original aim was to make the EU agriculture more competitive in the world.

The EU has adopted a series of reforms of its common agricultural policy since 1992: the MacSharry reform or the 1992 reform for period 1993-1999, the Agenda 2000 for the period 2000-2004, the 2003 reform for 2004-2013 and the 2014 reform for 2014-2020. The CAP reforms encompass a variety of programs and subsidies; with originally pillar I the output price subsidies schemes and pillar II the structural investment programmes. The first major reform was the 1992 reform or the MacSharry reform (1993-1999), a movement from price support to the direct farm payments in terms of production volumes. The second major reform was the Agenda 2000 (2000-2004), which further reduced price support and introduced the idea of an integrated rural development policy (RDP) as a second pillar of the CAP. The RDP consists of individual farm programmes and regional programmes that may vary between EU member states. The 2003 CAP reform mainly involves the decoupling of subsidies from farm production, which means that subsidies based on production (i.e. direct payment scheme or coupled payments) are transformed into lump sum payments (i.e. single payment scheme, or decoupled payments, or single farm payments).

3.2 The 2003 CAP reform

The 2003 reforms introduced a framework for rural development based upon three major Axes, which are:

• Axis 1: Improving the competitiveness of agriculture and forestry.

Under this axis “support to farm modernisation and restoring agricultural production potential can sustain adaptation to climatic changes. For example, preventive mechanisms against adverse effects of climate related extreme events (e.g. setting up of hail nets) and adaption of buildings (e.g. housing livestock) can be supported.

• Axis 2: Supporting land management and improving the environment.

This includes “support for diversifying crop patterns, structure and agricultural activities as well as diversification into non-agricultural activities’…. “This helps make production systems more resilient to economic but also climatic factors, as diversification is a key strength factor for the stability of agricultural incomes”…. “Agri–environmental schemes targeted to better management of soil, water, and landscape have an important role. In particular measures that contribute to reducing pressure on biodiversity, enhancing green infrastructure, and promoting organic agriculture contribute to adaptation”(EC, 2009:15).

• Axis 3: Improving the quality of life and encouraging the diversification of economic activities.

These reforms primarily concern the scope and detailed content of support for less-favoured areas, areas with environmental restrictions, training, forestry and the promotion of the development of rural areas.

3.3 The CAP post-2013

The new CAP for period of 2014-2020 continues along this reform path, moving from product to producer support and now to a more land-based approach. This is in response to the economic, environmental and territorial challenges facing the sector, many of which are driven by factors that are external to agriculture. This translates into three long-term CAP objectives: viable food production, sustainable management of natural resources and climate action and balanced territorial development.

To achieve these long-term goals, the existing CAP instruments had to be adapted. The reform therefore focused on the operational objectives of delivering more effective policy instruments, designed to improve the competitiveness of the agricultural sector and its sustainability over the long term. In short, EU agriculture needs to attain higher levels of production of safe and quality food, while preserving the natural resources that agricultural productivity depends upon.

This can only be achieved by a competitive and viable agricultural sector operating within a properly functioning supply chain and which contributes to the maintenance of a thriving rural economy. In addition, to achieve these long-term goals, better targeting of the available CAP budget will be needed.

To summarize, for more than twenty years, the CAP has been through successive reforms which have increased market orientation for agriculture while providing income support and safety net mechanisms for producers, improved the integration of environmental requirements and reinforced support for rural development across the EU. The nature of the CAP has been changing progressively over recent years towards a more holistic approach to the wider rural economy and the development problems experienced by rural areas as a whole.

Recent studies have also shown that the CAP has increasingly opened up with regard to more innovative changes to its institutional as well as its ideational set-up (Lynggaard, 2006). Since the mid-1980s, the CAP has seen several incremental reforms in this direction (Villarejo and Lopez, 2014). The policy has expanded its funding to non-production targeted measures in the course of the Agenda 2000 reforms, a set of alternative management principles that take account of decentralisation, partnership, multi-annual frameworks and financing has been introduced. The CAP policy has seen the prospect of a “piecemeal change from below”. The latest CAP reforms (2003, 2008, “Health check”, 2014) introduced a concern for ‘multifunctionality’ of the agricultural sector. Especially the implementation of the so-called second pillar of the CAP has opened up margins which allow member states to push for reform and integrate the diverse needs and circumstances of their regions in a responsive policy implementation process (Lowe et al., 2002).

3.4 How agricultural adaption has been addressed in the CAP

The Common Agricultural Policy consists of two branches: one that helps farmers to be competitive, the so called first pillar or pillar I, and the other that promotes development in rural areas, i.e. the second pillar or pillar II. Concerning the link between agriculture and the environment, the European Commission points out:

“With about 40 % of the EU’s land area being farmed, agriculture has a very important impact on the natural environment. Over the centuries, farming has created and maintained a variety of valuable semi-natural habitats on which a wide range of wildlife depend for their survival. Farming practices can have an adverse impact on natural re-sources, such as pollution of soil, water and air, fragmentation of habitats, and a loss of wildlife. This relationship between agriculture and the environment has to be taken into account when integrating environmental concerns and safeguards into the Com-mon Agricultural Policy (CAP)” (EC, 2014).

In the CAP, emphasis is placed on reducing the risks of environmental degradation and enhancing the sustainability of agro-ecosystems through:

- Cross-compliance criteria on agricultural market measures − as a condition of receiving direct payments, farmers must comply with certain requirements, including some related to environmental protection; and

- Targeted agri-environmental measures − as part of Rural Development programmes, agri-environmental payments are available to farmers who commit to agri-environmental management schemes for a minimum 5-year period.

The climate change adaptation practices in the CAP is often implicit in formulations that lay down its environmental objectives. Even though the policy may not be specifically geared towards adaptation, it can nonetheless enhance the adaptive capacity of the agricultural sector.

This cross-compliance scheme includes statutory management requirements (SMR) that farmers need to integrate into their work. These specify certain standards concerning public health, animal and plant health, deriving from the provisions of existing EU legislation on these subjects. By complying, a farmer shall keep his land in good agricultural and environmental condition (GAEC). Each member state specifies its own GAEC in accordance with the 2003 CAP reform. The cross-compliance scheme is financed by the Single Payment Scheme. In order to receive a full payment, farmers need to participate in the cross-compliance scheme. A reduction in or cancellation of the direct payments is the result of non-compliance.

Additional measures that serve broader environmental objectives have been developed under Pillar II of the CAP, namely as part of the above mentioned agri-environmental measures that focus on rural development and planning. Pillar II is subject to co-financing from EU sources as well as the Member States. The European Agricultural Fund for Rural Development (EAFRD), supporting rural development under Pillar II of the CAP, has been introduced. The payments compensate farmers for the extra costs that they incur and the income that they forego when they undertake these practices. In accordance with Community guidelines, Member States have to produce a national strategy plan for the period from January 2007 to December 2013, and submit them to the European Commission prior to presenting their rural

development plans. The practices must go beyond a number of obligations, which apply to farmers in any case – including (but not limited to) cross-compliance and relevant national legislation.

The implementation of Member State's national strategies is carried out through rural development plans, wherein the different measures are assigned to 4 'Axes'. Axis 1: Improving the competitiveness of the agricultural and forestry sector, on which a minimum of 15 per cent of allocated funds of the EAFRD must be spent; Axis 2: improving the environment and the countryside, on which a minimum of 25 per cent of allocated funds of the EAFRD must be spent; Axis 3: quality of life in rural areas and diversification of the rural economy, on which a minimum of 15 per cent of allocated funds of the EAFRD must be spent; And Axis 4: LEADER84, where local action groups can secure funding for local development projects, with a minimum of 5 per cent of EAFRD funds being ring-fenced for LEADER initiatives across the three axes. The LEADER approach builds on seven principles: networking, cooperation, innovation, integrated multi-sectoral actions, local public private partnerships and Local Action Groups, a bottom-up elaboration and implementation of strategies as well as area-based local development strategies. Local Action Groups (LAGs) are comprised of local public, private and civil society representatives, who work together on strategies and delivery of those. A Local Development Strategy allows them to address important local priorities in an innovative, locally specific, and participatory way. LAGs are an example for flexible structures that allow for organisational learning and offer different ways to respond to and shape change. Such structures of endogenous development are conductive of adaptation in so far as they provide for on-going self-organisation processes in correspondence with other actors that may be affected by climate change (cf. Bülow, 2014).

Table 1 provides an overview of the effect of climate change adaptation practices, which can be adopted with regard to the CAP.

Table 1 Climate change adaptations addressed in the CAP (adopted from Bülow,2014)

Action type	Climate threat addressed in adaptation
Establishment of buffer strips, Council regulation (EC) No 73/2009, Annex III	Soil erosion, storms, flooding, flash floods
Conversion of arable land to grassland, Council Regulation (EC) 1782/2003, Art. 5	Soil erosion, storms, flooding, flash floods
Conservation soil tillage, Council Regulation (EC) 1782/2003, Art. 5; Soil Directive	Soil erosion, storms, flooding, flash floods
Maintenance/reintroduction of terraces, Council Regulation (EC) 1782/2003	Soil erosion, storms, flooding, flash floods
Increase diversity of crop rotations, Council Regulation (EC) 1782/2003	Soil erosion, droughts, flooding, temperature extremes, disease
Set-aside, Art. 56 Council Regulation (EC) 1782/2003	Soil erosion, storms, flooding, flash floods, disease
Planting of winter cover crops	Soil erosion, storms, flooding, flash floods, droughts
Crop residue management	Soil erosion, storms, flooding, flash floods, droughts
Organic farming, Regulation (EEC) No 2078/92., repealed by Council Regulation (EC) No 1257/1999	Soil erosion, storms, flooding, droughts, temperature extremes
Afforestation on agricultural or other land, Art. 36 (b) ii, iv, vi, EAFRD	Soil erosion, storms, flooding, flash floods
Establishment of agro-forestry systems (growing farmland trees), Art. 36 (b) ii, iv, vi, EAFRD, Council Regulation (EC) No 1290/2005	Soil erosion, storms, flooding, flash floods
Adaptation of agricultural infrastructure (e.g. buildings) to extreme weather, Art. 20 (b) v, EAFRD, Council Regulation (EC) No 1290/2005	Storms, flooding, temperature extremes
Improved irrigation efficiency, Council regulation (EC) No 73/2009, Annex III	Water scarcity, droughts
Insurance schemes (to shift climate change risk), Art. 68. (EC) No 73/2009; Art. 20 (b) vi, EAFRD, Council Regulation (EC) No 1290/2005	All
Farm advisory services for climate change risks and adaptation, Art: 20(a) v, EAFRD, Council Regulation (EC) No 1290/2005; Council Regulation (EC) 1782/2003, Art. 13	All

3.5 Mainstreaming

An important approach for climate adaptation is ”mainstreaming”, i.e. the integration of adaptation into (sectoral) policies. This is a well-known and recognized aspect of effective adaptation policy (cf. Biesbroek et al. 2009). In most countries documents and experts simply emphasize the need for mainstreaming without suggesting specific solutions or more concrete actions. The UK identified the key for successful mainstreaming in the accessibility of tools and information on adaptation. Some sectors seem to be more complicated and problematic than others with regard to mainstreaming, whereas in agriculture, water management and forestry some adaptation measures can be integrated with already existing policies on disaster management or sustainable development. Some sectors need more explicit work for mainstreaming climate adaptation, such as spatial planning, infrastructure and energy.

The role of the CAP is to provide a policy framework that supports and encourages producers to address the economic, environmental and territorial challenges while remaining coherent with other EU policies.

“Climate change will require farmers to adapt while they are also called to reduce farm-level greenhouse emissions, and to improve agriculture's environmental performance. Developing a progressively evolving and comprehensive response to climate change is needed to maintain the resilience and competitiveness of EU agriculture so that it can continue to play its role as supplier of high quality food and environmental and landscape services, as well as contribute to the sustainable development of EU rural areas. Climate change also brings an additional perspective to the challenge of food security”. (EC, 2009)

“Adaptation is a long-term process which needs to evolve over the coming decades according to the climatic trends and by building on a growing body of knowledge and practical experience. In this process, it is important to further engage the farming community in the discussion on adaptation needs and in sharing good practices, as farm-level changes are a key component of adaptation.”(EC, 2009)

“In the context of the review of the Common Agricultural Policy after 2013 the need to ensure favourable conditions for the adaptation of agriculture and rural areas will need to be examined. Effective adaptation and adoption of new technologies, which contribute both to mitigation and the long term viability of farming, will require investments and planning efforts beyond the capacity of individual farms. Public authorities will have a role to play in supporting and facilitating climate change adaptation policies.”(EC, 2009)

Different levels of government play a varied but equally important role in shaping adaptation. Some stress the need for adaptation at a global scale (Burton et al. 2008), while others underscore the importance of local institutions (Agrawal 2008).

The concept of adaptation itself is very general and can encompass a wide range of concrete actions and problems. Adaptation is not only about a technical response, but a process of social learning involving scientific, policy and practitioner communities (Hinkel, 2011). This includes to mainstream climate change into policy (McGray et al, 2007). Adaption needs to take place in the human society (Berrang-Ford et al, 2911). There are five areas of importance for successful adaptation policy: the science-policy nexus, communication and awareness-

raising, multi-level governance, policy integration and review and implementation (Biesbroek et al. 2009).

Until 2010 the Directorate-General for Environment was responsible for dealing with issues regarding climate change and adaptation. Since February 2010, a special DG for Climate Action is in charge of those questions.

The commission staff document (EC, 2013) clearly states:

“Successfully integrating climate change adaptation considerations into the CAP will also bring benefits for the economy and society as a whole by ensuring that essential biodiversity and ecosystem services dependent on land management continue to thrive and that the productive capacity and viability of the land based sectors is maintained. Adaptation planning can bring opportunities to build agricultural systems with greater resilience to environmental, climatic and economic risks”.

However, the current adaptation strategy within the 2014 CAP reform remains focusing on autonomous measures such as ‘good practices’. It has been highlighted that there are a range of barriers that make it challenging for people to choose the right adaptation strategy, including market failures, adaptive capacity, natural capacity and behavioural barriers (D1.2, 2014 of the ECONADAPT programma). These barriers are mentioned and general guidelines are discussed, but these barriers are not directly tackled yet under the CAP reform.

Although a new policy instrument of the first pillar (greening) in the CAP post-2013 is directed to the provision of environmental public goods, it is difficult to achieve the goal due to market failures for the provision of these public goods. Market failures related to the provision of non-market public goods such as ecosystem services are part of the CAP by means of cross-compliance, but it is still to be seen whether the full potential is actually used in practice.

4 Challenges for the CAP in the context of climate change

4.1 Introduction

Important challenges exist to mainstream adaptation under the current and future CAP. Although the current CAP already has several mechanisms to enhance adaptation and to pay more attention to sustainability and climate resilience, further strengthening of these mechanisms can be considered. In particular it deserves careful monitoring of how in practice the CAP is reaching its objectives of enhancing a climate resilient and low carbon agricultural sector in Europe.

4.2 Options for mainstreaming

The set of options for mainstreaming climate adaption in the CAP ranges from simple provision of information on climate change and adaptation options in the context of the CAP policies, at one extreme, to a very fundamental revision of the systems, at the other extreme, as such that much larger shares of the CAP payments are directly related to environmental targets and investments in adaptation to ensure that the agricultural sectors in Europe will become more resilient to climate change.

4.3 Impacts on growth in the agricultural sector leading to increased risks

Although the rural development and CAP policies aim at fostering a climate resilient agricultural sector in Europe, under the current system there still is a risk that despite the large amount of CAP subsidies, or even as a results of these CAP subsidies, the agricultural sector is still developing into a direction that makes it even more vulnerable to weather extremes that may occur under climate change. For instance, droughts in the Mediterranean regions may have severe impacts on the agricultural sector, and the investments in the agricultural sector that are currently taking place may lead to more risk in the future. Similarly the extension of the dairy and livestock sector, which is at least to some extent enabled by the agricultural support under the CAP, has the potential to lead to emissions of more greenhouse gases and larger environmental impacts. These sectors can also be more vulnerable for diseases under climate change.

4.4 Behavioural barriers for adaptation

The 2014 CAP reform pays limited attention to practical mechanisms that deal with the behavioural barriers related to adaptation decisions under long time horizons and uncertainty. An important issue is, for example, how discounting should be used in adaptation decision-

making as private sectors tend to use a high discount rate. In many cases adaptation to climate change requires a long term perspective that enables important investments in irrigation or improvements in water supply security, or changes in crops and cropping patterns over Europe. If high discount rates are applied these investments opportunities may not be selected and implemented, or they may only become viable if public private partnerships are established.

4.5 Implementation of other mechanisms

Other mechanisms can be used to stimulate and facilitate adaptation such as insurance, capacity building, networks and partnerships and this is certainly advocated under the CAP. However, currently it is not clear how the proposed measures are implemented in practice and whether the speed and intensity of the actions is sufficient to provide for the required resilience in the agricultural sector. To what extent the measures are adequate will also depend on the characteristics of future climate change and the stochastic development in the related weather patterns, both for the temporal and spatial dimension. This makes it very difficult to assess whether the measures to stimulate and facilitate adaptation are adequate.

4.6 Water management and environmental implications

In the context of water quality management the CAP support may currently lead to developments that have a tendency to aggravate the existing problems, e.g. with manure management, nitrogen leakage and eutrophication. This would not be in accordance with the water framework directive, and it produces counter-effective results. For this reason it is important to even further harmonize the impacts of the CAP system with important policy areas such as biodiversity conservation, protection of nature and landscape and water and air quality. Although the current CAP makes efforts through pillar II and cross-compliance to support sustainable management in the agricultural sector, a large part of the budget is simply allocated in terms of income support without providing strong incentives for sustainable development or climate resilience.

4.7 Autonomous adaptation and pro-active adaptation by the public sector

One might argue that the private actors in the agricultural sector are responsible for optimal adaptation to climate change. However, many of the farmers have imperfect information on what would be the challenges of climate change and what adaptation options are available and suitable to use. This implies that it certainly is worthwhile to consider whether the financial means that are involved in the current CAP arrangements can be used to provide stronger incentives to farmers to adapt to climate change and to make the agricultural sectors in Europe more climate resilient and less greenhouse gas intensive. With respect to carbon sequestration one might wonder whether the CAP support can be used to a larger extent than currently is the case to foster carbon sequestration in soils and forests.

