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Decision spaces in agricultural risk management: a mental model study of Austrian crop farmers

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Abstract
Drought has become a dominant climate risk both around the world and in Europe, adding to the already challenging task of farming and governing the agricultural sector under climate change. Drought risk management is extremely complex. Apart from irrigation, most drought risk management options have more than one goal and may potentially have negative trade-offs with other risk management objectives. Moreover, government regulations and market mechanisms influence farmers' decision-making. However, previous studies, both in developed and in developing countries, have predominantly focused on attitudinal and structural influencing factors on farmers' risk management behavior. In this paper, we comprehensively investigate farmers' decision spaces with respect to drought risk management. We address two applied research questions: (1) What are farmers' preferred drought risk management measures? (2) From a farmer's perspective, what are the dominant factors influencing drought risk management decisions? We find that farmers primarily think of production-based rather than financial measures with respect to drought risk management. At the same time, natural and technical constraints and enabling factors dominate their mental decision space, followed by public and private institutional aspects. This research provides a basis for the design of integrated and holistic drought risk management policy and the drought risk governance needed for sustainable use of land and water resources such as needed to address systemic risks and achieve the Sustainable Development Goals. Moreover, we introduce a novel approach using mental models extracted from interviews to explore cognitive representations of farmers' decision spaces. This approach has the potential to complement mainstream research using standardized surveys and behavioral models to analyze drivers of risk management.

Keywords Decision space · Mental model · Agriculture · Climate risk · Drought · Risk management

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1 Introduction

For many countries in Europe, droughts, exacerbated by climate change, pose a new challenge, most importantly for the agricultural sector (DG Environment, 2012; GWP CEE, 2020; IPCC, 2012). Austria, for example, has experienced an increase in mean temperature of 2 °C since the 1880s, which is considerably higher than the global average increase of 0.85 °C (*AAR14*, 2014). Scientists expect that drought events will increase, especially in already dry regions north of the Danube and in the easternmost parts of the country, the Austrian breadbasket (*AAR14*, 2014). Damage from drought has increased in recent years: agricultural damage from drought amounted to approximately 120 million Euros in 2012, 170 million Euros in 2015, and 210 million Euros in 2017 and 2018 (Österreichische Hagelversicherung, 2017, 2018, 2019).

Drought risk management (DRM) is complex as it cannot be reduced to a set of standalone measures that exclusively address drought risk, with the exception of irrigation and drought insurance. There are many measures that serve multiple purposes, some synergistic and others detrimental to addressing drought risk (Hanger-Kopp & Palka, 2020). Moreover, management options may address different stages of drought risk, such as hydrological, agricultural, or even socioeconomic factors (Wilhite et al., 2014). This means that, inevitably, DRM is to some extent part of agricultural risk management, whether intentional or unintentional (Hanger-Kopp & Palka, 2020).

Building and supporting effective DRM practices is thus crucial as well as difficult. Farmers are the key to production-based DRM in the agricultural sector, as we rely on them for the implementation of most measures to ensure the stable production of agricultural goods (Wilhite et al., 2007). Understanding their decision space (i.e., their range of options), but also the limitations of these options by other agents and factors, is thus crucial to DRM strategies, which are increasingly important in the European Union (EU). Empirical studies on farmers' risk management and adaptive behavior are most often based on behavioral economics and psychology. They thus focus almost exclusively on a limited set of structural, socioeconomic, perceptional, and attitudinal factors to explain preferences, actions, or the intention to act. Looking at the scientific literature, we see a gap with respect to studies discussing a broader set of factors driving DRM, most importantly of the institutional kind (Hanger-Kopp, 2021). Given the fact that the agricultural sector is highly regulated in Europe, we assume that these factors might play an important role that has been underestimated in previous studies.

In this paper, we describe farmers' decision spaces with respect to DRM. To this end, we present an innovative analytical framework combining the decision space concept with a mental model approach, which allows us to use in-depth qualitative interviews systematically to analyze a more diverse set of influencing factors of DRM behavior than survey-based studies. This novel analytical experiment allows us to answer two applied research questions for the case of Austria: (1) What are farmers' preferred DRM measures? (2) What are the dominant influencing factors of DRM decisions? The answers could help inform more effective drought-related decision-making and policy design at the farm and government levels. This is particularly important in light of increasing attention to DRM in the EU (GWP CEE, 2020). Methodologically, we contribute to mental model research, in general, opening new avenues to complement findings on risk management and adaptive behavior from standardized surveys.

