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Science Session Report

Session name: **Adapting farming systems to climate variability and change in Europe: the MACSUR experience**
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Session ID: **SC 2.10**

Chair: Reimund P. Rötter, Georg-August-Universität Göttingen, Germany

Rapporteur: Floor Brouwer, LEI Wageningen UR, the Netherlands

Presentations:

The session was introduced by Reimund P. Rötter, Georg-August-Universität Göttingen, Germany.
FACCE MACSUR (www.macsur.eu) is a European Knowledge Hub, improving agricultural systems models (crop and livestock production) across scales: farm, regional, national, European and global scales. Climate-induced risks are assessed, including opportunities and consequences of adaptation and mitigation in agriculture. So far, farm behaviour is often neglected in bio-economic modelling, and MACSUR offers tools to model adaptation of agricultural systems to climate change. MACSUR takes into account the increasing variability in climate and increases in the occurrence of extreme events. Improvements are made through participation of regional stakeholders.

Martin Schönhart, BOKU University of Natural Resources and Life Sciences, Austria.
The presentation **'Integrated assessment of climate change mitigation and adaptation trade-offs in Austria'** clarifies how climate change and related policies may impact land use and also examines whether there are synergies and trade-offs from combined climate and land use changes. Some regions might benefit from climate change, and not only latitude but also altitude needs to be considered in impact studies. Trade-offs exist between climate mitigation and adaptation, for example by measures to link food production and achieving biodiversity values. The analysis offers evidence of synergies between biodiversity and meanwhile reducing greenhouse gas emissions. Such synergies are achieved by extensification of production, reducing the use of nutrients and the production of biomass. Flexibility from adaptation shows trade-offs between agricultural production and environmental protection. Trade-offs between climate adaptation and mitigation might arise, for example through the maintenance of grassland and productivity increase. The author also concludes that future rural development programmes and environmental policy design (e.g. Water Framework Directive) should take changes in productivity into account.

Heikki Lehtonen, Natural Resources Institute Finland (LUKE), Finland,
presents **'More strategic farm management needed to adapt to climate change in the Northern Savo region'**. The region has emphasis on dairy production. Under climate change there might be less snow. For the growing season, higher temperatures and evapotranspiration are projected, with a threat of drought. Climate-related problems include variability of crop yields (over time and among fields), feed quality losses, winter-time damages, soil compaction and wet conditions. Plant pests may become more frequent. Adaptation solutions include using cereal cultivars that can make use of a longer growing season, with decreased vulnerability to

(early summer) drought and more tolerant to heat stress. Also, crop protection practices may change, increasing the use of fungicides. Forage grasses may require cultivars that are more resistant to heat stress and drought with better nutritive value. The longer growing season may enable earlier and more cuts so that grass yields may increase up to the middle of this century by 10 – 15%. However, the risks of climate change remain significant to farmers, and they need to keep sufficient grassland area and buffer stocks. Investments in adaptation is a long-term process, requiring adjusted cultivars, increasing knowledge and skills of farmers to cope with adverse climate effects and extreme events, investments to improve drainage and water systems, more crop rotations to improve soil structure. Farmers could be supported by increased co-funding (e.g. shift from CAP Pillar 1) for long-term investments of drainage and soil structure, the promotion of home-grown proteins (requiring more diverse rotations), payments for ecosystem services and cost compensations based on biodiversity and/or reduced nutrient leaching. This would all require more long-term management paradigm, which still is not widely adopted among farmers.

Kairsty Topp, Scotland's Rural College (SRUC), Scotland, presents **'Adaptation of European dairy farms to climate change: a case study approach'**. In her presentation, she clarifies the direct effects of climate change, including heat stress (which can reduce milk production), accessibility of land (from heavy rain), water availability during periods of drought and diseases. In addition, indirect effects of climate change include change in forage and crop production and quality, due to thermal growing season, drought, heat stress, waterlogging and diseases. The top four adaptation measures in dairy farming in Ireland, the Netherlands, Italy and France include fertilisation rate (because of the extended growing season), use of mixtures of plant species (with greater drought tolerance), novel crops (less severe winters which give opportunities to use cover crops) and irrigation practices (to cope with reduced rainfall and higher evapotranspiration during summer). Kairsty Topp concludes that adaptation of the dairy sector is required to remain productive and profitable. The measures however, vary across Europe, because of the impacts of climate change, adaptation and mitigation measures and trade-offs and synergies between adaptation and mitigation.

Tao Fulu, Natural Resources Institute Finland (LUKE), Finland, presents '**Design future climate-resilient barley cultivars using crop model ensembles'**. There is evidence crop yield growth rates have been stagnating in the last decade in some important agricultural regions around the world. The presentation concludes that the development of varieties and improved agronomic practices are important adaptation strategies in crop production. The integration of knowledge from several disciplines remains necessary, including genetics, breeders, agronomists and crop modellers.

The session discussion focussed on the importance of the long-term capital costs of adaptation. In Finland, for example, land prices increased in the recent past, while they decreased in Ireland. Such long-term investments are often overlooked in the research. While farmers themselves need to decide which option they introduce, the research needs to develop a range of promising ones to present uncertainty of climate change and market conditions. In conclusion, more strategic and long-term management is needed to cope with the climate and market challenges through long-term investments in adapted infrastructure. Also, policies could better focus on adaptation to climate change in synergy with other environmental policy targets (e.g. water protection).