5 Case study on adaptation and CAP in the East Midlands

In the course of the project we have undertaken a case study, analyzing how the CAP 2007-2013 has supported adaptation measures to Climate Change in the East Midlands in England.

5.1 Introduction

Policy interventions in farming structures and regulatory arrangements have the potential to trigger flexible responses to threats posed by climate change and thereby enable effective adaptation. Does the European Union's Common Agricultural Policy categorize as a policy that stimulates agricultural adaptation to climate change and promotes resilience? We combine the conceptual strands of adaptive governance on the one hand and resilience on the other hand in order to provide an evaluation framework for adaptive organisational approaches to agricultural climate change regulation. Our focus is on procedural implications for adaptation and resilience with regard to the CAP policy implementation between 2007 and 2013 at the regional level in the East Midlands, England.

5.2 Implementation of the CAP in the East Midlands

In the UK, the communication and coordination of the agricultural policy and its implementation is largely a top-down process (Lowe, Buller, Ward 2002). However, we can find more dynamic arrangements at the regional level, that combine top-down and bottom-up elements. This is largely a result of increased involvement of farmers, which is triggered by the CAP's second pillar. In the following, we briefly describe, to what degree the lower-level governmental bodies, civic and private actors as well as citizens are actually involved in regional decision-making and policy implementation concerning the CAP.

For the East Midlands, a Regional Implementation Programme (RIP), effective from 2007 to 2013, has been set-up to deliver the Rural Development Programme for England (RDPE), a seven year funding programme under the CAP, with a budget of £3.9 billion (Defra Website). The compilation of the RIP was accompanied by "extensive consultation and engagement with stakeholders" (RDPE 2010: 4). The Regional Programme Management Group (PMG) governs the RIP and is accompanied by meetings of a Regional Consultative Group (RCG) (Ibid.). Both the PMG and the RCG are arrangements under on-going review and can be adjusted if that is considered necessary (RDPE 2010). The PMG consisted of representatives from Emda (East Midlands Development Agency), the Forestry Commission and Natural England, with GOEM (Government Office for the East Midlands) attending as observers (RDPE 2010). They are obligated to allow for delivery partners "to discuss progress against all aspects of programme delivery", enable "regular monitoring of organisational performance toward agreed delivery goals", and give the opportunity to "share information and ideas" (RDPE 2010: 40). Decisions taken in the context of the PMG are subjected to consensus agreements (Ibid.). The Regional Consultative Group is hosted by the East Midlands Rural Affairs Forum (EMRAF) and consists of a broad range of actors "with an interest in the East Midlands regional delivery of the Rural Development Programme for England" (Ibid.). Links between the

RCG and the National Programme Board are established, allowing for regional issues to be raised and discussed at national level as well (Ibid.). Thus, regular meetings concerning regional decision-making and implementation involve a broad range of actors that can contribute to the policy regulation and governance in the East Midlands.

Assessment and categories of inquiry

In order to analyze the structural preconditions for agricultural adaptation to climate change in the CAP, categories of inquiry are formulated that correspond to the conceptual linkages between adaptive governance, adaptive co-management and resilience. Those linkages are the features that figure in each of the three, namely: (1) polycentricity, (2) networks and cooperation, (3) information access and elicitation, and finally (4) opportunities for learning. Those categories of inquiry are evaluated, assuming that they go hand in hand with an enhancement of adaptive capacity at both the individual and the societal/administrative-regulatory level. We have chosen these four drawing on the Stockholm Resilience Center's Principles for applying resilience thinking (Stockholm Resilience Center 2014).

Polycentricity

With regard to polycentricity, it is important to test for diversity in agents and interactions, contributing to a network structure with various nodes that signify authority and leadership. We were hoping to find "nested" institutions and responsibilities characterised by redundancy.

Decisions on agricultural planning in the East Midlands have been impacted by newly established networks and groups, for example by the Local Action Groups and Rural Farming Networks in the East Midlands, institutionalised by the EU CAP. Rural Networks, a form of technical assistance to improve governance and effectiveness of Rural Development Programmes, are in place to "spread good practice" and encourage wider stakeholder participation and involvement beyond the region (Marquard 2010: 8). The implementation is characterised not just by a horizontal network of farmers and their respective municipalities, but also involves regional and national authorities, which makes it both multilevel and polycentric (Naustdalslid 2014). The process of decision-making and implementation both at regional and local level, involving national authorities, funded by EU bodies and national government resources, provides feedback structures that have an impact on a very small set of decisions, applicable in the East Midlands. To make this more explicit: Decisions that are part of the Regional Implementation Programme are discussed in different forums and meeting constellations that engage a broad range of actors, as has been indicated above (RDPE 2010). Commonly, governmental stakeholders are present in almost all of these meeting constellations, while other stakeholder groups are only represented in certain instances (ibid.). Yet, their decisions have an impact on decision-making in the different circumstances as the programming is decided upon in consensus agreements (ibid.). National governmental authorities are thus overlapping and redundancy is present in networking structures as well as regional and local negotiations and meetings, which means that these different forums have the potential to perform correction efforts in dependence on each other. In addition to that, the structures of decision-making are open to changes, as both the PMG and the RCG are arrangements under on-going review and can be adjusted if that is considered necessary (RDPE 2010). Leadership roles are thus clear, but not overpowering the exchange of ideas and approaches to decisions that are made in the context of the regional CAP implementation. The benefit of having governmental agencies sit in regional

forums is that both they and regional actors get the chance to engage in a discussion on policy-priorities concerning agricultural adaptation to climate change. We have found special mentioning of agricultural adaptation objectives in the RIP, where it is stated that the RDPE will

- Support activities which increase the resilience and adaptability of the natural environment to climate change – e.g. promoting habitat linkages, including woodland creation, thereby reducing habitat fragmentation and promoting eco-system services;

- Recognising the role of land managers in contributing to climate change objectives and encourage land management practices which mitigate against/ assist climate change adaptation;

- Support activities which will reduce energy demand e.g. encourage environmental technology transfer in relation to the reduction of greenhouse gas emissions;

- Provide a clear framework for the assessment of the biodiversity and landscape impact of energy crops and other renewable sources;

- Support activities that raise awareness of the impact of climate change and action required by land managers and rural communities to address it (RDPE 2010: 18).

Regional planning efforts under the CAP have thus resulted in objectives that clearly address agricultural climate change adaptation and resilience and are the result of an interaction between different decision-making levels and actor types.

Networks and cooperation

In this category, we checked for instances where group dynamics were motivated. For cooperation to be successfully realised across different but interconnected networks, the role of leaders needs to be clarified, in order to deal with power issues and potential conflicts. The people involved in such collaborative efforts need be able to communicate a common vision. In our case, agricultural adaptation to climate change is thought of as the common goal.

Networking structures have been institutionalised and funded by the EU and the national government. As has been mentioned with regard to polycentricity, Rural Networks and Local Action Groups, institutionalised under pillar II, are an example of decentralised engagement and capacity building in a network-constellation. Also, national governmental agencies like Natural England, The Forestry Commission, and the Environmental Agency that jointly manage the CAP implementation under the Defra's framing, are engaged in networking structures, seeking to promote knowledge exchange and providing for leadership in participatory settings (European Union Committee of the House of Lords 2010). When analysing the regional decision-making processes, it is not always clear, who is chosen to participate, for what reasons, and under which circumstances, as the motivation for participation is not stated. Although decisions for the RIP were consensus agreements (RDPE 2010), it is unclear from our analysis of the Rural Development Programme for England if stakeholders got to participate on equal terms. To assess this, more research would be necessary that involves interviews and outcome evaluations.

Cooperation and networking in the East Midlands is visible in several publicly funded formats, such as °Climate East Midlands (°Climate East Midlands Website). A look at its partners reveals a very broad association of participants. For example, the Environment Agency,

Natural England, the East Midlands Council, which is a voluntary association of the local authorities in the East Midlands, Business in the Community, and well as NHS East Midlands, a Sustainable Development Network of NHS Trusts, which is providing a link with the health sector. Farmers in the East Midlands can engage in workshops that are organised by the partnership and that focus on resilience and adaptation. One example is the Planning to Adapt project, a locally active commitment of authorities to identify and manage climate risks (ibid.). Such projects can also be funded by the CAP, as can be seen in a local flood-defense project Farming and Water for the Future project (FWF), an OnTrent partnership project together with the Environment Agency and Natural England, which works with farmers along the river Soar "to introduce innovative land management practices and land use changes on agricultural land" (Leicestershire County Council 2012: 3). We can hence detect trans-policy-effects, where the more rigidly structured CAP is used to meet specific planning needs and complement more flexible arrangements.

Thus, at both the regional and local level, implementation is a cooperative effort, that involves stakeholders from different backgrounds and establishes a strategy that reflects EU objectives, and also responds to and integrates regional features and needs by means of participatory negotiation meetings and additional projects. The 'learning by doing'-attitude, which has been mentioned before, seems to be immanent in local and regional planning in the East Midlands. The CAP provides a structural backdrop, which can be mobilised to grant financial support as the relevant monitoring authorities of the policy-implementation figure in projects such as °Climate East Midlands.

Information access and elicitation

Both the relative risk perception and the individual's perceived capacity to adapt play a role with regard to adaptation activities (Grothmann & Patt 2005). We assume that farmers need information on climate risks, the risk probability as well as the costs of such an event in order to assess their individual need to adapt. Access to information is the first step in the individual process of capacity building with regard to adaptation. Elicitation refers to the process of providing occasions and incentives for stakeholders to provide information. Examples of elicitation methods are interviews, questionnaires, agenda points with lead questions (Newig et al. 2013).

Targeted information on agriculture and climate change in the East Midlands is provided online[i]. However, the information provided is often not instructive, but only informatively-descriptive to the point where one knows that such cases of agricultural adaptation exist. Also, local data is not aggregated to inform regional planning, let alone national planning. Furthermore, regional and national information on climate change activities does not highlight the impact of the CAP on climate change adaptation, merely listing it as a tool for funding. The link between the CAP as a regulatory framework that can set incentives for agricultural adaptation to climate change is not explicit. Publications with regard to agriculture and climate change could be enhanced by specifically addressing the interplay between the policy and climate change adaptation, especially considering the upcoming greening efforts which have been introduced in the latest CAP reform. Not surprisingly, agricultural adaptation to climate change with regard to policy planning and implementation is subsequently not yet monitored explicitly. But, as monitoring of the CAP implementation is mandatory, it is likely that climate change adaptation might play a role in upcoming monitoring reports and that this will facilitate

further research efforts. This is likely to be the case with regard to the upcoming implementation period (e.g. SWD 139 2013).

Opportunities for learning

Establishing a context for knowledge sharing is paramount when we aim for successively building up adaptation to climate change at the regional and local level. Therefore, it is necessary to ensure sufficient resources to institutionalise learning and set incentives that enable people to network and create communities of practice.

The consultation of experts is institutionalised under pillar I and pillar II, by means of advisory services. These have been increasingly made use of during the implementation of the 2007-2013 CAP (ADAS 2009). Stakeholders that are affected or somehow involved in regional decision-making in the East Midlands have the opportunity to express themselves and exchange opinions, knowledge and ideas. They can participate in Local Action Groups, institutionalised with regard to the CAP, rural networks as well as in the decision-making meeting on the RIP, where they are given the opportunity exchange ideas and information. Unfortunately, the material under review neither indicates if their discussions can be characterised as 'fair discourse' nor does it allow for comments on trust relationships. Also, there is no data on conflicts that may have come up during the decision-making process. We can thus underscore that the CAP stimulates loci of knowledge exchange and that financial incentives exist that further promote information exchange. However, individual-level responses and effects need to be tested in greater depth in order to account for a build-up of individual adaptive capacity.

5.3 Conclusions from the case study

With regard to the East Midlands, regulatory-organisational structures that are in place because of the CAP or with recourse to it, support the first steps towards increasing farmers' ability to be able to change and adapt in relation to climate change. Decision-making with regard to regional agricultural planning allows for structural reinventions and a targeted approach to land management in a collaborative effort. These collaborative planning events potentially introduce a different mind-set and organisational strategy with regard to agricultural climate change adaptation. With regard to governance structures, the preconditions to perform constant re-invention and co-evolution in accordance with dynamic exterior effects while maintaining institutional and regulatory stability exist. The structural-organisational preconditions for resilience building are present and approaches to promote resilience are financed by the CAP, which potentially constitutes a framework for adaptive activities at the individual level. Networking and knowledge exchange, hence the individual capacity to adapt and a mutual knowledge exchange on climate change, can thus be stimulated by involvement in decision-making. However, there may still be a variance in agricultural adaptation at the farm-level, which cannot be addressed here. With regard to agriculture in the East Midlands, the regulatory-organisational agricultural policy structures allow for farmers to be able to change and adapt by means of adaptive co-management. Following our conceptualisation, this also means that resilience is promoted and that it indents agricultural decision-making and policy implementation structures.

In conclusion: Having more regionalised arrangements makes decisions more flexible and potentially more responsive to the specific contextual needs. However, if farmers are not motivated by the bureaucratic apparatus to become engaged in adaptive farming and management strategies, all structural arrangements remain ineffective when a farm is faced with actual climatic threats. We therefore encourage further research to integrate both socio-cognitive factors of agricultural adaptation and external stimuli, such as they are set by the CAP.

6 Contribution to the analysis of future CAP reform and its ability to accommodate adaptation measures: A survey of Greek farmers

6.1 Introduction

There is an increasing interest in understanding the processes that shape farmers' adaptation to climate change at the national, market and farm level. Insights gained are being used to address a range of questions on the determinants of investment, risk and hedging patterns in the agro-food sector. Results have been reported in a wide range of studies in relation to the ability and preparedness of individual farmers to undertake autonomously climate-induced transformations in their practices. (Uddin et al 2014; Mertz et al 2009; Wheeler et al 2013) However, adaptation efforts at the farm level may fall short of the socially optimal level owing to market failures such as externalities, information asymmetry and moral hazards as epitomized in the on-going contrast between 'dump' and 'clairvoyant' agents. (Schneider et al 2000) Policy interventions are thus needed to align privately profitable actions with socially desirable outcomes (OECD 2015).

To this end, extensive empirical research in farmers' perceptions towards climate risk and adaptation choices is still needed in order to identify a set of guiding principles for government intervention. The present chapter reports on a recent survey on the potential and constraints of farm-level climate change adaptation in the Greek farming system. The survey intends to shed light on questions, which are directly relevant for understanding the past record of adopting agro-environmental measures in Greece while informing the design of future policies to strengthen the capacity of Greek farmers to adapt to climate variability.

6.2 Impact of climate change on Greek farming

The quantification and valuation of aggregate impacts of climate change on the agro-food sector is an extremely challenging task, made difficult by the incomplete understanding of plant physiology vis-à-vis rising temperatures and the accompanying changes in water availability, soil erosion and pests occurrences. Thorough understanding of the impacts of climate change on the Greek farming system is still lacking. The most articulated research up-to-date has been undertaken by Karamanos et al. (2013) in the framework of the Bank of Greece's Committee for the Study of the Impacts of Climate Change (BoG 2011).

Karamanos et al. (2013) use the AquaCrop model (version 3.1). AquaCrop has certain advantages: it assesses the effect of water on both plant growth and crop productivity; compared with other models, it requires fewer parameters; it is simpler to use; and, lastly, it is more accurate, with lower error probabilities (Raes et al., 2009). Simulations were run by

downscaling to the regional climate zone level of Greece IPCC scenarios A1B, A2 and B2 for the periods 2041-2050 and 2091-2100 compared to baseline period 1991-2000. To increase accuracy, Greece was divided into the following 11 climate zones: E. Macedonia-Thrace, W. Macedonia, E. Greece, W. Greece, Ionian coast and islands, W. Peloponnese, E. Peloponnese, Cyclades islands, NE Aegean, Dodecanese islands, and Crete. It was assumed that crop management practices (e.g. sowing or harvesting), irrigation and fertilizer use (quantity and frequency) remained unchanged at current levels. The study took into consideration the impact of desertification on crop yield in order to estimate the annual rate of land loss by climate zone. The combined impact of climatic change and desertification on the production of a number of crops was accordingly simulated. The study focused on arable and tree crops, and more specifically on wheat, cotton, maize, olive and vines. The impact analysis was conducted both factoring including and excluding soil desertification.

Of the three scenarios considered, Scenario B2 appears to be most favourable to crop production. The impacts of climate change become increasingly 'less negative to positive' the further one moves north and east: consequently, Eastern Macedonia-Thrace and Western-Central Macedonia are the zones that will benefit the most or suffer the least depending on the crop/case. The most vulnerable arable crop was shown to be wheat, while cotton production is projected to decrease the most under both Scenarios A1B and A2 in Central Eastern Greece. The impact of climate change on tree crop production by mid-century will range from neutral to positive but will become increasingly negative by 2100, especially in the country's southern and island regions. Vegetable crops will move northward and the growing season, longer than it is today due to milder-warmer winters, will result in increased production (Karamanos et al., 2013).

The isolated effect of climate change, excluding desertification, was found to have an immediate positive effect on farmer income in the period 2041-2050, a turning point after which the economic impacts (in the period 2051-2100) worsen. In contrast, the impact of climate change induced desertification is expected to be negative. Desertification negatively impacts agricultural production and, consequently, farmer income, due to the loss of fertile farmland and the decrease in cultivable area. The overall impact of climate change on farmer income, factoring in desertification, was found to be negative under Scenarios A1B and A2, but positive under Scenario B2. Unless measures to counter desertification are taken, climate change will thus negatively impact farmer income.

Using a discount rate of 1%, the impacts of climate change on Greek farmers as a percentage of GDP were estimated to range from +13.37% (scenario A2, without desertification) to -17.81% (scenario B2 with desertification).

6.3 Material and methods

A quantitative household survey was designed to gather data on, inter alia, perceived risks and attitudes towards climate change, preparedness and capacity to adapt and future actions. It includes a characterization of adaptation options as well as a wide range of other socioeconomic data that might influence decision-making processes and hence confound possible correlations between actual and intended practices.