2 Background

2.1 Mainstream research on drivers of DRM and adaptive behavior in agriculture

The drivers or influencing factors of individual behavior with respect to risk reduction and climate change adaptation have been receiving increasing academic attention since the early 2000s. This is in large part driven by climate change adaptation discourse, where two dominant areas of empirical investigation have emerged. The literature on households under flood risk is widely available for developed countries (e.g., Kellens et al., 2013; Poussin et al., 2014), whereas agricultural risk management and adaptation efforts, most often with respect to droughts, is more often investigated for developing countries, which are more affected by droughts and are frequently more vulnerable (IPCC, 2014). Studies on individual adaptation behavior use similar theoretical backdrops, drawing on psychology, economics, and sociology. Preferred approaches in the scientific literature include the theory of reasoned action, the theory of planned behavior (Beedell & Rehman, 2000; Bergevoet et al., 2004; Mase et al., 2017; Wauters et al., 2010; Wheeler et al., 2013; Willock et al., 1999), as well as protection motivation theory (PMT) and versions thereof, most prominently the model of private proactive adaptation to climate change (MPPACC, Frank et al., 2011; Grothmann & Patt, 2005; van Duinen et al., 2015; Woods et al., 2017).

Another branch of research into agricultural drought risk and behavior falls under the umbrella of agricultural risk management, but it is mostly independent from the climate adaptation research in the agricultural sector. These studies have an almost exclusively economic context, but theoretical approaches and analytical strategies are similar to the adaptation literature referred to above (Menapace et al., 2013; Meraner & Finger, 2017; Meuwissen et al., 2001). Moreover, the Five Capitals approach, popular for categorizing the factors of development and resilience, has also been used for categorizing socioeconomic and structural drivers of behavior; it distinguishes natural, human, social, technological, and financial capital (e.g., Below et al., 2012; Li et al., 2017; Wheeler et al., 2013). Finally, there are other studies that use no or no explicit theoretical or conceptual backdrop (e.g., Haden et al., 2012; Larcher et al., 2016).

All of the above-cited studies collect their main data using standardized surveys. They consider a variety of drivers for adaptive behavior. The most frequently studied variables are risk perception, also called threat appraisal in PMT, perceived cost or cost-effectiveness (see also Hanger-Kopp, 2021), and climate change perception. We find that few studies explore the influence of institutional structures and policies and regulations on farmers' adaptation behavior. For example, Eakin et al., (2019) explore knowledge-seeking and learning, availability of information, and institutional factors as indicators of adaptive capacity, yet not as actual drivers of behavior. If at all, public and private policies are assessed individually and independently from other potential drivers (Deryugina & Barrett, 2015; Goodwin & Smith, 2013). However, particularly in high-income countries, public and private institutional constraints may be dense and complex enough to overrule many of a farmer's personal preferences.

Across the board, the empirical studies cited here explain risk management and adaptive behavior only in part. Indeed, similar methods applied in the flood risk management context have been generally questioned as to their usefulness (Seebauer & Babcicky, 2020). The direction of influence of specific variables is unclear not only across studies but also within the same study. The influencing factors considered are predetermined by the study design and the psychological models tested, even if interview-based pilots inform some of them (Hanger-Kopp, 2021). Thus, apart from institutional drivers, other practical considerations such as natural constraints are not part of the emerging models explaining DRM behavior. Indeed, some researchers suggest that qualitative in-depth approaches are better suited for understanding some of the subjective, mental models underlying farmers' DRM decisions (Morgan, 2002). Compared to standardized surveys, such approaches may provide a view on the complexity of decision strategies different from psychological and economic models but equally if not more informative. There are some qualitative frameworks for investigating the drivers of farmers' adaptive behavior. For instance, Mitter et al. (2019) uses MPPACC in a qualitative study. Feola et al. (2015), by contrast, provides a very comprehensive framework looking at decision models, scale interactions, and temporal dynamics. The potentially relevant literature is vast, and similar approaches can be found under different names, thus a comprehensive review would go beyond this paper. Therefore, here, we focus only on approaches that explicitly employ mental models. We do this to put clear boundaries on our target literature and also because we believe that such approaches are best for developing a decision space method.

