Agricultural experts' perceptions on climate change impacts and adaption in Austria

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***Abstract* – Agricultural experts play an important role in facilitating climate change adaptation in Austria. We aim at investigating their perceptions, observations and future expectations of changes in regional climate conditions, agricultural impacts, and private adaptation measures. Qualitative, semi-structured interviews have been conducted in two case study regions, i.e. Mostviertel and South-East Styria. The results show that changes in temperature and extreme events as well as high future uncertainties are perceived as most challenging. Observed impacts are focused but not limited to negative effects on crop production. A broad variety of incremental, systemic and transformational adaptation measures are perceived relevant for the case study regions. Their implementation is driven by farm and regional characteristics as well as by legal, policy and market conditions.**

Introduction

Agricultural productivity and land use potential are likely to alter under changing climatic conditions. Modelling results for Austria show high regional differences in expected climate change impacts leading to different adaptation potentials (Mitter et al., 2015; Schönhart et al., 2014). A timely recognition of chances and risks is essential for developing and implementing adaptation strategies. Although agricultural experts play an important role in facilitating and supporting climate change adaptation in Austria, information on their perceptions and expectations of changes in regional climate conditions, climate change impacts and adaptation is limited. This knowledge gap can constrain the adaption process and may reduce the capacity and willingness to take adaptation decisions (Moser and Ekstrom, 2010).

This article presents results of a qualitative study focussing on perceptions, observations and future expectations of a broad range of agricultural experts on the subject of climate change. In particular, we are interested in perceived and expected changes in regional climate conditions and induced impacts on the agricultural sector as well as on adequate adaptation measures. Furthermore, we examine the level of information of agricultural experts, their preferred information sources and information needs and how climate change is addressed in agricultural institutions in Austria.

Data and Method

Two agricultural production regions, the Mostviertel and South-East Styria, have been selected as case study regions. The selection was based on the heterogeneity in pedo-climatic conditions among the regions and on results from integrative modelling studies on the regional vulnerability of the agricultural sector. While grassland production in the Mostviertel is likely to benefit from climate change in the next decades, cropland production may benefit or loose. In South-East Styria, previous model results show adverse impacts on the agricultural sector for most climate change scenarios (see Mitter et al., 2015, 2014; Schönhart et al., 2014).

A focus group discussion with twelve farmers and agricultural experts from extension services has been conducted in the Mostviertel region in May 2015 in order to frame the research questions and develop the qualitative interview guide for data collection.

Twenty-one qualitative, semi-structured interviews have been conducted with agricultural experts in the two case study regions between August and October 2015. The interview partners represent the bandwidth of agricultural institutions in the case study regions and include agricultural extension specialists, people from administration, teachers and heads of farming engineering schools, scientists and engineers at regional research institutes, people from agricultural cooperatives, producer groups and machinery co-operations as well as people working for regional development agencies and environmental organizations.

The interviews lasted between 40 and 90 minutes each. They were digitally recorded and have been transcribed word-for-word. Qualitative content analysis, facilitated by Atlas.ti, has served as a means for narrowing down, coding and interpreting the statements. Deductive and inductive coding has been used. In a first step, codes were defined based on the interview guide and were finally assigned to relevant text passages. During this procedure additional codes were created for emerging topics (see Friese, 2012).

Results and Discussion

The interviews indicate that perceived and observed changes in regional climate conditions are similar in

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the two case study regions. The agricultural experts responded that temperature levels and variabilities have increased, precipitation distributions have changed, and the number and intensity of droughts, heat waves and heavy rainfall events has risen. For the future period, the agricultural experts expect further increases in mean temperature and temperature fluctuations, further changes in timing of precipitation as well as more frequent and more severe extreme events.

Perceived and observed climate change impacts are focused but not limited to crop production. This emphasis can be explained by the direct link between changes in regional climate conditions and crop growth rates. Furthermore, extension activities traditionally concentrate on production-related aspects which may amplify their dominance in the interviews. The agricultural experts mostly address negative impacts such as crop damages, problems with animal welfare, additional management-related expenses and soil loss. Perceived positive impacts comprise increases in yield levels and yield quality due to higher temperatures. Expected future impacts refer to reductions in crop, grassland and livestock yields and to harmful effects on natural resources, i.e. soil and water.

The agricultural experts reported on private, public, and evolutionary adaptation, depending on the main 'actor' taking the respective adaptation measure. Private adaptation measures are mostly implemented for private benefit but may also exert beneficial or adverse effects on public goods. Incremental, systemic and transformational private adaptation measures have been perceived in the case study regions. Incremental adaptation relates to land and livestock management decisions, which are taken at sub-system level in order to 'preserve' the existing farm. They include, for instance, changes in timing of cultivation, changes in stocking densities, and adjustments in feeding ratios. Systemic adaptation is linked to management decisions at farm level, land use and land cover change, and investment decisions. Examples are the conversion to organic or conventional production, the expansion of cropland, fruit and wine growing areas, and the investment in water reservoirs and new technologies. Transformational adaptation refers to the strategic orientation of the farm and includes, for instance, converting from full-time to part-time farming, changing the farm type, farm withdrawal and engaging in non-agricultural secondary activities. Several incremental and systemic adaptation measures are perceived to gain on importance in the future. They comprise of the implementation of new technologies, changes in land use and land cover, and the adoption of more sophisticated financial and risk management strategies.

Climate change, related impacts and adaptation strategies are directly or indirectly addressed in all institutions represented by the agricultural experts, though for different purposes (e.g. education and training, strategic orientation of the institution) and with different priorities. The majority of the agricultural experts feel very well or well informed about changes in climate conditions and well or moderately informed about latest developments in adaptation measures. Almost all are actively seeking for information related to changing weather and climate conditions and they rate the available information generally as good. However, they expressed various information needs which can be summarized in two major categories, (i) generalized data and information which are easily accessible and user-friendly, and (ii) context-specific data and information with high practical relevance.

Conclusions

Feedback from agricultural experts shows that higher temperatures and an increase in frequency and duration of extreme events (i.e. droughts, heat waves and heavy rainfall events) are the main climatic parameters affecting agricultural production. Although perceived climate signals and dominating chances and challenges are similar in the case study regions, observed impacts are influenced by the prevalent agro-ecosystems and the socio-economic conditions. Similarly, regional climate change is one of many drivers for implementing private adaptation measures. The agricultural experts perceive market and agricultural policy changes as well as the legal framework as equally important at least. Furthermore, available resources (such as land, water and infrastructure) as well as farmers' and farms' characteristics shape adaptation decisions. This highlights the need to put climate-related chances and risks in the context of the farm, the region and the legal, policy and market conditions.

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