Stakeholders related to science and administrative entities were approached to consult on the appropriateness of the survey mode, timing and organization. A structured questionnaire was then designed and pretested with a limited number of stakeholders. Two trained interviewers

administered the face-to-face interviews during November and December 2014. The sample included farmers from four regions with an important farming activity: Peloponnese, where mostly wine growers were interviewed, Western Greece, Thessaly and Central Macedonia where a mixture of arable crops is cultivated. (Figure 1) Due to election period and unstable political and economic situation in Greece (from November 2014 to February 2015) the survey had to be postponed several times. A total of 70 (as of 10th April 2015) usable responses were elicited.

Figure 1: Location of survey sites

Data collected were analysed using a multitude of analytical approaches. First, descriptive statistics present central tendencies and averages. A self-reported psychometric test was used in order to measure individual risk aversion. Cultural theory was applied as a way of coming to grips with the disputes that characterize the socio-cultural underpinnings of risk attitudes. Cultural theory seeks to contribute to the understanding of public attitudes towards risk by anchoring individual perceptions in alternative ways of organizing and perceiving social relations. These alternative ways - or 'lifestyles'- support and sanction particular perceptions, values, emotions and interests. (Brenot et al., 1998; Jones 2011; Marris et al., 1998) Finally, logistic regressions are applied to isolate factors influencing individual behaviour (Below et al., 2012; Shiferaw et al., 2009).

6.4 Results

In this section we present descriptive statistics of our sample and the results of our survey organized around the following nine questions: Is climate change happening? How are climate impacts manifested? Are farmers risk averse? Are farmers prepared to adapt? How should adaptation be organized? What shapes farmers' preferences for adaptation options? Whom to trust? Who should be responsible? What is the social value of crop insurance as a hedging mechanism?

Descriptive statistics

Table 1 illustrates the socioeconomic characteristics of the sample. About 14.9% of the respondents were female and 85.1% male. The mean age of the respondents is 48.6 years and the mean household size 2.5 persons. The mean household income is €11,220 per year and the cultivated area extents in average to 60.9 acres. Farmers in our sample cultivate in average 2.5 crop varieties while in the majority are members of cooperatives. Referring to their educational level, 42.6% of the respondents visited only primary school, 14.9% middle school, 31.9% high school, 6.4% vocational technical school and the rest 4.3% higher educational or technological institutes.

Table 1: Socioeconomic characteristics of the sample (mean and std. deviation).

Socio-economic parameters	**Sample characteristics**
Age	48.6 (12.9)
Gender (1=male, 2=female)	1.2 (0.4)
Household size	2.5 (1.4)
Household income (€ per year)	11,220 (5,220)
Cultivated area (acres)	60.9 (47.2)
Number of cultivated types of crops	2.5 (1.1)
Engaged in cooperative (1= member, 0=otherwise)	0.9 (0.3)

Is climate change happening?

The majority of the respondents agreed with the statement that the phenomenon of climate change is already happening or is likely to happen in the near future. Specifically, an aggregate of 80% of the sample stated that the impacts of climate change occur nowadays (42%) or are going to manifest themselves within the next 20 years. At the other end of the spectrum, only 2% of the participants believe that the impacts will never occur (Figure 2).

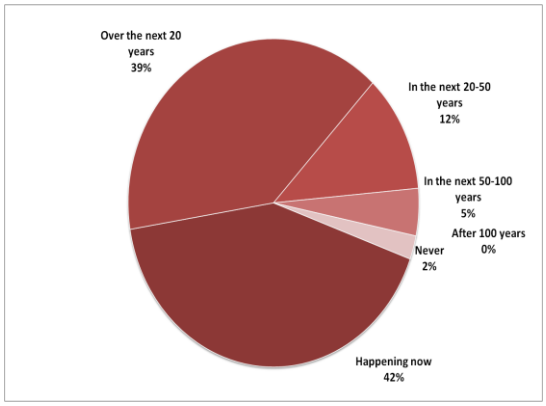

Figure 2: Occurrence of the impacts of climate change.

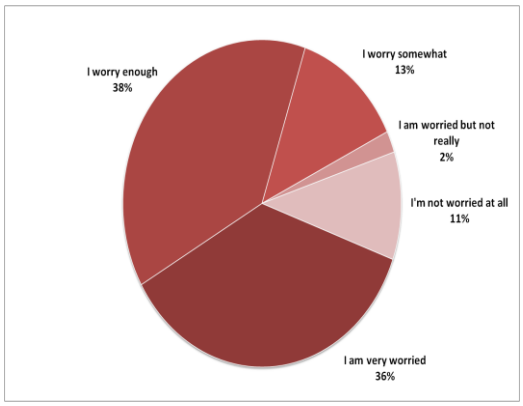

Figure 3: Level of concern about climate change.

Accordingly, 87% of the respondents expressed their concerns about the problem of climate change and its impacts while a minority (13%) do not worry about climate change (Figure 3). Awareness about climate change is strongly linked with information provision. Respondents characterize existing level of information about climate change and its impacts as ambiguous. Specifically, 40% assessed the provision of information as limited, while 36% of the respondents seemed to be satisfied with the existing level of information (Figure 4).

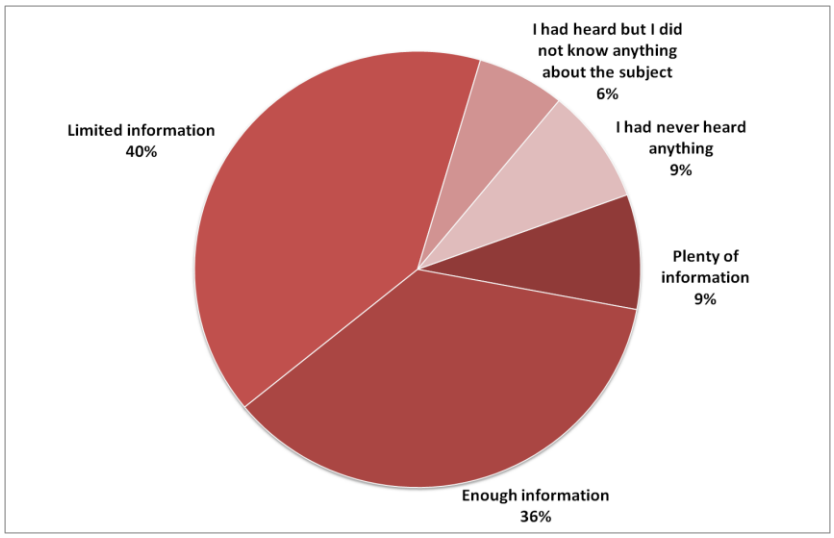

Figure 4: Level of information about the phenomenon of climate change.

How are climate impacts manifested?

Respondents evaluated their experience during their entire professional life with extreme weather events. Hail, frosts, heavy rainfalls and heat waves were considered as the most common extreme weather events exhibiting the highest frequency of appearance in the respondents' region (Figure 5). In contrast, snow, droughts and floods were less common events (Figure 6).

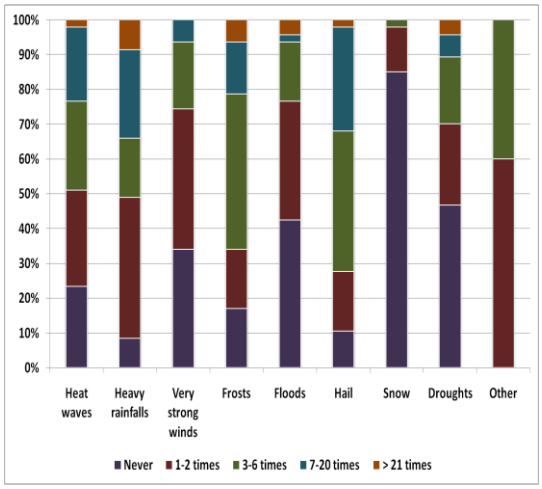

Figure 5: Frequency of extreme weather events.

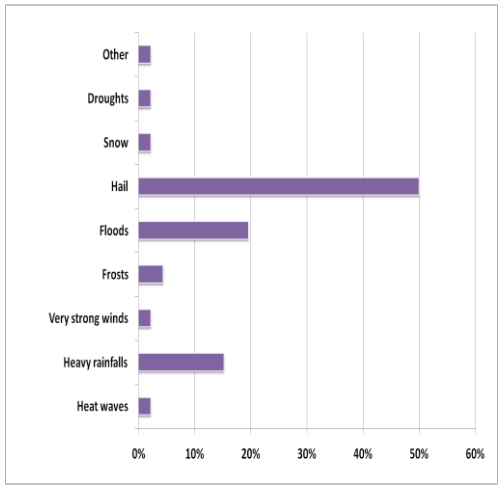

Figure 6: Ranking of extreme weather events

Then, the respondents were asked to specify which of the already mentioned extreme weather events led to the most important damages. Half of the respondents chose hail as the most dangerous event resulting in severe damages (Figure 6). Floods and heavy rainfalls appeared to be less dangerous in comparison with the hail but they caused also destructive impacts when they occur.

Subsequently, timing of the occurrence of these extreme weather events was examined. The majority of the specified worst extreme weather events occurred from May to September; July was reported as the month with the highest frequency of extreme weather events, probably due to the seasonal level of maturity of crop varieties (Figure 7). Although the occurrence of these extreme weather events can be characterized as continuous, an intensification of the appearance of the extreme weather events has been noticed in the last years, especially the last five years, as depicted in Figure 8.

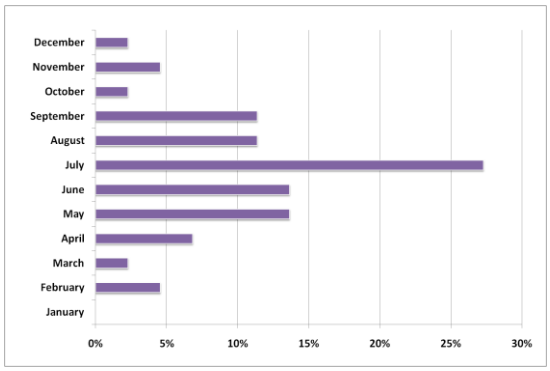

Figure 7: Month of appearance of the worst weather event.

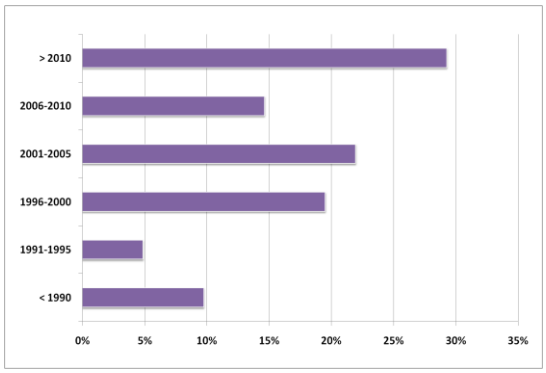

Figure 8: Year of appearance of the worst extreme extreme weather event.

The participants were then asked to identify what components of their property were mostly affected by the occurrence of extreme weather events. According to their responses, the most severe damages referred to yields and, consequently, expected income (Figure 9). Damages

on soil and lands were not permanent, whereas the infrastructure including machinery and building were not affected at all. Damages on the adjacent crops and land were considered almost identical to damages occurring to the respondent. The psychological impacts on health and personal prosperity were characterized neither as important nor as unimportant indicating that this is an aspect that merits further investigation.

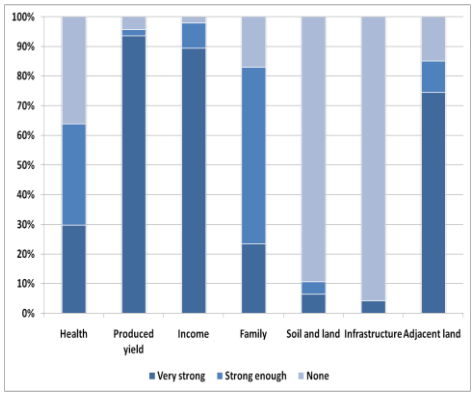

Figure 9: Affected aspects from extreme weather event.

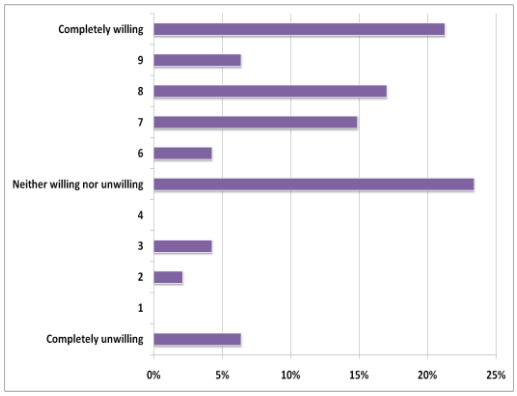

Figure 10: Willingness to undertake risks.

Are farmers risk averse?

The attitudes of the participants on risk were assessed using both a conventional self-reporting psychometric test of willingness to undertake risks in life (Willock et al. 1999) as well as the mental typologies of cultural theory (Wildavsky 1987).

In the psychometric test, 64% of the sample was willing to undertake risks during their life for various issues. (Figure 10) Of the rest, 23% of the respondents were neither willing nor unwilling while 13% of them expressed unwillingness representing more conservative attitudes.

We then seek to empirically validate the fourfold categorization of individuals in cultural types as advocated in cultural theory. The analysis of the cultural types of the participants was performed examining both their environmental and risk perceptions. According to their responses, the allocation of the sample to the four cultural types was the following: 31% Egalitarians, 15% Fatalists, 24% Individualists and 30% Hierarchists (Figure 11).

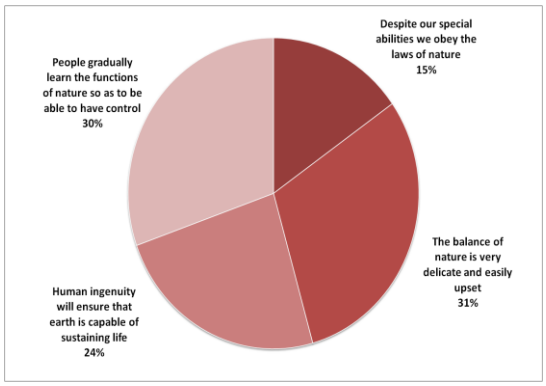

Figure 11: Examination of cultural types through environmental perceptions.

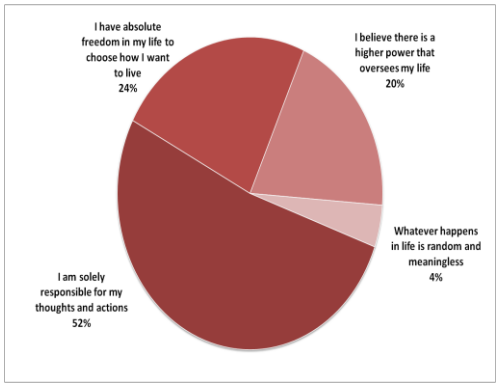

Figure 12: Examination of cultural types through risk perceptions.

The corresponding allocation according to the questions for the analysis of risks attitudes was 52% Egalitarians, 4% Fatalists, 24% Individualists and 20% Hierarchists (Figure 12).

Are farmers prepared to adapt?

In the past, farmers were not prepared to address extreme weather events or rising temperatures. As a consequence, only a small minority of farmers has already acted against extreme weather events and rising temperature. Such past adaptation actions took solely the form of investing in irrigation efficiency. Notwithstanding the fact that 61.9% of our sample was the owner of the damaged property, only 4.3% of them was prepared in the past to confront an extreme weather event. Nevertheless, and in spite of their experience, only 28.3% of the participants claim that they would be prepared to handle it in the future in case it occurs again.

With respect to farmers' preparedness to undertake short-term adaptation measures (that is, during the years 2015 and 2016) the majority of the respondents are willing to undertake some of the proposed adaptation options (Figure 13). The most appropriate practices include measures for efficient irrigation, changes in farming practices, intensified use of fertilizers and pesticides and substituting the current type of crops with a different variety exhibiting greater durability vis-à-vis heat waves. Hence, 89.4% of the sample stated that they would be willing to implement at least one of the examined measures within the next two years so as to confront effectively the potential impacts from climate change. Only 10.6% of the sample stated that they would not undertake any preparatory action.

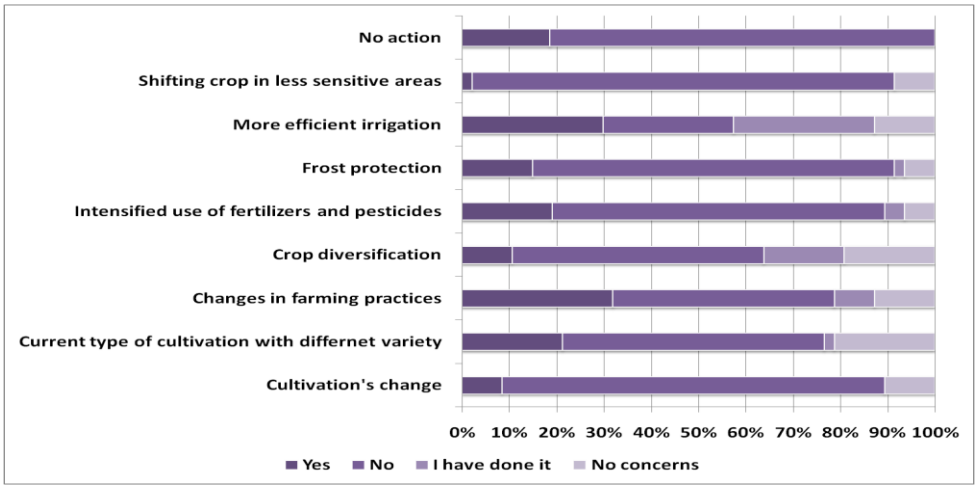

Figure 13: Measures for the preparation of the extreme weather events during the next two years.

How should adaptation be organized?

Respondents were then asked about public and private initiatives that would foster a mentality of preparedness among farmers. First, we look at the preferred public policies that would efficiently support the implementation of the adaptation options. In conformity with the majority of published evidence on this topic, respondents stated a number of relevant state interventions: provision of technical assistance and support, adoption of new policies in

climate risk insurance, mobilization of public funds for climate-proofing existing infrastructure, subsidies or financial grants for agricultural practices beneficial for the climate and the environment (Figure 14).

