Exploring farmers' reasons for drought adaptation

Bernadette Kropf[1], erwin Schmid[1] and Hemine Mitter[1]

***Abstract* – Understanding farmers' reasons for drought adaptation is essential to develop tailored policy measures that encourage adaptation. We qualitatively explore farmers' drought adaptation behaviour in the Austrian case study region Seewinkel. The qualitative content analysis reveals that farmers implement incremental measures such as shifting toward drought-tolerant crops and varieties, irrigating or adopting conservation tillage practices. Transformative measures are implemented such as additional water reservoirs or specializing in production activities. Drought adaptation is not only influenced by reasons referring to perceived self-efficacy, costs and effects, but also to farmers' economic, environmental, social, legal and technical contexts. The results will be graphically depicted in a behavioural systems map, which provides the basis for further analysis and the development of tailored policy measures.**

Introduction

Climate change is likely to increase frequency and severity of agricultural droughts. Thus, farmers need to adapt in order to reduce or avoid potential adverse impacts. Farmers' adaptation to agricultural droughts is not only essential to ensure their incomes through agricultural production, but also to preserve food security and related economic and social stability (IPCC, 2022).

Researchers and practitioners deal with and continually enhance the knowledge on a plethora of incremental and transformative drought adaptation measures. However, their implementation is still limited, and sometimes lacks effectiveness or leads to adverse trade-offs (Iglesias and Garrote, 2015). Explanations include, for example, cognitive biases of individuals, such as maintaining the already known (Kahneman, 2011). With respect to policy measures, the overemphasis on informational measures and the disregard of economic, environmental, social and technical contexts on farmers' behaviour impede adaptation (Hanger-Kopp and Palka, 2021; Mitter et al., 2019; Wheeler et al., 2013).

Despite an increase in scientific investigations into farmers' drought adaptation, the interaction between individual and contextual information is often disregarded and the application of quantitative methods is prioritized (Hanger-Kopp and Palka, 2021).

We use a qualitative approach to analyse farmers' drought adaptation behaviour in the semi-arid case study region Seewinkel, located in eastern Austria. In particular, we aim to reveal drought adaptation measures, farmers' reasons for their implementation, as well as contexts encouraging adaptation behaviour.

The case study region Seewinkel is characterized as a semi-arid agricultural production region with an individual groundwater body. The Pannonian climate (annual precipitation sums below 600 mm and mean annual temperatures around 10 °C) and the opportunity to use groundwater for irrigation offer favourable conditions for agricultural production (Blaschke et al., 2015). However, agricultural droughts increasingly threat regional agricultural production (Kropf et al., 2021).

Method

We conducted qualitative, semi-structured interviews with farmers operating in the Seewinkel region, aiming to collect farmers' perceptions of droughts and their reasons for drought adaptation. An emphasis was put on irrigation, which is of particular relevance within the Seewinkel region. The Model of Private Proactive Adaptation to Climate Change (MPPACC) informed the development of the interview-guideline (Mitter et al., 2019).

Interviewees were selected according to the maximum variation principle with regard to farm characteristics (e.g. farm type, location of the farm, main production activity, farm size, cultivation system) and farmer characteristics (e.g. age, gender). Potential interviewees were searched online. Additional interviewees were initially contacted via gatekeepers who informed them about the interview and were thereafter contacted by the interviewer.

One interviewer conducted 21 face-to-face interviews (with 24 interviewees) between November 2019 and February 2020. The interviewed farmers (17 men, 7 women, aged between 24-71 years) follow diverse production activities (multiple answers were possible) such as cropland (13), viticulture (10), livestock (8), vegetables (6), fruit (5), grassland (4), forestry (2), other (2) on their farms with a size between 2 to 2100 ha. The interviews lasted between 25 and 125 minutes and were conducted either at the interviewer or interviewees homes. The transcribed interviews were analysed by means of a qualitative content analysis following Mayring, (2014). Using the text analysis software Atlas.ti, we applied a deductive-inductive coding scheme. Deductive codes were derived from the MPPACC (e.g. perceptions of droughts and drought adaptation measures including self-efficacy, adaptation efficacy and costs). Inductive codes resulted from the interviewees' statements and were used to further refine deductive codes. For the present analysis we exclusively focus on statements referring to drought adaptation and underlying reasons. Reasons are specified as adverbs, conjunctions or prepositions which introduce conditions for drought adaptation measures (e.g., if

[1] All authors are working at the University of Natural Resources and Life Sciences Vienna, Institute for Sustainable Economic Development (bernadette.kropf@boku.ac.at, erwin.schmid@boku.ac.at, hemine.mitter@boku.ac.at).