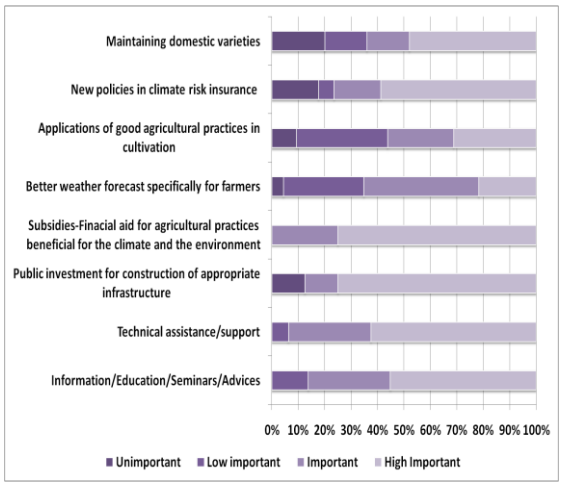

Figure 14: Supporting public policies

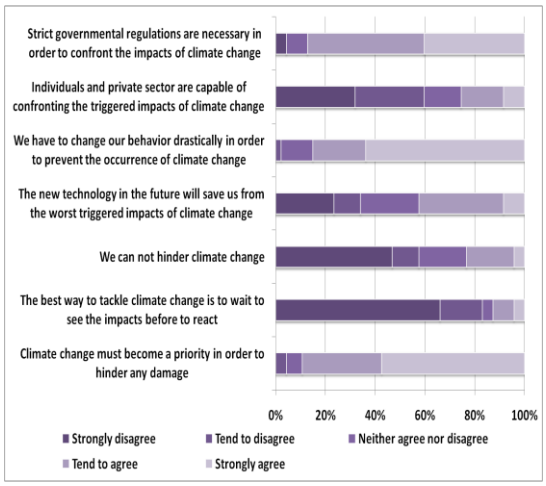

Figure 15: Supporting private initiatives

As shown in Figure 15, farmers supported the statements that:

- Climate change must become a priority
- It is our obligation to change our behaviour drastically
- Strict state regulations are needed in order to confront climate change.

They disagree though with the statements that:

- The best way to tackle climate change is to wait to see the impacts and then react
- It is not possible to address climate change
- Individuals and private sector are capable of confronting the triggered impacts of climate change

Finally, respondents show an indecisive stance to the statement that future technologies would solve the problem of climate change.

What shapes farmers' preferences for adaptation options?

The factors, which influence the attitudes and preferences of farmers towards adaptation, were examined. Income losses and expected damages were the main factors shaping private attitudes towards adaptation to climate variability and extreme weather events. In this respect, the occurrence of these events somewhere else in the world was also considered as a determining factor. The stimulus of institutions such as church and non-governmental organizations seem to be minor. On the other hand, press media, friends and family, and increased insurance against extreme weather events have a medium impact on the formulation of the public perceptions (Figure 16).

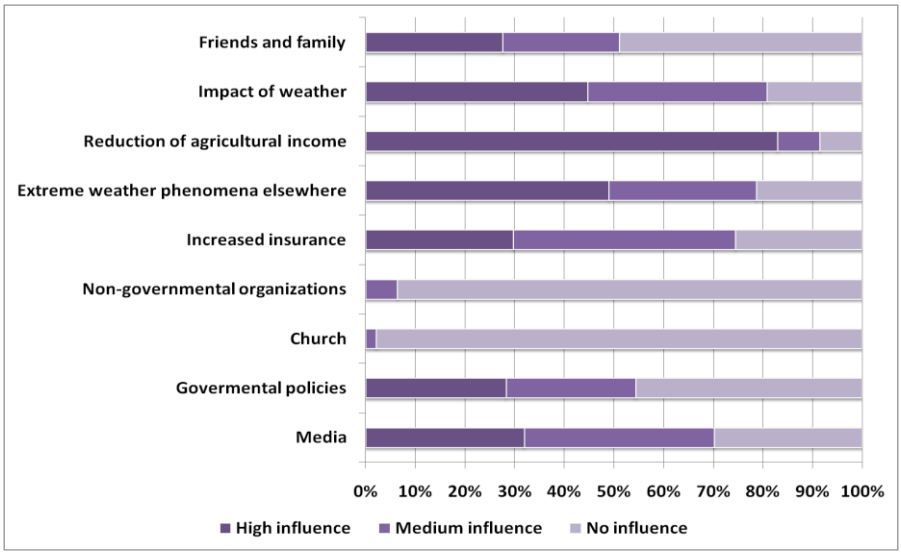

Figure 16: Factors influencing attitudes towards climate change and extreme weather events

An additional analysis of the factors affecting the attitudes of the farmers towards the adoption of adaptation measures was carried out. The non-parametric Spearman correlation was utilized for the identification of the potential relationships between farmers' willingness to implement at least one of the examined measures within the next two years and the rest of the examined variables. The Spearman's rank correlation coefficient (Spearman's rho) shows the statistical dependence between two variables. It identifies the type and strength of relationship between two variables using a monotonic function. When each variable is a perfect monotone function of the other, Spearman's rho equals +1 or −1. The Prob > |t| indicates the level of statistical significance. The results of the Spearman correlation are presented in Table 2.

Table 2: Correlated variables with farmers' adaptation attitudes.

Variables	Coding	Spearman's rho	Prob > |t|
Frequency of appearance of frosts	1: Never 5: More than 21 times	0.2819	0.0549
Adjacent land was affected from the occurrence of the worst extreme weather event	1: Very strong 3: None	-0.2799	0.0567
Media influence attitudes towards weather changes	1: No influence 3: High influence	0.2730	0.0633
Governmental policies influence attitudes towards weather changes	1: No influence 3: High influence	0.3535	0.0159
Greek government must be responsible for the adoption of	1: No responsibility	-0.2673	0.08

Variables	Coding	Spearman's rho	Prob > |t|
measures	3: High responsibility		
EU must be responsible for the adoption of measures	1: No responsibility 3: High responsibility	-0.2858	0.06
Information, Education, Seminars and Advices Measures will be utilized for the confrontation of climate change	1: Unimportant 5: Very important	0.2662	0.07
Better weather forecast specifically for farmers will be utilized for the confrontation of climate change	1: Unimportant 5: Very important	0.2637	0.08
Knowledge about climate change	1: Plenty of information 5: I know nothing	-0.2703	0.07
Individuals and private sector are capable of confronting the triggered impacts of climate change	1: Strongly disagree 5: Strongly agree	-0.3782	0.01

Furthermore, a logistic regression (probit model) was conducted to analyse the factors affecting the willingness of farmers to implement at least one of the examined measures within the next two years (Table 3).

Table 3: Factors affecting farmers' adaptation attitudes.

Variables	Coding	Coef.	P>z
Adjacent land was affected from the occurrence of the worst extreme weather event	1: Very strong 3: None	-1.42	0.03
EU must be responsible for the adoption of measures	1: No responsibility 3: High responsibility	-1.77	0.05
Knowledge about climate change	1: Plenty of information 5: I know nothing	-1.21	0.02
Constant	-	11.79	0.01

Observations	**67**
LR chi2(3)	**18.57**
Prob>chi2	**0.0003**
Pseudo R2	**60.1%**

According to the probit model, farmers who experienced very severe damages in the adjacent lands (coef. -1.42), believe that EU has not the main responsibility for the adoption of efficient measures (coef. -1.77), are familiar with the phenomenon of climate change due to the provision of adequate information (coef. -1.21), and are more willing to undertake the necessary adaptation measures in order to be prepared towards the impacts of climate change.

Whom to trust? Who should be responsible?

Considering the allocation of responsibility for the adoption of the appropriate measures, half of the respondents highlighted the high responsibility of the central, regional and local governments to undertake the necessary measures, which can alleviate the impact of extreme weather events (Figure 17).

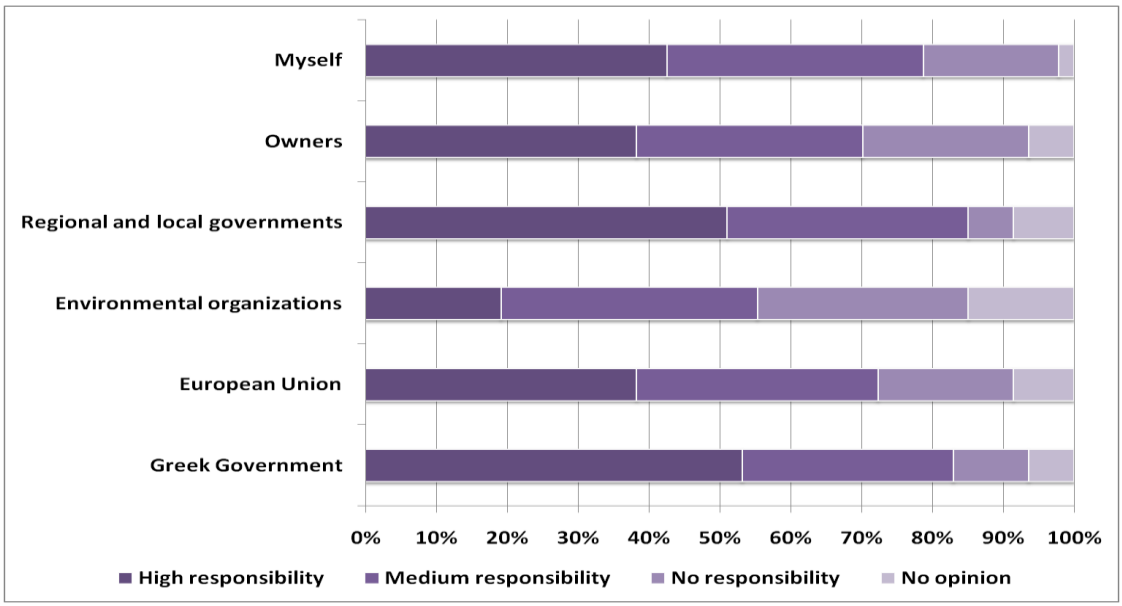

Figure 17: Allocation of the responsibility for the adoption of measures

The participants identify also their own responsibility pinpointing the significant role of the owner of damaged assets to adapt, while stating that the EU could facilitate the implementation of actions for the reduction of impacts. Interesting, environmental

organizations were not considered as efficient instruments for the implementation of the necessary actions.

What is the social value of crop insurance as a hedging mechanisms?

We investigate the role of crop insurance as hedging mechanism towards climate change damages. Due to its nature, farming activity is exposed to all kind of risk from extreme weather events. Insurance systems function as a risk sharing/transfer mechanism. Referring to the present insurance status of Greek farmers, 58.7% of the respondents were compensated for damages from extreme weather events. The reported average estimated damages amounted to €11,280 per household. Of these, a total of €8,282 per household - or 73.42% - was compensated through the state. All the participating farmers are insured with the Greek Agricultural Insurance Organization (ELGA) for an average annual premium of €647. It is obvious that ELGA does not manage to cover the total economic losses from extreme weather events. Respondents are asked to rate the degree of security they enjoy through the ELGA insurance system. For this reason, we evaluate the individual's subjective 'level of security' in a scale of 0-100 where 100 denotes a fully secured individual and 0 a fully insecure one. The average degree of security against extreme weather events among Greek farmers amounts to 23 indicating a failure of ELGA to function as a risk sharing/transfer mechanism.

What is then the social value of crop insurance as hedging mechanism? In the final section of the questionnaire, we ask respondents' willingness-to-pay (WTP) for a gain in the level of security against extreme weather events. The valuation question asks individual farmers the maximum amount they are willing to pay in order to improve their risk exposure from existing (subjective) levels (on average 23 in a scale 0-100) to a 100% (subjectively assessed) safe level.

According to the results, 40% of the respondents were willing to contribute a positive amount of money in order to increase their current levels of security. The rest of the sample was unwilling to pay. The main reasons for their unwillingness to pay are presented in Figure 18. Of those who were unwilling to pay, 29% of the respondents stated their bad economic situation as the main reason for their choice; we denoted them as 'true zero bidders'. Accordingly, the participants who are willing to pay equal 57% of the total sample (47 point estimates) including true zero-bidders.

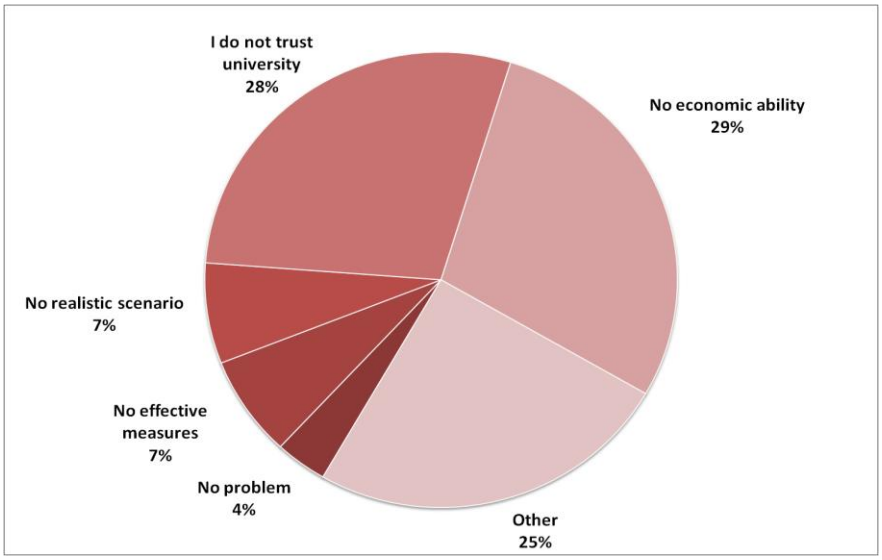

Figure 18: Reasons for refusing to pay.

We fit a linear regression model to estimate a bid function of stated WTP. The variables and the main components of the model are depicted in Table 4.

Table 4: Farmers' bid function

Variables	Coding	Coef.	P>t
The soil and the land were affected from the occurrence of the worst extreme weather event	1: Very strong 3: None	-430.70	0.00
Income	1: < €6,000 8: > €60,000	184.89	0.00
The increased insurances influence attitudes towards weather changes	1: No influence 3: High influence	-121.19	0.02
Frequency of appearance of floods	1: Never 5: More than 21 times	172.20	0.00
The balance of nature is very delicate and easily upset	1: Agree 0: Disagree	-271.17	0.00
Participation in a cooperative organization	1: Yes 0: No	-317.62	0.02

Constant	-	1370.14	0.00
Observations		**47**	
R2		**91.6%**	
Adjusted R2		**89.1%**	
Root MSE		**171.4**	
Mean WTP (€)		**382.6**	

According to the estimated linear regression model, the farmers who have experience of significant damages on their soil and land (coef. - 430.70) have the highest income (coef. 184.89), do not participate in a cooperative (coef. -317.62), disagree with the statement that the balance of nature is very delicate and easily upset (coef. - 271.17), have more experience of floods during their career (coef. 172.20) and believe that the imposition of an increased insurance premium does not affect significantly the formation of individual attitudes (coef. -121.19). These respondents seem to be more willing to contribute a higher amount of money in order to increase the level of safety towards extreme weather events. The implementation of the linear regression model leads to an estimated amount of WTP equal to €383 per household annually.

6.5 Synopsis and conclusions

The survey provided valuable insights for answering the questions that framed our research. These insights are discussed below.

Climate change *is* happening now

The majority of the participants report serious concerns about climate change and its expected impacts in the short to medium term. They believe that climate change has already begun or it is likely to happen in the near future portraying it as an inevitable phenomenon.

Climate impacts are manifested mostly as yield and income losses

A gradual rise of temperature is not (yet) a matter of concern. Climate impacts are best manifested as extreme weather events. An intensification of the appearance of the extreme weather events has been noticed, especially the last five years. The incurred damages are mostly losses in yield and income.

Farmers are *not* risk averse

Contrary to the prevailing opinion, Greek farmers report their willingness to undertake risks during their life indicating a risk-friendly attitude in spite of the fact that all respondents have confronted extreme weather events in their carrier. It is worth investigating this topic further by enlarging the sample and enriching the survey with qualitative research tools (e.g. focus groups)

Farmers are *not* prepared to adapt

Only a tiny percentage (4.3%) of the respondents were prepared to address the occurrence of extreme weather events. What is even worst, only 28.3% of the participants would be prepared to address similar risks in the future, a statement implying a relatively low inclination towards the undertaking of adaptation measures.

Adaptation could be organized with a multitude of measures

Only a small fraction of respondents practice adaptation already. Proposed policies regarded by respondents as most efficient for boosting adaptation behaviour are: provision of technical assistance and support, restructuring of risk insurance systems, mobilization of public investment for construction of appropriate infrastructure, and provision of subsidies or financial aid.

Previous experience and income losses shapes farmers' preferences for adaptation options

Analysis of the factors affecting risk perceptions shows that income losses and previous experience are the main drivers shaping farmers preferences towards adaptation.

Adaptation is a shared responsibility for state and individuals

Adaptation is regarded as a state concern encompassing central, regional and local governments. At the same time, it is also the responsibility of individual farmers to change behaviour and invest in adaptation.

Improving crop insurance would increase considerably farmers' welfare

Crop insurance has a very important role to play in agricultural adaptation policies. On the one hand, since farmers are to-date only partially compensated and climate risk is (at least partly) endogenous, ELGA provides the incentive for undertaking precautionary measures and thus adapting to future extreme weather events autonomously. On the other hand, Greek farmers would be willing to pay on average €383 annually in order to increase the existing level of safety to a level of 100%.

7 Stakeholder analysis

7.1. Introduction

As shown in the previous two chapters, the future of agriculture in the European Union is threatened with increased droughts, water scarcity, heat waves, storms, floods and changes in seasonal climate patterns. There is a need to mainstream adaptation policies into existing policy domains, such as the agricultural policies of the EU. The Common Agricultural Policy (CAP) is intended to support and guide the development of agriculture in the EU. Important steps have been made in this respect, but to what extent further improvements are possible is still to be discussed. How has the CAP promoted adaptation to climate change at the local, regional and national level? And how can it do this better in the future? These are some questions that need to be answered. For this purpose, we have organized workshops and meetings with representatives of farmers, farmers' organisations, policy analysts and experts to obtain their perception in order to facilitate dialogues between research and policy.

7.2 Financing of adaptation workshop at OECD

The first workshop took place on June 2014 in Paris at OECD headquarters in the context of the jointly organized workshop on "Financing of adaptation" by OECD and ECONADAPT. The specific goal has been to identify the main methodological challenges for assessing the adaptation options and to discuss how pro-active policies for adaptation to climate change could be combined with autonomous adaptation by the private actors and how adaptation to climate change could be financed. The summary report of the workshop is included in Annex 1 to this report.

7.3 Meeting with representative of DG AGRI

A meeting was organized in Brussels on December 11, 2014, with a representative of DG AGRI and the project officer of the ECONADAPT project to discuss the planning of the research project. The specific goal was to exchange ideas with the representatives of DG AGRI on whether climate change is considered an important topic and if so what is considered to be to most important aspects and whether have specific objectives and actions exist to assist in making European agriculture more climate proof in the future and whether CAP is playing an important role in this respect, and if so how. Many sources of information were exchanged including information on the main policy issues and main policy documents on the CAP reform and adaptation to climate change in the agricultural sector. We also discussed the relations with other policy domains such as land use planning, biodiversity and nature conservation and the links with the Water framework directive and policies focusing on sustainability. We discussed the set up and contents of the intended workshop on stakeholder

consultation for the agricultural sector in relation to CAP and adaptation to climate change and asked for a list of potential participants.

7.4 Stakeholder workshop on June 1st 2015 in Brussels

The workshop took place on June 1st, 2015 in Brussels. This workshop is specifically focused on the perception of stakeholders about the implications of climate change for the agricultural sector and the extent to which the reformed CAP provides opportunities for supporting measures and management practices directed to promoting climate resilient and low carbon agriculture in Europe.

The workshop brought together a range of key stakeholders and policy makers to discuss detailed scenarios exploring the effects of climate change on European agriculture, to co-examine the current performance of the Common Agricultural Policy (CAP), and to explore the ways in which the CAP can be improved to better facilitate adaptation to climate change. Participants critically reflected on the CAP and the impacts of climate change in Europe from multiple perspectives.

The aims of the workshop are to develop crucial new insights of how to address the challenges of climate adaptation for primary production and processing; to build expanded networks of stakeholders, policy makers and researchers; and form tangible implementable actions. The report of the workshop is included in Annex 2 of this report and describes the result of that process which was designed to have a direct impact on future CAP revision with regard to climate adaptation.

8 Conclusions

Under the revision of the CAP in 2013 a tremendous step forward has been made for mainstreaming climate change policies with regard to adaptation to climate change and the reduction of greenhouse gases from the agricultural sector. In the objectives and in the actions the topic of adaptation to climate change is very explicitly included.

Through the rural development plans it is possible to implement and fund specific activities for making the agricultural sector more climate resilient and it is possible for member states to shift a part of the funds under Pillar I to Pillar II in order to pay more explicitly attentions to cross-compliance and specific targets for climate resilience.

There is no clear picture yet to what extent the potential for mainstreaming through the CAP is actually used in practice. The total amounts for pillar I and Pillar II, as announced in the Agricultural Brief on CAP (December 2013) for the period 2014-2020 in constant prices of 2011 is 277.85 billion for Pillar 1 and 84.94 for Pillar 2, in total 362.79 billion Euro.

To what extent these amounts will be used in practice for making the agricultural sector more resilient is extremely difficult to assess because a fraction of the funds under Pillar 1 can be used by the private actors to respond to the challenges of climate change and to adjust the practices at the farm level through autonomous adaptation. A careful study of the rural develop programs could reveal which actions will be implemented under Pillar 2 for cross compliance and for climate adaptation at the regional level in the various regions of Europe. At the moment it is not yet possible to give an overview of the flow of funds and the reallocations of funds from Pillar 1 to Pillar 2 in the light of adaptation to climate change.

Although adaptation to climate change receives a lot of attention in the policy documents on climate change, CAP, and adaptation, it is as yet not clear to what extent the various instruments are applied in practice and what the most important requirements for adaptation are for the various agricultural sectors in the different agro-ecological zones in Europe.

On the basis of the literature study and the work plan of ECONADAPT, we suggested to further investigate how the agricultural sector in Europe can adapt to climate change and what the implications will be of climate change under scenarios of no, or low adaptation. It can then also be studied how the performance can be improved if adaptive measures are implemented, e.g. in terms of changes in land use planning, crop and variety choices and improving the security of water supply for irrigation in periods of serious droughts. Also the costs and benefits of adaptation in the agricultural sector can then be assessed in more detail.

It has been proposed that Work Package 7 of ECONADAPT would focus on these questions by applying the GLOBIOM model to assess the implications of climate change for the various agricultural activities in Europe at the regional level and to assess the best adaptation strategies that can be implemented combining structural and non-structural measures in Europe to improve the resilience to climate change, to reduce the emissions of greenhouse gases by the agricultural sector, and to enhance carbon sequestration in forests and soil.

Conclusions from the case studies in this report

Case study 1: Adaptation and CAP in the East Midlands

- With regard to the East Midlands, regulatory-organisational structures that are in place because of the CAP or with recourse to it, support the first steps towards increasing farmers' ability to be able to change and adapt in relation to climate change. Decision-making with regard to regional agricultural planning allows for structural reinventions and a targeted approach to land management in a collaborative effort. These collaborative planning events potentially introduce a different mind-set and organisational strategy with regard to agricultural climate change adaptation.

- With regard to governance structures, the preconditions to perform constant re-invention and co-evolution in accordance with dynamic exterior effects while maintaining institutional and regulatory stability exist. The structural-organisational preconditions for resilience building are present and approaches to promote resilience are financed by the CAP, which potentially constitutes a framework for adaptive activities at the individual level.

- Networking and knowledge exchange, hence the individual capacity to adapt and a mutual knowledge exchange on climate change, can thus be stimulated by involvement in decision-making. However, there may still be a variance in agricultural adaptation at the farm-level, which cannot be addressed here.

- With regard to agriculture in the East Midlands, the regulatory-organisational agricultural policy structures allow for farmers to be able to change and adapt by means of adaptive co-management. Following our conceptualisation, this also means that resilience is promoted and that it indents agricultural decision-making and policy implementation structures.

- Having more regionalised arrangements makes decisions more flexible and potentially more responsive to the specific contextual needs. However, if farmers are not motivated by the bureaucratic apparatus to become engaged in adaptive farming and management strategies, all structural arrangements remain ineffective when a farm is faced with actual climatic threats. We therefore encourage further research to integrate both socio-cognitive factors of agricultural adaptation and external stimuli, such as they are set by the CAP.

Case study 2: CAP reform and its ability to accommodate adaptation measures: A survey of Greek farmers

- Climate change *is* happening now: The majority of the participants report serious concerns about climate change and its expected impacts in the short to medium term. They believe that climate change has already begun or it is likely to happen in the near future portraying it as an inevitable phenomenon.

- Climate impacts in Greece are manifested mostly as yield and income losses: A gradual rise of temperature is not (yet) a matter of concern. Climate impacts are best manifested as extreme weather events. An intensification of the appearance of the extreme weather events has been noticed, especially in the last five years. The incurred damages are mostly losses in yield and income.
- Farmers in Greece are *not* risk averse: Contrary to the prevailing opinion, Greek farmers report their willingness to undertake risks during their life indicating a risk-friendly attitude in spite of the fact that all respondents have confronted extreme weather events in their career. It is worth investigating this topic further by enlarging the sample and enriching the survey with qualitative research tools (e.g. focus groups)
- Farmers in Greece are *not* prepared to adapt: Only a tiny percentage (4.3%) of the respondents were prepared to address the occurrence of extreme weather events. What is even worse, only 28.3% of the participants would be prepared to address similar risks in the future, a statement implying a relatively low inclination towards the undertaking of adaptation measures.
- Adaptation could be organized with a multitude of measures: Only a small fraction of respondents practice adaptation already. Proposed policies regarded by respondents as most efficient for boosting adaptation behaviour are: provision of technical assistance and support, restructuring of risk insurance systems, mobilization of public investment for construction of appropriate infrastructure, and provision of subsidies or financial aid.
- Previous experience and income losses shapes farmers' preferences for adaptation options: Analysis of the factors affecting risk perceptions shows that income losses and previous experience are the main drivers shaping farmers preferences towards adaptation.
- Adaptation is a shared responsibility for state and individuals: Adaptation is regarded as a state concern encompassing central, regional and local governments. At the same time, it is also the responsibility of individual farmers to change behaviour and invest in adaptation.
- Improving crop insurance would increase considerably farmers' welfare: Crop insurance has a very important role to play in agricultural adaptation policies. On the one hand, since farmers are to-date only partially compensated and climate risk is (at least partly) endogenous, ELGA provides the incentive for undertaking precautionary measures and thus adapting to future extreme weather events autonomously. On the other hand, Greek farmers would be willing to pay on average €383 annually in order to increase the existing level of safety to a level of 100%.

Conclusions from the ECONADAPT stakeholder workshop

- Across all participants in all activities of the ECONADAPT workshop of June 1st, 2015, there is very strong agreement that the CAP has an important role to play in climate adaptation in Europe, that it has a lot of potential to facilitate adaptation and that it should and that it is currently not living up to that potential and needs to be adjusted.
- There is strong agreement that adaptation must take place at all levels from local, through national and regional to all of the EU and that the principle of subsidiarity should apply.
- The main strengths of the current CAP relate to direct and decoupled payments, which provide farmers with safety nets and the financial freedom to experiment with adaptations; as well as an overarching focus on the environment and sustainability.
- The main weaknesses of the CAP relate to maintenance and enhancement of diversity (in terms of crops, biodiversity and farming systems) as well as money going to large farmers rather than those that need it most. A major weakness from the adaptation perspective is lack of long term, integrated perspectives and a lack of integration with other policies.

The CAP was successfully tested across two diverse future linked socio-economic and climate scenarios for Europe drawn from the cumulative work of the IPCC and the EU Climsave and Impressions programs. Adjustments to the CAP robust across the scenarios to support adaptation to future climate change are:

- Creation of new opportunities through cooperative approaches.
    - Support local networks and cooperatives.
- More community based and farmer based – bottom up approaches.
- Pillar 2 approaches by making contracts between farmers and authorities.
- Links between CAP and other environmental and social policies, on a national, regional or local level (short supply chains and co-operations).
- Learning network between farmers, knowledge building. Support context specific knowledge sharing.

General conclusions

Important challenges exist to mainstream adaptation under the current and future CAP. Although the current CAP already has several mechanisms to enhance adaptation and to pay more attention to sustainability and climate resilience, further strengthening of these mechanism can be considered. In particular it deserves careful monitoring of how in practice the CAP is reaching its objectives of enhancing a climate resilient and low carbon agricultural sector in Europe.

The set of options for mainstreaming climate adaption in the CAP ranges from simple provision of information on climate change and adaptation options in the context of the CAP policies, at one extreme, to a very fundamental revision of the systems, at the other extreme, as such that much larger shares of the CAP payments are directly

related to environmental targets and investments in adaptation to ensure that the agricultural sectors in Europe will become more resilient to climate change.

Although the rural development and CAP policies aim at fostering a climate resilient agricultural sector in Europe, under the current system there still is a risk that despite the large amount of CAP subsidies, or even as a results of these CAP subsidies, the agricultural sector is still developing into a direction that makes it even more vulnerable to weather extremes that may occur under climate change. For instance, droughts in the Mediterranean regions may have severe impacts on the agricultural sector, and the investments in the agricultural sector that are currently taking place may lead to more risk in the future. Similarly the extension of the dairy and livestock sector, which is at least to some extent enabled by the agricultural support under the CAP, has the potential to lead to emissions of more greenhouse gases and larger environmental impacts. These sectors can also be more vulnerable for diseases under climate change.

The 2014 CAP reform pays limited attention to practical mechanisms that deal with the behavioural barriers related to adaptation decisions under long time horizons and uncertainty. An important issue is, for example, how discounting should be used in adaptation decision-making as private sectors tend to use a high discount rate. In many cases adaptation to climate change requires a long term perspective that enables important investments in irrigation or improvements in water supply security, or changes in crops and cropping patterns over Europe. If high discount rates are applied these investments opportunities may not be selected and implemented, or they may only become viable if public private partnerships are established.

Other mechanisms can be used to stimulate and facilitate adaptation such as insurance, capacity building, networks and partnerships and this is certainly advocated under the CAP. However, currently it is not clear how the proposed measures are implemented in practice and whether the speed and intensity of the actions is sufficient to provide for the required resilience in the agricultural sector. To what extent the measures are adequate will also depend on the characteristics of future climate change and the stochastic development in the related weather patterns, both for the temporal and spatial dimension. This makes it very difficult to assess whether the measures to stimulate and facilitate adaptation are adequate.

In the context of water quality management the CAP support may currently lead to developments that have a tendency to aggravate the existing problems, e.g. with manure management, nitrogen leakage and eutrophication. This would not be in accordance with the water framework directive, and it produces counter-effective results. For this reason it is important to even further harmonize the impacts of the CAP system with important policy areas such as biodiversity conservation, protection of nature and landscape and water and air quality. Although the current CAP makes efforts through pillar II and cross-compliance to support sustainable management in the agricultural sector, a large part of the budget is simply allocated in terms of income support without providing strong incentives for sustainable development or climate resilience.

One might argue that the private actors in the agricultural sector are responsible for optimal adaptation to climate change. However, many of the farmers have imperfect information on what would be the challenges of climate change and what adaptation options are available and suitable to use. This implies that it certainly is worthwhile to consider whether the financial means that are involved in the current CAP arrangements can be used to provide stronger incentives to farmers to adapt to climate change and to make the agricultural sectors in Europe more climate resilient and less greenhouse gas intensive. With respect to carbon sequestration one might wonder whether the CAP support can be used to a larger extent than currently is the case to foster carbon sequestration in soils and forests.

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Annex 1

Expert Workshop on Adaptation Financing and Implementation

Putting Priorities into Practice in OECD Countries

Summary Note

18-19 June 2014, OECD Paris

Introduction

Recent years have seen significant progress in OECD countries' preparations for the effects of climate change. More than three-quarters of OECD countries have published, or are currently developing, national strategies for climate change adaptation. A common element of these strategies is their emphasis on mainstreaming adaptation into government policies, with a focus upon capacity building. In moving from planning to implementation, it will be essential to ensure that the right evidence, tools and approaches are in place to make the case for action and identify the most effective adaptation pathways. It will also be important to ensure that adequate finance is available to support implementation.

This Expert Workshop, co-sponsored by the ECONADAPT research project, brought together over 50 participants over two days, including leading adaptation experts from academic and private sectors, international organizations and agencies (such as UNDP, IFC, UNFCCC) and OECD country delegates.

The first day of the workshop focused on national adaptation policy-making, with a focus on prioritisation and mainstreaming processes. There was also a session on public-private collaboration in building climate resilience. The second day explored the challenge of public sector finance for adaptation, which was followed by an interactive session on evidence gaps and the research needs. This note provides a summary of the discussions and dialogues in each session. The Expert Workshop was conducted under Chatham House rules, therefore comments have not been attributed to specific participants.

Day 1: Putting priorities in practice in OECD countries

The initial results from a survey of OECD countries were presented to help frame the subsequent discussion. All of the survey respondents were pursuing a mainstreamed approach to adaptation, with the majority having developed tools to support this process. The results from the country surveys showed that expert judgement and involvement of stakeholders are the most widely used techniques for prioritisation. Currently, there is limited uptake of cost-benefit and cost-effectiveness analysis to inform the choice of adaptation measures. Most countries have also developed tools to support mainstreaming of adaptation. There are important differences between integrating adaptation into policy-making and project

appraisal. The survey also showed that the majority of countries were taking a mainstreamed approach to financing adaptation.

The following presentation identified some of the main recent trends in adaptation planning and implementation. The first of these was that national assessments were increasingly focussing upon policy needs, rather than starting with impacts and then going on to consider adaptation needs at the end. This has the potential to support a focus upon what needs to be done now rather than in 2040s. However, in doing so, the range of issues to consider becomes significantly wider, including: adaptive capacity, policy appraisal and investment, timing and urgency of decisions.

Subsequent discussion focussed upon the challenges with economic appraisal of adaptation costs and benefits. National strategies have focussed heavily upon capacity building, yet this is an area where little is known about the costs and benefits of potential interventions. More generally, there is a tendency to only include those things for which data are available. This has the potential to skew decisions towards the adaptation measures where costs and benefits are easiest to identify, rather than those that are necessarily most efficient or effective. A particular challenge in the context of adaptation is to recognise the economic benefits arising from increasing flexibility or robustness.

Session 1. Prioritising adaptation at the national level

Identifying adaptation needs and prioritising adaptation options are central elements of adaptation planning. This session drew upon countries' experiences of using scientific evidence, economic analysis and stakeholder consultation to inform the development and implementation of adaptation strategies.

The presentation from the UK provided an overview of their adaptation strategy and the evidence base used to inform it. In particular, it was noted that in prioritising activities, both the public and private sector contributed to the formulation of the national adaptation plan, informed by the Climate Change Risk Assessment. The prioritisation process was structured around the use of policy questions in 12 fields, including agriculture, health and the natural environment. The questions used in the prioritisation process were developed on the basis of: assessment of the scale of the challenge, assessment of adaptive capacity, and the potential barriers to autonomous adaptation.

The presentation from Germany outlined the evidence used to inform the development of their national strategy and plan. The cross-sectoral prioritisation of possible adaptation measures was outlined as a central task within Germany's adaptation strategy, but the subsequent Action Plan noted that it was not currently possible to comply fully with the stipulation formulated in the strategic document. The lesson from this was that the practical realities were far more complex than the theory. In particular, the existence of multiple entry-points for policy design, long-time horizons and existing policy frameworks all need to be taken into account. This is a more complex process than prioritising adaptation needs on the basis of a single set of well-established criteria.

The presentation from Greece provided information on their economic assessment of adaptation. This technical report on climate change outlined significant cost-effective potential

for both mitigation and adaptation. Although it can be more straightforward to model the effect of standalone measures, the policy focus lay primarily in mainstreaming climate policies and showcasing ancillary benefits. This presentation also noted the importance of aligning the type of results presented (e.g. cost-benefit analysis, cost-effectiveness analysis) with the decision-making tools that are used by national governments. The presentation also noted that the results of this type of analysis could also be useful outside of the immediate target audience.