… then, when), purposes (e.g., that) or reasons (e.g., because, as).

Results

The results show that an increasing number of agricultural droughts and accompanying decreasing soil water availability necessitate farmers to implement drought adaptation measures. These measures were categorized based on Wheeler et al. (2013) and include incremental (e.g. irrigate, switch to drought-tolerant crops and varieties, soil conservation, drought insurance) and transformative adaptation measures (e.g. build water reservoirs, farm specialization, abandon certain production activities).

Irrigation including capacity increases and efficiency improvements are central for farmers in the Seewinkel region. Reasons that motivate farmers to irrigate include their expectations for improved crop yields and product quality. However, the expected costs (including labour) depend on field size and spatial distribution of fields and impede irrigation or force farmers to pro-actively switch to drought-tolerant crops and varieties. *"If we had to purchase an irrigation system now, it would be intensive. We would have to cultivate certain crops or fields, so that it is at least profitable – Seew_I6".* Expectations to increase irrigation efficiency (i.e.-water- and energy-use per unit of crop yield) through reduced evapotranspiration motivates farmers to shift irrigation to night-times.

Farmers' choice of cultivated crops also influences irrigation water quantity. They argue with irrigation costs, expected yields, and related income to ensure the viability of their farms, but also to economic contexts such the market demand. Farmers perceived self-efficacy also influences the choice of cultivated crops. On the one hand, self-efficacy is perceived low due to limited knowledge about the cultivation and marked potential of new plants. On the other hand, it is perceived high based on already gained experiences with new plants on their farms, or vicarious experiences of farmers in drier European regions, who also cultivate crops profitably.

Farmers also point to the social context, such as prevailing narratives within farming communities, which influence the implementation of drought adaptation measures. For example, prevailing narratives on conventional tillage impede the shift to conservation tillage practices, which are currently only implemented by few farmers.

Conclusion and Outlook

Reasons for farmers to adapt to droughts are related to the perceived costs, perceived effectiveness or their personal capacity to implement respective measures. Additionally, farmers' perceptions of the economic, environmental, social, legal and technical context influence their drought adaptation. These results support the development of tailored policy measures, such as initiatives to develop new narratives or the provision of financial incentives to decrease irrigation water use and preserve the regional groundwater body. In a next step, the results will be graphically summarized in a behavioural systems map (Hale et al., 2022) to depict causal relationships of drought adaptation and the reasons for it.

Acknowledgement

This work was supported by the Austrian Climate and Energy Fund within the Austrian Climate Research Program, research projects FARMERengage (grant number KR18AC0K14641) and Build Back Better (grant number KR20AC0K18173). Furthermore, we would like to thank Tina Achs for conducting and transcribing the interviews as well as Carina Auzinger and Julia Vihanek for their support in transcribing interviews.

References

Blaschke, A.P., Reiner, Philipp, Gschöpf, Christine, 2015. Studie zum Grundwasserbewirtschaftungsplan für den Seewinkel. TU Wien, Wien.

Hale, J., Jofeh, C., Chadwick, P., 2022. Decarbonising Existing Homes in Wales: A Participatory Behavioural Systems Mapping Approach (preprint).

Hanger-Kopp, S., Palka, M., 2021. Decision spaces in agricultural risk management: a mental model study of Austrian crop farmers. Environ Dev Sustain.

Iglesias, A., Garrote, L., 2015. Adaptation strategies for agricultural water management under climate change in Europe. Agricultural Water Management 155, 113–124.

IPCC, 2022. Climate Change 2022. Impacts, Adaptation and Vulnerablity. (Working Group II contribution to the Sixh Assessment Report of the Intergovernmental Panel on Climate Change).

Kahneman, D., 2011. Thinking, Fast and Slow. Penguin Random House UK, Great Britain.

Kropf, B., Schmid, E., Mitter, H., 2021. Multi-step cognitive mapping of perceived nexus relationships in the Seewinkel region in Austria. Environmental Science & Policy 124, 604–615.

Mayring, P., 2014. Qualitative content analysis: theoretical foundation, basic procedures and software solution. Klagenfurt.

Mitter, H., Larcher, M., Schönhart, M., Stöttinger, M., Schmid, E., 2019. Exploring Farmers' Climate Change Perceptions and Adaptation Intentions: Empirical Evidence from Austria. Environmental Management.

Wheeler, S., Zuo, A., Bjornlund, H., 2013. Farmers' climate change beliefs and adaptation strategies for a water scarce future in Australia. Global Environmental Change 23, 537–547.