In the subsequent discussion, some participants noted that their countries have chosen not to undertake explicit prioritisation of adaptation measures. This was because they viewed adaptation as a learning process and considered that the currently available information is insufficient in order to allow for the complete prioritisation. Other countries noted the importance of considering different scales for prioritisation: for example, prioritisation may be undertaken at the local or regional level, rather than the national level. A common theme arising from the discussion was that the evidence base for adaptation was increasing, but that the evidence used to inform planning remained insufficiently focussed upon the needs for implementation.

Session 2. Sectoral approaches for assessing and implementing adaptation

This session compared the tools and methods being used to mainstream adaptation in different sectors, such as risk management, energy and water. The challenges to provision of evidence and the question of how to address adaptation responses that cut across existing sectoral boundaries.

OECD countries have made significant progress in achieving resilience to natural hazards. Positive drivers have included increased understanding of risks, and mainstreaming of disaster risk management across public policy areas. However, there are remaining issues with the funding and maintenance of protective infrastructure, lagging regulatory reforms and enforcement of the regulations. There is also scope to strengthen business continuity planning by companies and improve households' ability to manage their exposure to hazards. It was also noted that improved international collaboration was needed to address trans-boundary risks.

Participants also highlighted the issues of finding the right balance between resistance and resilience, in particular when thinking about the appropriate regulations today and in the future. Examples of sectoral collaboration to build resilience were discussed, particularly in the context of the energy sector.

Discussions also focused on the water sector, which is particularly important for the adaptation – countries' strategies frequently mention water and potential challenges include scarcity (droughts), excess (heavy downpours; floods), water quality, water supply and sanitation, and freshwater ecosystems. Water is also a significant cross-cutting theme in sectors such as energy, agriculture and health. The OECD is promoting a risk-based approach to water management to address climate risks and other drivers of change. This is based on three levels: the first one is related to knowing the risk such as building the evidence base and understanding perception (i.e. water vulnerability assessments, flood risk maps, adaptation guidance etc.) - by far most adaptation activities are related to this activity. The second category is related to "setting the acceptable level of risk" by setting the adaptation

targets such as revising flood production standards and abstraction limits – as we face more extreme events, we have to keep adjusting our policy targets. The third category relates to "managing the risks" – these are related to putting in place the instruments such as water trading and pricing, environmental taxes or investments in structural flood protection, urbane drainage or green infrastructure.

Participants also discussed the particular case of the Netherlands Delta Programme, which has undertaken a substantial research programme to identify the potential impacts of the climate change, such as the sea level rise, which may affect the safety of people and assets (currently, 2/3 of Netherlands could be at risk of flooding either from the sea-side and the river-side). This has included research into tipping points that relate to present water management and estimates according to different scenarios for how long the current practices can be continued. These different scenarios are used to provide sufficient data and knowledge fort the decision-makers and it is included in different adaptation strategies, which are also subject to CBA and MCA.

The session also covered the issue of determining the "acceptable level of risk" and the methodologies currently undertaken to conduct this evaluation. For instance, in the water sector the setting of acceptable levels of risk has often occurred implicitly. The challenge of how to balance the risk of taking action with the benefits of doing so was also brought up in the discussion. In addition, the effectiveness of the current flood risk measures was discussed, as was the need to better understand the fiscal impacts of extreme events. It was agreed that systematic data collection efforts and understanding what are countries doing is needed.

Session 3. Tools for mainstreaming adaption into policy-making

There has been considerable progress in developing tools for appraising adaptation projects, but successful implementation of a mainstreamed approach brings with it an additional set of challenges. This session examined how countries have been integrating climate change into policy and programme design. Examples discussed included mainstreaming of the adaptation in the EU funds, the case of Finland's adaptation policy, and the challenges of the adaptation implementation by the private sector.

Participants started the discussions by looking at the case of the adaptation mainstreaming at the European Commission. With the Council Decision as of February 2013, it was decided that at least 20% of expenditure in the EU budget 2014-2020 should be related to climate. The proportion is higher for research, where 35% of funds should be climate-related. The tracking of finance will build upon the Rio Marker methodologies. The mainstreaming process can be seen as a fuel which allows to moving from EU projects to concrete action. In addition, internal factsheets serve to demonstrate that the climate change can be mainstreamed into various funds. This session also explored the issue of dividing the funds on climate change between adaptation and mitigation –whether it should be 50/50 or whether it should depend on specific needs of each country.

The discussion also covered Finland's experience with mainstreaming adaptation. Having been the first OECD country to publish an adaptation strategy in 2005, Finland is now entering the second round of the cycle with the draft resolution of the new, more detailed, adaptation

strategy. Its legal status will also be reinforced by the Climate Act, which is currently under preparation. This is intended to encourage sectoral involvement in adaptation across all sectors. Legal instruments, such as reporting requirements, are expected to improve the general implementation of the adaptation policies. At the same time, these are only applicable to the public sector and do not concern autonomous adaptation.

The discussion also drew attention to the challenges regarding the implementation of the adaptation at the local level in many countries. The lack of consistent adaptation efforts at the local level was noted, as was the importance of varying priorities and capacity constraints at different levels of government. For example, some decision-makers at the local level encountered difficulties with economic assessment methods, which were felt to be overly burdensome to apply and not directly applicable to some of the issues they are dealing with. Some practical tools have been already developed – but it was recognised that much more needs to be done. For instance, in Finland the new adaptation strategy aims to support local action and will require all the municipalities to carry out climate risk assessments. Furthermore, it was noted that when adaptation is mainstreamed into sectoral policies, the results can be difficult to monitor.

Session 4. Public-private partnership to build disaster and climate resilience

Past decisions have led people and assets being located in areas of increasingly high risk, such as exposed coastal areas. This session explored the ways of how public-private collaboration can facilitate action to address these risks in an equitable and efficient way.

Participants recognised that looking into the link between disaster risk management and climate risk adaptation is particularly important for several reasons. First of all, disaster risk management represents a long standing area of expertise and useful entry point for mainstreaming. Second, disasters can galvanise political will and provide an impetus for adaptation planning. Lastly, extreme events illustrate the scale of the challenge: even with visible risks that are occurring now such as flooding, there is still more to be done in terms of implementation. An important element of this lies in ensuring that the right standards are set, and that those standards are adhered to.

Economic instruments can help to manage risk either directly through risk financing or indirectly through providing incentives by means of subsidies, taxes and fees, licencing/permits and other market based instruments. Economic instruments are flexible tools that can provide incentives for anticipating and reducing impacts and can have lower costs to the public budget. However, there remain problems of effective implementation to be addressed. There is also some evidence that while risk financing mechanisms at local, national, regional and global scales contribute to increasing resilience to climate extremes and variability, they also involve major design challenges in order to avoid providing disincentives, causing market failure and worsening equity situation. Different sector-specific approaches to incentivize adaptation have also been identified.

Participants also discussed the role of the insurance sector in adaptation. In Europe, only a third of losses are currently insured. Insurance systems vary across OECD countries, ranging from the full compensation system in the Netherlands to the solidarity system in France and

commercial insurance in the UK. Risk financing instruments can be assessed based on multiple criteria: applicability and effectiveness for risk sharing, effectiveness for incentivizing physical adaptation, efficiency and distributional aspects. It was recognized that the EU Solidarity fund is an important mechanism. The potential use of index-based insurance to reduce the moral hazard was also discussed.

The private sector's activities are essential for adaptation, but the discussion highlighted some challenges in this area. These include the lack of awareness or direct evidence about the effects of climate change on their profitability. Resource constraints and planning horizons can also militate against preparing for the longer-term effects of climate change. Impacts that are viewed as long-term and uncertain are not readily compatible with businesses that are focused on their quarterly financial results. The incentive to invest in adaptation is also not high if they view their supply chains and operations to be flexible. Participants discussed whether increased governmental incentives would facilitate private sector engagement in the adaptation. It was also noted that there have been some recent legal developments, with some lawyers arguing that sufficient information is now available on climate change for it to be a foreseeable risk.

DAY 2: Financing climate resilience

Session 5. Facilitating public sector finance for adaptation

OECD countries have predominantly adopted a mainstreamed approach to financing adaptation, with funding expected to be delivered through existing channels. This session examined countries' experiences in financing adaptation to date, with a focus upon the evidence needed to make these approaches operate effectively.
This session highlighted the importance of tracking adaptation finance and outlined some practical challenges. Firstly, it is inherently difficult to delineate adaptation and therefore care is needed to avoid double-counting. Further, different sectors are taking adaption into account in different ways. It was noted that while some sectors make use of 'softer' measures, e.g. guidelines and information, not requiring large costs thus not showing very large expenditures in national accounting, other sectors might make use of larger scale "hard'' investments. It is, therefore, important to avoid conflating cost with effectiveness. There can be a trade-off between maintaining the same methodology over time and allowing the methodology to evolve.

France provided some insights on its national approach to adaptation financing. Its response to appropriate balance between mainstreamed and earmarked funding is that earmarking is limited to climate projections, transversal actions to foster adaptation practices including outreach, education and research projects.

Participants also agreed on the importance of monitoring and evaluation to ensure clarity about adaptation spending is also an issue in developing countries, especially with regards to ensuring that the most vulnerable communities are targeted. Mainstreaming adaptation efforts may be preferred for overall development, but at the same time some countries prefer to have earmarked funds and stand-alone projects, since this can provide greater transparency. For international funding to be mobilized for adaptation there can be the demand for additionality

of the measures to make sure those resources are well spent. However, developing countries face additional challenges of – often - lacking technical capacity and personnel as well as strong governance and clear legislation. To involve the private sector it can furthermore be productive to use pilot projects to demonstrate successes.

Panel discussion: Enabling the transition to climate resilience

This final session concluded the workshop by examining how evidence, institutions and finance can be harnessed to support adaptation. Based on the presentations and discussions, it was clear that countries face common challenges around dealing with engagement of the private sector, in co-ordinating adaptation at different levels of government, in prioritising the most vulnerable and in mobilising political will in support of adaptation.

The first discussions drew upon the US federal government experience with the work on climate change adaptation. It was noted that the US is looking at the adaptation not just as a federal issue, but also as a national issue. As a result, they are engaging with a wide range of stakeholders: the federal agencies, tribal governments, state and local governments, as well as the private sector and the civil society. The role of the federal government, in addition to managing the territories that are under the federal responsibility, is to work effectively on the adaptation issues with local governments and the private sector. It was noted that while a significant amount of funding goes to the work on climate change at the federal level for information provision and coordination purposes, there are still unmet needs in terms of communicating and connecting all the available climate change data and research, as well as challenges in reaching relevant decision-makers, especially in the most vulnerable communities.

The engagement of the federal government with the private sector on adaptation is currently limited. However, business imperatives were driving companies to exploit potential market opportunities for resilience. For instance, there are signs of the new economy of resilience such as resilient technologies, material or energy (e.g. micro grids). To better engage the private sector, the US federal government has come up with the New Climate Data initiative – which provides the data that the private sector can use putting it in acceptable format (i.e. weather service forecast at the retail level), targeting particularly smaller communities in the US.

It was also noted that the climate change is still often considered as an environment issue, and the challenge is to make the dialogue better reflect the health, security, social, economic and justice aspects of the climate change.

Participants also discussed how prioritization and implementation of adaptation measures is taking place at the local level. For example, some European cities are looking for the adaptation support are working directly from the European Environment Agency, rather than working through their national administration. In particular, there are demands for the knowledge base to support putting the topic of adaptation on the local policy agenda. It was also noted that the adaptation priorities at the local level are often much more integrated and cross-cutting than on the national level due to the smaller partners and having key people in

charge of different topics at the same time, which facilitates looking across the sectors (e.g. recreation or tourism).

Different policy challenges to create demand for climate resilience were also discussed. It was noted that, the federal government is looking at the resilience actions being undertaken by certain cities to see how it can learn from the experience and update the federal policies where needed. At the same time, as the example of the US highlighted, the degree of local engagement on adaptation is variable, due to varying contexts, capacity and degree of political leadership.

Lastly, the discussion emphasized that in order to encourage adaptation measures, increasing awareness of socioeconomic issues such as economic or health effects is often helpful. It was noted that engaging the most vulnerable communities can be a challenge. While there are a lot of programmes that target the vulnerable population, their practical implementation is still difficult. This is the case especially when the process to obtain funding for adaptation is a competitive one favouring the most economically beneficial projects.

Annex 2

ECONADAPT
Economics of Adaptation

ECONADAPT Workshop Report: "The Common Agricultural Policy and adaptation to climate change in Europe"

Table of Contents

- **Introduction**

The objectives of ECONADAPT are to build the knowledge base on the economics of adaptation, and to convert this new knowledge into practical material to help support adaptation planning and decision makers. These outcomes are achieved by working with policy makers and stakeholders to learn and co-develop outputs, and ensure that the research is grounded in practice.

ECONADAPT WP6 focuses on The Common Agricultural Policy and Climate Change in Europe. In keeping with the participatory, grounded approach of ECONADAPT, WP6 involves stakeholder engagement activities including bilateral meetings and a large workshop. This report describes the results of the workshop titled "The Common Agricultural Policy and adaptation to climate change in Europe", held in Brussels, on June 1, 2015.

The workshop brought together a range of key stakeholders and policy makers to discuss detailed scenarios exploring the effects of climate change on European agriculture, to co-examine the current performance of the Common Agricultural Policy (CAP), and to explore the ways in which the CAP can be improved to better facilitate adaptation to climate change. Participants critically reflected on the CAP and the impacts of climate change in Europe from multiple perspectives.

The aims of the workshop are to develop crucial new insights of how to address the challenges of climate adaptation for primary production and processing; to build expanded networks of stakeholders, policy makers and researchers; and form tangible implementable actions. This report describes the result of that process which was designed to have a direct impact on future CAP revision with regard to climate adaptation.

- **Methodology**

This section describes the participatory methodology designed and implemented to engage stakeholders in developing crucial new insights of how to address the challenges of climate adaptation for primary production and processing in Europe, through the CAP.

Stakeholder Identification

Representation was sought from the following groups of stakeholders in European Agriculture: policy makers, NGOs, the private sector, academic subject matter experts. This representation was achieved through a snowball process building on the extensive contact network already extant within ECONADAPT. The list of participants and their affiliations is given below:

No.	Name	Affiliation
1	Hannah Steenbergen	Sustainable Food Trust
2	Maddalena Dali	European Commission (ENV)
3	Tarek Soliman	Groupe de Brugges
4	Natalia Brzezina	European Commission (AGRIC), Groupe de Brugges, Transmango
5	Petr Havlik	IIASA

6	Piet van der Meer	Ghent University and Free University of Brussels
7	Bert-Jan Ruissen	Ministry of Economics Netherlands
8	Justus Wesseler	Wageningen
9	Jana Polakova	Czech University of Life Sciences
10	Edit Konya	European Commission (AGRI)
11	Koen Dillen	European Commission (AGRI)
12	Marina Guanjardo	European Commission (AGRI)
13	Faustine Defosez	EEB
14	Nathalie le Cocq	Fediol
15	Kasper Kok	Wageningen
16	Ekko van Ierland	Wageningen
17	Alistair hunt	Bath
18	Anne Biewald	PIK
19	Ben van Doorslaer	European Commission (AGRI)
20	Leonarda Lobefaro	European Commission (AGRI)

Process Design

The workshop began with an overview of ECONADAPT and summary of key findings to date. Professor Alistair Hunt presented the overview of ECONADAPT, Professor Ekko van Ierland spoke specifically about the work conducted on the CAP and climate change, Professor Petr Havlik also presented on the CAP and climate change from a modeling perspective, particularly the Globiom model.

A facilitated process was designed to allow participants the opportunity to systematically reflect on the capacity of the CAP to support and enable climate adaptation now and in the future. In order to achieve this a two stage participatory SWOT analysis was conducted in break out groups. The first stage focused on current performance and the second on future performance.

Effective planning for the future requires planners and decision makers are mindful of the context for which plans are being made. Ultimately the success or failure of any policy or other intervention depends on a range of uncertain factors complex that can be systematically considered through scenario testing. Accordingly, a set of diverse exploratory scenarios for linked socio-economic and climate futures for Europe were used to test the future performance of the CAP and develop suggested options to improve its performance in the context of each scenario. Comparison of options across scenarios allows for the development of more robust policies to future uncertainty. If a plan or policy is considered to be feasible under a wide range of challenging futures, it could be considered more robust. Each scenario provides a unique set of challenges and opportunities for participants to work with in order to achieve desirable outcomes.

The scenarios used in the workshop have been developed through the EU FP7 Programs CLIMSAVE and IMPRESSIONS. Two combinations of the European Shared Socio-economic Pathways (SSPs) and Representative Concentration Pathways (RCPs) were selected to maximize scenario diversity and plausibility. RCP 4.5 was combined with SSP1, and RCP 8.5

was combined with SSP3. The summaries of these scenarios are provided in an Appendix. Professor Kasper Kok presented these scenarios and provided supporting material for scenario immersion in the introductory sessions of the workshop.

Participants are facilitated to immerse themselves in the scenario using the materials provided. During this process participants describe in detail what Europe would look like and what would be happening in that situation. Following scenario immersion, participants then test the performance of the CAP in terms of climate adaptation in that situation.

Following testing within each scenario, comparison of SWOT analyses generated a list of robust options for improving the capacity of the CAP to enable adaptation to future climate change.

Workshop Agenda

9:30am Registration and coffee.
10:00am Introduction to the workshop, purpose and format, presented by Prof. Ekko van Ierland.
10:10am Introduction to ECONADAPT presented by Prof. Alistair Hunt.
10:20am Climate change scenarios and impacts for Europe, presented by Prof. Kasper Kok.
10:50am Climate change and the common agricultural policy: a perspective on the use of the Globiom model, presented by Petr Havlík, International Institute for Applied Systems Analysis (IIASA).
11:15am Tea and Coffee.
11:30am Break out groups: Narrative analyses of the current functioning of the Common Agricultural Policy (CAP).
12:30pm Report back from each group on current strengths and weaknesses of the CAP.
1:00pm LUNCH.
2:00pm Break out groups: Scenario testing of CAP, development of recommendations for CAP revision across scenarios.
3:30pm Tea and Coffee.
4:00pm Report back from each group on the changes to the CAP required in each scenario.
4:30pm Individual reflection and questionnaire on revision of the CAP.
5:00pm Concluding remarks.

Questionnaire

An anonymous written questionnaire was developed and distributed to participants to allow them to express their views on some important topics related to the Common Agricultural Policy and adaptation to climate change in Europe that they may have been unable to express in the group setting. The questionnaire contains statements that can be scored on a Likert scale from 1-5 and it provides space for providing additional comments. This questionnaire is provided below.

General

The CAP should play an important role in making the agricultural sector in Europe more climate resilient

agree	1	2	3	4	5	disagree

Comment:

The CAP is meant for income support and by providing income support it automatically enables adaptation to climate change

agree	1	2	3	4	5	disagree

Comment:

Adaptation to climate change has nothing to do with the CAP because farmers need to adjust to climate change by themselves

agree	1	2	3	4	5	disagree

Comment:

Adaptation to the climate has always been a primary focus of the agricultural sector and does not need additional attention through CAP

agree	1	2	3	4	5	disagree

Comment:

The CAP provides an excellent opportunity to mainstream climate adaptation policies for the agricultural sector

agree	1	2	3	4	5	disagree

The most important adaptations in the agricultural sector in Europe should focus on (in order of priority):

1.
2.
3.
4.
5.

Comment:

Current CAP:

The setup of the current CAP is adequate to allow for adaptation to climate change

agree	1	2	3	4	5	disagree

Comment:

The current CAP leads in practice to adequate adaptation to climate change

agree	1	2	3	4	5	disagree

Comment:

The current CAP offers opportunities to stimulate public investment in adaptation options for climate change, e.g. construction of irrigation water reservoirs or similar facilities

agree	1	2	3	4	5	disagree

The strengths of the current CAP in relation to adaptation to climate change are:
1.
2.
3.
4.
5.
Comment:

The weaknesses of the current CAP in relation to adaptation to climate change are:

1.
2.
3.
4.
5.
Comment:

Potential future revision of CAP:

It is recommendable to use the CAP funds to provide more incentives for adaptation to climate change by the private actors in agriculture in Europe

agree	1	2	3	4	5	disagree

Comment:

It is recommendable to use the CAP funds to provide more incentives for adaptation to climate change by the public sector (e.g. local or regional authorities or water boards) for agriculture in Europe

agree	1	2	3	4	5	disagree

Comment:

The CAP funds are not meant for stimulating adaptation to climate change and future revision should not focus on adaptation to climate change

agree	1	2	3	4	5	disagree

Comment:

The best mechanisms for providing new/additional incentives for adaptation under a newly revised CAP are:
1.

2.
3.
4.
5.
Comment:

Other topics:

Insurance systems in the agricultural sector are important for adaptation to climate change

agree	1	2	3	4	5	disagree

Comment:

Autonomous adaptation to climate change in agriculture is most important

agree	1	2	3	4	5	disagree

Comment:

National authorities are responsible for adaptation to climate change in the agricultural sector

agree	1	2	3	4	5	disagree

Comment:

The European Union is responsible for adaptation policies in the agricultural sector in Europe

agree	1	2	3	4	5	disagree

Comment:

The regional authorities are responsible for adaptation policies in the agricultural sector

agree	1	2	3	4	5	disagree

Comment:

The subsidiarity principle should be applied to adaptation policies for the agricultural sector in Europe

agree	1	2	3	4	5	disagree

Comment:

General comments or further explanations:

- **Results**

This section of the report provides the results of the stakeholder engagement through focus groups.

Current Performance of the CAP

The session began with 5 minutes of individual reflection and recording on post-it notes of existing strengths, weaknesses, opportunities and threats of the current CAP.

Group 1

Current strengths:

- Rural development program helps members adjust more to their own situation.
- Development program provides suggested adaptation measures and investment support.
- Direct payment scheme creates stability for farmers and markets, related to pillar one, decreases the risk for farmers. Maintaining economic and income stability for farmers is also important so that farmers actually can survive while adapting.
- Livelihood support with a lot of flexibility and farmers have room to decide for themselves how they want to adapt, safety net, maybe supports adaption from an ecological perspective.
- Support provided for rainwater harvesting.
- Support provided for energy.
- Support is provided for risk management.
- Support is provided for development of business plans.
- Decoupled payments leave room for flexibility and allows for adaptation of farming techniques.
- Cross compliance rules leave room for country- or region-specific rules, regulation and adaptation.

Current Weaknesses:

- Uptake of adaptation measures is slow and not well enforced (much talk, less action).
- The CAP helps the people that need it the least. The biggest farmers get the most money so from adaptation viewpoint it might be inefficient, because those farmers have the money to change on their own accord, whereas smaller farmers might need this support more.
- Subsidies provide flexibility for famers to try out different measures without high risk, but if wrong measures are supported then even if they are ineffective, farmers will still take them up because they earn money that way.
- Are subsidies actually efficient? Livelihood support lets non-economically competitive farmers stay in business.
- Farmers have too little income support, so specialized agricultural systems might be lost if they face degradation.

- Cross-compliance is only a potential support for climate change adaptation.
- Subsidiarity can lead to very scattered policy, also can leave decision making to national or local levels where expert knowledge or experience might be missing and poor decisions might be made.
- Rural development plan: not enough specific climate change adaptation regulations, move money between pillar 1 and pillar 2, cannibalism between measures (measures can get into each other's way, have different financing levels that might not be linked to the actual efficiency and adaptive effect; going for easy options that are not as good for the climate than others).
- Farm advisory system for farmers is too general, no explanation about why is it important to adapt, not enough content knowledge on climate change adaptation/ecosystem services covered; very government-based, not enough links to farmer networks; might be coupled with the European Innovation Partnership (*opportunity*), transaction costs.
- Lack of long-term perspectives and especially not enough long-term measures in CAP.
- No linkage with other policies (like climate change adaptation).
- Top-down policy constrains autonomous adaptation on the national, local and individual level, subsidiarity hasn't been explored enough or isn't used in the most efficient way, things get overlooked.
- Greening: there is no flexibility for farmers to choose the best practice for their own land, on the other hand initially they were very top-down but now there are many exceptions and a lot of flexibility on national level, laws get very diversified from within different countries.
- Inadequate support for farmers who are under pressure from structural changes (landscape destruction, political unrest etc.) but who are important for ecosystem services managers.
- Complexity: Agricultural support could help but often farmers don't understand the aims and regulations.
- Greening (support) is too weakly defined, not going to have a high effect.
- CAP mainly has top-down approaches.
- Cost of decoupled payment: is this the most cost-efficient way to achieve our aims?

Current Opportunities:

- Cross-compliance rules could be more explicitly linked to climate issues and adaptation.
- Recoupling of crops that are more resilient to enforce adaptation to better suited crops.
- Greening can also have the potential to support adaptation positively.
- Farm advisory system could help farmers make decisions that are in compliance with climate adaptations, and to get new ideas.
- Potential to help the European innovation partnership in pillar 2.
- Moving money from pillar 1 to pillar 2 to give greater flexibility (modulation and flexibility).

- Some measures that are being enforced have a long-term effect, even if they are not enforced with a long-term perspective.

Group 2

Current strengths:

- Income stabilization to isolate from extreme shocks on markets:
  - Safety nets.
  - Insurance.
- Market orientation, farmers become responsive, helps to adapt.
- Decoupled direct payments: gives farmers possibility to switch crops, minimizes risks gives them certain amount of income.
- Support for modernization helps farmers to adapt and invest in other technologies.
- Support for some diversity of agricultural production approaches (farm systems)
  - Modernization.
  - Organic.
- Standardized best practice
- Funds available (flexible)
- System to account for climatic risks.
- Good practices, more general good practices.
- Entrepreneurship: leaving more decisions to farmers.
- Decentralized solutions permitted.
- Through rural development plan some adaptation can be integrated.
- Use of public consultation in some cases, such as organic farm policy.
- Climate change mitigation and adaptation are cross-cutting aims.
- Rural development and mainstreaming adaptation.
- CAP is providing framework for production and supply on EU markets.

Current Weaknesses

- Reduction of agricultural genetic diversity: number and variety of crops and livestock.
- Lack long-term policy direction
- Linking research and development with implementation:
  - Lack of appropriate support mechanisms.
  - Lack of link with long-term policy.
- Coordination of adaptation across:
  - Member states.
  - Supply chain.
- Support for environmental diversification in context of climatic change.
- Remunerating public and ecosystem goods and services.
- CAP does not support all types of farming, and there are questions over how it treats traditional farming that does not align with modernization. CAP explicitly supports modernization.
- CAP has nothing specifically to promote uptake of technological advances: member states can do it, but is not always done:
  - Making link between development, about investment, access to technologies, knowledge of technologies, so not just information, also training/finance, advisory services, etc.

    - Framework available but how can we make best use of it? Participatory approach should be used where farmers and whole food chain can have say in what are problems/solutions: linking solutions to technical challenges.
- Not good in implementing or fostering new ideas e.g. new production systems.
- Recognizing that there is some research, there is still little focus on crop and livestock improvement (research).
- Consumer targeting, informing consumers, informing people on decisions that they make: food policy rather than farm policy needed?
- Better integration of environmental concerns and biodiversity could be made:
    - CAP focus on certain crops in certain areas, leads to biodiversity loss in longer term (in particular agro-biodiversity).
- There has been a shift in extension and research. Now there is a new structure and agency since last year and currently there is process stuff but no real content.
- Uncertainty on direct payments, do not know how long this will continue (after 2020).
- Large part of funds cannot be allocated to adaptation.
- Risk of lack of coordination is counterpart of decentralized solutions.
- CAP can be very complex, how does that combine with adaptation being a flexible concept – complexity versus flexibility.

Current Opportunities:

- Responsiveness to markets
    - Promotes entrepreneurship
- Information provision/education/awareness raising
    - Producers (entire supply chain).
    - Consumers.
- Research is happening everywhere. CAP could do a better job of promoting research and developing it.
- Promote more diversity:
    - Share knowledge and match solutions to contexts.
- Promoting optimal adaptation through better
    - Coordination.
    - Knowledge sharing.
    - Funding.

Current Threats

- Complexity of the CAP making it hard to understand and less flexbile.
- Collapse of full system
    - Standards
    - Markets
    - Funds

Summary

Combining the results from both groups we obtain the following lists of current strengths, weaknesses, opportunities and threats.

Current Strengths

- Income stabilization to isolate from extreme shocks on markets:
    - Safety nets.
    - Insurance.
- Market orientation, farmers become responsive, helps to adapt.
    - Entrepreneurship: leaving more decisions to farmers.
- Decoupled payments leave room for flexibility and allows for adaptation of farming techniques.
- Support for modernization helps farmers to adapt and invest in other technologies.
- Support for some limited diversity of agricultural production approaches (farm systems)
    - Modernization.
    - Organic.
- Standardized best practice
- Funds available (flexible)
- System to account for climatic risks.
- Good practices, more general good practices.
- Decentralized solutions permitted. Cross compliance rules leave room for country- or region-specific rules, regulation and adaptation.
- Through rural development plan some adaptation can be integrated.
    - Development program provides suggested adaptation measures and investment support.
- Use of public consultation in some cases, such as organic farm policy.
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    - Framework available but how can we make best use of it? Participatory approach should be used where farmers and whole food chain can have say in what are problems/solutions: linking solutions to technical challenges.
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- CAP mainly has top-down approaches.
- Reduction of agricultural genetic diversity: number and variety of crops and livestock.
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    - Lack of link with long-term policy.
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    - Member states.
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    - CAP focus on certain crops in certain areas, leads to biodiversity loss in longer term (in particular agro-biodiversity).
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    - Funding.

Current Threats

- Complexity of the CAP making it hard to understand and less flexible.
- Collapse of full system:
    - Standards
    - Markets
    - Funds

Future Performance of the CAP

Group 1

Scenario Immersion Description: ICARUS

Religious trouble and divides about religion and culture exist. There is a rise in xenophobia and extreme movements. Increasing nationalism and right-wing movements together with skepticism about the EU lead to the break-up of the EU. Minorities are pushed out of society. Climate skepticism and denial of scientific research prevents the timely implementation of action. Demand for resources continues to increase which puts too much pressure on the environment and leads to an environmental and economic tipping point. The economy is too fragile and one big blow leads to the disintegration of all international structures.

As a result of all this, over time there is outmigration from rural to urban areas, at first because of lack of infrastructure and the need for people to feed themselves increases while employment opportunities in cities decreases. With remigration into rural areas there is a reversal of re-wilding. Energy supplies depend on finite sources like fossil fuels and wood. Prices increase as these sources run out, but eventually unconventional, before that time too expensive sources will enter the markets (investments in green energy sources). Wood use for energy is a competition for agriculture, reforestation or short rotation periods in intensive farming forests (using land for energy and not for food).

Food prices increase and become a far more important policy and social issue. The main part of household income is spent on food. Volatility of prices becomes greater and has a higher impact on consumption patterns. Meat consumption is reduced by the increase in meat prices. This is good for both climate and public health.

As the EU begins to break up, different countries perform very differently, some are able to profit from the circumstances while others suffer. Overall, everyone is doing worse. Some countries slip back into low-income, low-development countries.

Fragmentation of food industry and international food trade, negatively impacts the food security of single countries. Increasing of hunger and malnutrition ensue. On the other hand the breaking up of big industry and going back to fragmented, local farming leads to more seasonal, resilient farming and eating habits, more organic farming because there are no pesticides available.

In terms of the effects of climate change in Europe, the north benefits and the south loses in terms of productivity. Central Europe faces more unstable weather and floods; the south becomes dry and hard to farm, while the north gets warmer and more winter rains, better farming conditions.

In terms of agricultural technology and approaches, there is a revival of co-ops managed through electronic networks, shortened food chains, communalization, people grow food in their gardens, land-use increases because of a less intensive agriculture.

Extensive farming helps adapted species that live with humans and in agricultural settings, however, there is a negative impact on biodiversity otherwise. Wilder areas are reduced or wiped out.

Existing farmers have to stick with their jobs, even though production decreases and competition increases. Farms get more employees because more people will move to the countryside. Food prices rise so farmers benefit from this but prices are also unstable, thus livelihoods are more risky. Farmers in the north do far better than farmers in the south. Scandinavian countries benefit economically and temperature-wise. There is more freedom for farmers, because regulations fall away. Some bad practices might emerge because of this and no enforcement.

Military and intelligence sectors will increase, which will make trade harder. Budget for everything else will be lower because of more investment in security. Food security will be a more important issue for national policy and safety. Trade might get far more competitive, national interests will be far more linked to agricultural trade.

Breaking up of EU and the effects described above eventually leads to some bottom-up movements to resurrect the EU or a similar network (maybe after a war).

What will the impact on CAP be?
CAP has features of a safety net and educational system today; money might not be available anymore for those things once the EU breaks up. What will happen to the funds and to the policy and guidelines?
Separate CAPs?

Future Threats

- CAP will continue in some form, but it will be constantly threatened to fall apart.
- Budget will be smaller.
- More subsidiarity.
- Nationalism.
- EU has always been fragile, and subsidiarity is a fragile point.
- Budget for the CAP is volatile.
- No linkage with any other policy.
- Extreme weather events and tipping points for environment and economy.
- Mitigation-related problems.
- Intensive agriculture is not sustainable, not reliable against climate change.
- Flood resilience is low, demands high humanitarian help and coordination.
- New borders and harder trade, trade regulation is down-scaled and mostly bi-national, more freedom on the national level.
- Dangerous lock-ins of maladaptation from earlier decades.

Opportunities

- Once the CAP breaks down, people have the chance to start again and learn from past mistakes.
- Re-nationalization might lead to experience and knowledge being used on a national level; expertise will stay for a while as long as older, educated people will be alive.
- More pillar 2 approach for farmers.
- On a local level more cooperation might emerge.
- High price level for food might help farmers.
- Decentralization would be followed by regionalization, this could lead to more cost-effective policies.
- More peer-to-peer education and experience-sharing.

Weaknesses:

- Linkages to water policy have not been addressed.
- No income for farmers.
- Budget is a financial incentive to make farmers do something that they might otherwise not do (as fast).
- Livelihood support is reduced or disappears, and the big farmers might still get money in a corrupt world with a weak government structure.
- Very little or no cross-compliance.
- With less education and research in the longer run expertise will decrease.
- In a corrupt system most of the budget will disappear and the rest will be channeled into the easiest options, “transaction costs” (corruption) will increase highly.
- Lack of long-term perspectives or linkage with other policies.
- Some measures have long-term effects but those might be maladaptive.
- More recoupled payments with more nationalism lead to more opportunities for targeted audience but can also lead to distortions.

Strengths:

- More subsidiarity.
- Preventative measure: CAP is a common framework for all farmers and might prevent the scenario of getting really bad.
- One of the most mature policies in the EU, it is not going to be dismantled in a very short time, its measures will keep running on national levels for a time even after the EU itself disappears.
- Weak farmers will be driven out of the business.

Recommendations for the CAP

- How can the CAP help to stabilize Europe?
    - The CAP plays a key role in climate adaptation and it helps to prevent the climate-related collapse of the environment.
    - Learning from the mistakes and weaknesses of the past for the future.

- Can play a leading role in climate adaptation policy, give people more trust in EU due to effective and working measures.
- With a long-term perspective the CAP can help to stabilize Europe.
- If farmers and agriculture are more stable that helps the society to remain peaceful (no hunger riots or malnutrition).
- Take frustrations of farmers and people serious now so that the CAP doesn't become a focus point of EU criticism and vehicle of fragmentation now.

- How can the CAP be reinvented?
  - Bilateral agreements between countries and cooperative approaches to create new opportunities.
  - More farmer-based, bottom-up.
  - Pillar 2 approach by making contracts between farmers and authorities.
  - Links between CAP and other environmental and social policies, but on a national, regional or local level (short supply chains and co-operations).
  - Learning network between farmers, knowledge building.
  - Measures to manage aridity in the south (sustainable irrigation plans linked to the successor to the CAP and co-operations, advertising the use of adapted, resilient crops) and floods in the middle.
  - Stimulate business cooperation on international level (CAP-like network based on the food industry, use funding structures of the food industry).

- How can the CAP survive in a defragmented Europe and still function?
  - Reform direct payments, more efficient way of spending money for promoting adaptation, more targeted payments.
  - More transparency on return on investment.
  - Clearly demonstrate the value of the one market.
  - Knowledge of the current CAP, living laboratory for optional climate adaptations, learning environment in a Europe that loses its educational institutions.
  - Threat to budget: increase efficiency, funding from private sector.

"We are the world"-group comments: all of the measures and recommendations would work as well in their better scenario. There is some overlap with the other scenario: knowledge, localization, more climate adaptation, bottom-up movements, linkages to other policies, more efficiency, simplifying the framework. Some measures and recommendations from this scenario would seem dispensable in the better world with the reduced climate change and thus might be less well justified and put into action.

Group 2

Scenario Immersion Description: We Are the World

In this scenario the EU is the leader, encouraging further development in Europe. Europe has stopped exploiting developing countries in this scenario, which implies slower economic development with technological advancement and international competition coming

primarily from developing countries. The EU recognizes that relying on international competition to stimulate innovation and creativity opens the potential for internal conflict, and therefore the EU starts from redistributive system to create higher quality of life without rapid economic growth. The redistributive system includes social welfare, but also to compensate for differential climate impacts.

The EU shifts focus from economic growth to a focus on well-being without accelerating economic growth leading to:

- Less inequality and less resource intensive lifestyles.
- Imagine higher quality of life with less resource intensive lifestyle.

Without rapid economic growth people can still be very innovative/creative. This world will probably include a smaller financial world. Good information by governments and other actors is essential in this scenario.

Increased global governance allows for definition of certain standards or products; regulating more which may create a level playing field so that competition functions. Competition is not main driver of this scenario but is positive. This scenario we need significant dematerialization as there is only gradual economic growth. There is strong governance for funding innovation and research and development. There is competition for grants, support for research facilities etc.

With technology, innovation and investment in sustainability there is a slow trend to neutral emissions by 2050, which leads to a 2-4 degree world. This means there is only a limited amount of adaptation needed.

This scenario requires a world with a lot of organization. This means both people as individuals and different policy levels need to take responsibility. There is a bumpy road to achieving this. Bumps will come from climate change events, unequal development or social unrest, which give rise to the implementation of effective redistributive systems.

The EU even more centralized than now and governments have a stronger role than the private sector. The private sector is still certainly present and has to be compatible with stronger governance. The private sector will therefore not lead in changes, but will support them. The internalization of external costs is due to consumer demand as well as regulation. CAP payments are made conditional on sustainability.

The rate of migration to Europe will decrease, as quality of life increases in other areas globally. However, within there is internal migration from south to north due to differential climate impacts. The EU expands to encompass more territory. Within Europe many people live in cities however, it is made an attractive career to stay in rural areas and do farm work. This means providing goods and services to rural places. Meanwhile the majority of people living closer together leads to lower emissions. A good balance is found between urban and rural populations.

Low economic growth initially causes insufficient jobs until people become more creative with income sources, sharing and bartering. There are more part time jobs, more efficient use of resources in households and higher well-being on a lower income due to more time and more local production and management of resources. People live in “Slow Cities”: work less,

spend more time with people, local production of goods and services, decouple well-being from income. Society reframes the notion of wealth to one not based primarily on financial wealth. This combined with the redistributive system means there is less inequality and everyone is more average. Similar trends occur all over the world.

There are human losses along the bumpy road to achieving "We Are The World". There is a lower population because of this, the slowing of migration and people having less children in the new lifestyle. There is less depletion of resources, and we use more waste: there is a circular economy. More is produced with less, more renewables, changes agricultural production systems that manage the nitrogen and phosphorous cycles.

SWOT: CAP in this scenario

Strengths:

- Current CAP is already well suited with this modest type of climate change.
- Safety nets for possible volatility etc.
- Allows for some adaptation measures.
- Investment measures.
- Support for modernization etc.
- Some public consultation.

Weaknesses:

- If real world is different from this climate scenario than current CAP is not sufficient to deal with this climate change.
- Difficulty coordinating among member states.
- High support for livestock sector, if carbon neutral this needs to change a lot – currently subsidizing emissions.
- No policy for structural change at the moment.
- Direct payments share of financial expenses, trade wars impact on prices.
- There is a lack of access to enhanced/adapted crops from conventional or new breeding techniques.
- Acceptance of new foods, proteins etc.

Opportunities:

- Use funds of CAP more efficiently to promote sustainable agriculture.
- Increase in cultivated arable land, using available arable land more efficiently.
- Agricultural as landscape management tool, providing more positive externalities.
- Strengthened multi-stakeholder processes and multilevel dialogue among different actors.
- Creation of new jobs in agriculture.
- Expanding on green measures.
- Opportunity reducing fossil fuel use in agriculture and more nutrient cycling practices.
- Opportunity for CAP to promote job as farm worker.
- Behaviour change and more value on wellbeing, consumers may be willing to demand and pay more for food that is healthy, might include environmental costs that are included in food prices.
- Opportunities to reduce waste.
- Coordination and long-term vision.
- Consumer willing to pay can internalize costs.
- Greening measures.

- Innovation partnership is a big opportunity, as well as knowledge sharing and education.
- Making life outside of cities more attractive.

Threats:

- Low economic growth for sustained period means severe problems in society: leads to riots, unemployment, etc.
- Coping with aging population and abandoned farmland.
- Less available funds because of shocks.
- Regional differences cannot be taken into account.
- Advanced technologies might draw on other resource dependencies or exploitation of other resources.
- Loss of human life, decreased migration may lead to further decline of farm workers.
- Burden of centralization and coordination.
- How to deal with redistribution.
- Centralized governance may be less responsive to local differences.
- Disappearance of agriculture in certain regions, but need it for landscape maintenance and control carbon.
- Supply chains dealing with less pure product, less quality products.
- CAP needs to drive adaptability and change at certain pace, challenge to see if theory of CAP for change it allows is also translated into practice.

How would you revise CAP to deal with these things?

- User (e.g. producer or consumer etc.) centered policy design.
- Design thinking approach.
- Simplify the CAP.
    - Make it a framework.
    - Adjust regionally.
    - Allow local diversity.
- Creation of better of location specific statistical data.
    - Novel technologies for data generation at multiple levels e.g. crowdsourcing.
- Payments conditional on sustainability or adaptation metrics (biodiversity).
    - Strengthening greening measures.
    - Create 'greening' measures for livestock.
- Reduce subsidies to the livestock sector.
- Link better with other policies
    - Nutrition.
    - Food (novel foods, GM).
    - Changing consumer behaviour regarding (e.g. meat consumption) not currently CAP.
    - Pesticides.
    - Breeding.
    - Biodiversity.
    - Etc.
- Better coordination between DGs.
- New approach to information provision/promotion of novel techniques.
- Promoting farming as a career, entrepreneurship etc.
- Research on less resource intensive farm systems input reduction and output increase.

What measures listed above would work in Icarus scenario?

- If there is still some money in ICARUS, a few adaptation measures could potentially work. Payments conditional on sustainability won't work.
- Creation of better location specific statistical data not likely. Lack of coordination and management for this.
- More transparency and value for money in Icarus scenario fits with payments conditional on something: targeted pillar two measures.
- Simplify the cap fits in both scenarios.
- Linking better with other policies cannot happen in ICARUS there is lack of capacity.
- Networks, coops etc. will play more of an important role than governments in Icarus scenario, so new approach to information provision yes, but through different mechanisms.

Robust Changes to the CAP across scenarios

Both scenarios agree that the CAP plays a key role in climate adaptation and it helps to prevent the climate-related collapse of the environment, giving people more trust in EU due to effective and working measures. With a long-term perspective the CAP can help to stabilize Europe. If farmers and agriculture are more stable that helps the society to remain peaceful (no hunger riots or malnutrition). The CAP must take the frustrations of farmers and people serious now so that the CAP doesn't become a focus point of EU criticism and vehicle of fragmentation now.

Both scenarios allow for the following ways to improve the effectiveness of the CAP for climate adaptation:

- Creation of new opportunities through bilateral agreements and cooperative approaches.
- Support local networks and cooperatives.
- More community based and farmer based – bottom up.
- Pillar 2 approach by making contracts between farmers and authorities.
- Links between CAP and other environmental and social policies, on a national, regional or local level (short supply chains and co-operations).
- Learning network between farmers, knowledge building. Support context specific knowledge sharing.
- Measures to manage aridity in the south (sustainable irrigation plans linked to the successor to the CAP and co-operations, advertising the use of adapted, resilient crops) and floods in the middle.
- Stimulate business cooperation on international level (CAP-like network based on the food industry, use funding structures of the food industry).
- Reform direct payments, more efficient way of spending money for promoting adaptation, more targeted payments.
    - More transparency on return on investment.

- Clearly demonstrate the value of the one market.
- Knowledge of the current CAP, living laboratory for optional climate adaptations, learning environment in a Europe that loses its educational institutions.
- Threat to budget: increase efficiency, funding from private sector.

- More transparency and value for money by making payments conditional: targeted pillar two measures.
- Simplify the CAP.

Questionnaire

This section of the report summarizes the results of a survey conducted with the participants of the workshop on the day itself. The survey was provided to all participants in the workshop, 11 participants responded.

Question	Majority Answer	% Yes	Average Score (1-5 Scale)	Main Comments
General Questions				
The CAP should play an important role in making the agricultural sector in Europe more climate resilient.	Yes	91	1.73	Adaptation can't be tackled without mitigation. Some adaptations might be detrimental to environmental aspects and are not long term.
The CAP is meant for income support and by providing income support it automatically enables adaptation to climate change.	No	36.4	3.65	In theory but the bulk of the money is actually untargeted annual payments, it does not really do it.
Adaptation to climate change has nothing to do with the CAP because farmers need to adjust to climate change by themselves.	No	18.2	4.27	Financial incentives can help.
Adaptation to the climate has always been a primary focus of the agricultural sector and does not need additional attention through CAP.	No	9	4.45	
The CAP provides an excellent opportunity to mainstream	Yes	91	1.9	Balanced with other objectives such as

climate adaptation policies for the agricultural sector.				sustainable management of natural resources.
Current CAP				
The setup of the current CAP is adequate to allow for adaptation to climate change.	No	18.2	3.27	Greening and crop diversification could have helped but have been diluted in the current CAP.
The current CAP leads in practice to adequate adaptation to climate change.	No	20	3.6	
The current CAP offers opportunities to stimulate public investment in adaptation options for climate change, e.g. construction of irrigation water reservoirs or similar facilities.	Yes	80	2.13	
Potential Future Revision of the CAP				
It is recommendable to use the CAP funds to provide more incentives for adaptation to climate change by the private actors in agriculture in Europe.	Yes	80	2.3	Look at overall impacts and the most sustainable solutions.
It is recommendable to use the CAP funds to provide more incentives for adaptation to climate change by the public sector (e.g. local or regional authorities or water boards) for agriculture in Europe.	Yes	90	2.3	
The CAP funds are not meant for stimulating adaptation to climate change and future revision should not focus on adaptation to climate change.	No	10	4.4	
Other Topics				
Insurance systems in the agricultural sector are important for adaptation to climate change.	Yes	90	2.27	Yes but should not be in Pillar 2, and first alternative practices, such as crop rotation, should be enhanced.
Autonomous adaptation to climate change in agriculture is most important.	Yes	90	2.64	
National authorities are	Yes	90	2.18	Everyone is

responsible for adaptation to climate change in the agricultural sector.				responsible but national government may have the most power to implement/empower.
The European Union is responsible for adaptation policies in the agricultural sector in Europe.	Yes	90	2.45	
The regional authorities are responsible for adaptation policies in the agricultural sector.	Yes	90	1.82	
The subsidiarity principle should be applied to adaptation policies for the agricultural sector in Europe.	Yes	90	1.8	

There is strong agreement that the CAP has an important role to play, that it has a lot of potential to facilitate adaptation and that it should and that it is currently not living up to that potential and needs to be adjusted.

As 90% of people agreed that local, national, regional and EU bodies are responsible for adaptation, it becomes clear, as the comments specified, “everyone is responsible”. Further, 90% agreed that the subsidiarity principle should be applied.

The current strengths of the CAP in terms of climate adaptation were listed as:

1. Direct payments.
2. Research and development.
3. Safety nets.
4. Flexibility.
5. Focus on sustainability and environment.
6. Rural development policy.

The current weaknesses of the CAP were listed as:

1. Loss of biodiversity and agri-diversity
2. Structural changes, for example, big industrial farms
3. Raising awareness of the need to adapt.
4. Lack of knowledge of vulnerability and adaptive capacity at different levels.
5. Lack of cross impact analysis. Very focused measures in P2 not looking at the potential negative impacts.
6. Not always respecting existing EU legislation.
7. Not enough guidance to national governments on how to mainstream adaptation.

Participants reported that the most important adaptations in the agricultural sector that the CAP should focus on are:

1. More efficient resource use (water, fertilizer, energy).
    a. Reduce water use and carefully select appropriate crops.
    b. Reduce fossil fuel use.
    c. Reduce fertilizer use.
2. Adapted crops.
3. Diversity of farming systems.
4. Crop diversity, reduction of monocultures.
5. Integration of ecosystem management and biodiversity protection into farming systems.
6. Research and development.
7. Safety nets.
8. Irrigation, flood control.
9. Permanent grasslands.
10. Buffer strips.

- **Discussion**

Across all participants in all activities, there is very strong agreement that the CAP has an important role to play in climate adaptation in Europe, that is has a lot of potential to facilitate adaptation and that it should and that it is currently not living up to that potential and needs to be adjusted. There is strong agreement that adaptation must take place at all levels from local, through national and regional to all of EU and that the principle of subsidiarity should apply.

The main strengths of the current CAP relate to direct and decoupled payments, which provide farmers with safety nets and the financial freedom to experiment with adaptations; as well as an overarching focus on the environment and sustainability. The main weaknesses of the CAP relate to maintenance and enhancement of diversity (in terms of crops, biodiversity and farming systems) as well as money going to large farmers rather than those that need it most. A major weakness from the adaptation perspective is lack of long term, integrated perspectives and a lack of integration with other policies.

The CAP was successfully tested across two diverse future linked socio-economic and climate scenarios for Europe drawn from the cumulative work of the IPCC and the EU Climsave and Impressions programs. Adjustments to the CAP robust across the scenarios to support adaptation to future climate change are:

- Creation of new opportunities through cooperative approaches.
    - Support local networks and cooperatives.
- More community based and farmer based – bottom up.
- Pillar 2 approaches by making contracts between farmers and authorities.
- Links between CAP and other environmental and social policies, on a national, regional or local level (short supply chains and co-operations).
- Learning network between farmers, knowledge building. Support context specific knowledge sharing.

- Measures to manage aridity in the south (sustainable irrigation plans linked to the successor to the CAP and co-operations, advertising the use of adapted, resilient crops) and floods in the middle.
- Stimulate business cooperation on international level (CAP-like network based on the food industry, use funding structures of the food industry).
- Reform direct payments, more efficient way of spending money for promoting adaptation, more targeted payments.
    - More transparency on return on investment.
    - Clearly demonstrate the value of the one market.
    - Knowledge of the current CAP, living laboratory for optional climate adaptations, learning environment in a Europe that loses its educational institutions.
    - Threat to budget: increase efficiency, funding from private sector.
- More transparency and value for money by making payments conditional: targeted pillar two measures.
- Simplify the CAP.

The two scenarios can be loosely thought of as the Heaven and Hell scenarios for Europe. Note that all of the approaches to supporting adaptation that worked in the Hell scenario worked in the Heaven though the same was certainly not true the other way around. What this means is that by taking only the robust adjustments we miss out on an enormous range of possible options that are available in more positive scenarios. For this reason it is important to retain the full portfolio of suggestions generated though these will not be relisted here and can be found in Section 0.

- **Appendix**

Scenarios

Qualitative stories

EU-SSP1 – We Are the World

There is a high commitment to achieve development goals through effective governments and global cooperation, ultimately resulting in less inequality and less resource intensive lifestyles.

The financial crisis continues to have strong repercussions and EU leaders are forced towards further European financial policies. The crises fuel the feeling that behaviour has to change putting governments under pressure to take ambitious measures, including stimulating an energy transition towards renewables and a general support for innovative research facilities. This results in a higher quality of life and a growing feeling of security and safety. Trade wars and crises are solved by the increased effectiveness of governments worldwide. By 2040, efforts to transform Europe and the rest of the world into a sustainable environment are now starting to pay their dividends, reinforced by changing lifestyles.

A decrease in conflicts in developing regions leads to higher political stability and slower economic development. The European Union expands further and participates in new global governance initiatives. They thus take account of their responsibility for environmental impacts in developing regions and lead investments into sustainable development. As a result, migration towards Europe starts to decline for the first time this century. There is a substantial shift in the European political agenda with a greater focus on well-being than economic growth, driven by human losses associated with climate change combined with positive improvements in accessible education and lifestyle. Advances in technology are stimulated by international competition leading to a CO_2 neutral society by 2050.

EU-SSP3 – Icarus

Sparked by economic woes in major economies and regional conflict, antagonism between and within regional blocs increases, resulting in the disintegration of social fabric and many countries struggling to maintain living standards. Ultimately, a high-carbon intensive Europe with high inequalities emerges.

With the economy gradually picking up, the demand for resources increases, which turns out to be a tipping point for the state of the environment with severe ecosystem failures. At the same time, the economy does not perform as expected with new crises across the continent that stress the structural differences across and within countries. Populist movements become increasingly mainstream and are further fuelled by increasing riots in multicultural neighbourhoods. The persistence of conflicts and decline in trade also affects energy and food prices. Extreme weather events become more frequent and further increase the costs of resources; this causes the economy in Europe to start to stagnate. This, in turn, increases unemployment rates and leads to the phasing out of the social security system. In light of increasingly scarce public resources, long-term policy planning becomes rare with hardly any money for education, research or innovation. Eventually the EU breaks down.

Continuing negative social, environmental, and economic developments widen the gap between the haves and the have-nots. With the disintegration of social fabric, Europeans start to migrate in search of jobs, and are employed in countries that are somewhat better off, for relatively low wages. Eventually some counter-movements appear with some signs of a slight economic recovery. Yet, these signs are temporary and do not take root in an increasingly fragmented world with strong regional rivalry and conflict. The general lack of technology transfer and economic resources, coupled with weak institutions and governance structure, leads to an increasing resource intensity and fossil fuel use and burning wood.

[i] www.climate-em.org.uk.