2.2 Mental model-based studies

A small, recent set of empirical research uses the concept of mental models to gain a better understanding of the management of drought and other climate risks. Jones et al., (2011 p. 45) defines mental models as "…personal, internal representations of external reality that people use to interact with the world around them." They may serve to reason, make decisions, and influence individual behavior. Mental models are cognitive, dynamic, and incomplete abstractions of complex systems. Illustrating and understanding them may inform policies and tools to enhance effective risk management (Jones et al., 2011). However, mental models are able to reflect heterogeneous world views and values, and thus may vary among social contexts. They are difficult to elicit as people may draw on different mental models, such as ones indicative of what they do, which operate long-term, and others that are indicative of what they say, operating in the short-term (Argyris & Schon, 1974, cited in Jones et al., 2011). This has to be taken into account in the elicitation process, as for example, perceived social desirability may create biased data. The studies reviewed here are based on qualitative interviews, which still constitute a niche approach among empirical studies of DRM behavior compared to the mainstream ones reviewed in the previous section. We cannot detect a consistent trend in the application of mental models similar to that of survey-based studies. However, the few existing mental model studies in the context of DRM highlight the manifold uses of the concept.

Farmar-Bowers and Lane (2009), for example, use a grounded theoretical approach to identify rationales underlying the decision strategies of 30 farmers. They unravel the complexity of such processes and the usefulness of systems-thinking to make sense of them. Findlater et al. (2018) more narrowly focus on one specific adaptation strategy and its causal factors based on 30 in-depth interviews with farmers. Compared to the completely open narratives Farmar-Browers and Lane operate with, Findlater et al. work with very clear, prompting concepts to be able to statistically analyze their results and substantiate their claims on causalities with respect to drivers. Eakin et al. (2019) elicit 48 mental models of urban DRM combining open-ended and prompted interview components. They argue that mental models underlie the narratives of DRM, which in turn are indicative of the kind of action taken. Based on qualitative data, they identify clusters of terms that are indicative of meta-narratives and illustrate salient discourses on DRM. Eitzinger et al. (2018)

compare mental models on climate risks from experts (13) and farmers (58) in a set of qualitative interviews with a quantitative ranking component with respect to perceived barriers to action against climate risks.

These studies show how the type of interview protocol to some extent determines the types of analyses possible, and at the same time, the diverse qualitative and quantitative ways in which research can make use of mental models. Most importantly, these are examples of how to systematically analyze qualitative interview data.

Here, we contribute to this body of research, proposing a framework that uses mental models to illustrate farmers' decision spaces. This paper proposes a novel, largely qualitative approach that focuses on the depth of information and level of detail to unravel the complexities underlying DRM options and the factors constraining and enabling them. It holds the promise of further development using more sophisticated analytical methods such as those proposed elsewhere (Eakin et al., 2019; Findlater et al., 2018; LaMere et al., 2020), and to ultimately infer meta-models of decision spaces. We use high-income and increasingly drought-affected Austria as a case study.

3 Data collection and analysis

3.1 Analytical framework: mental models of farmers' decision spaces

Within the concept of decision spaces, we describe the effective choices available to farmers with respect to DRM, as well as the influencing factors that enable or constrain respective choices. The concept is open to any possible factors, ranging from the natural environment, technology, and institutions, to attitudes and values. Bossert (1998), who explicitly uses the term, describes a decision space as the range of options available to a decision-maker including the limitations of these options through other agents. Based on Principal Agent Theory, the principal agent in Bossert's research is the central government vis-à-vis the local agent, the decentralized government. The concept provides an elegant way to highlight institutional constraints, which thus far—if at all—were considered add-ons to the behavioral models as described in Sect. 2.1. However, Bossert does not consider any other factors. Ostrom's frameworks for institutional analysis (Ostrom, 2005) and socio-ecological systems (Ostrom, 2007) may have some similar components, as their ideas have been incorporated, for example, in the integrative actor-centered framework (IAC) (Feola & Binder, 2010). However, we find that the focus is ultimately different, as predefined categories focus on largely predefined drivers, which are more difficult to align with the mental model construct. Finally, frameworks might go beyond the idea of decision spaces. For example, Feola et al. (2015) consider decision-making models in only one dimension in a meta-analysis of studies of farmer's behavior, apart from cross-scale pressures and temporal dynamics.

Figure 1 illustrates the idea of decision space as we apply it to farmers with respect to DRM. It reflects a stylized version of our quasi-hypotheses (quasi because they do not draw on theories but rather are anticipated relationships that emerged from exploratory expert interviews in related research, our own expert and tacit knowledge of the field, and recent policy developments particularly with respect to insurance). We thus assume that the natural environment restricts farmers' decision spaces, and the structure and type of operation of a farm, especially if it has been run for several generations. Moreover, governments and markets restrict farmers' decision options. Personal attitudes, values, and

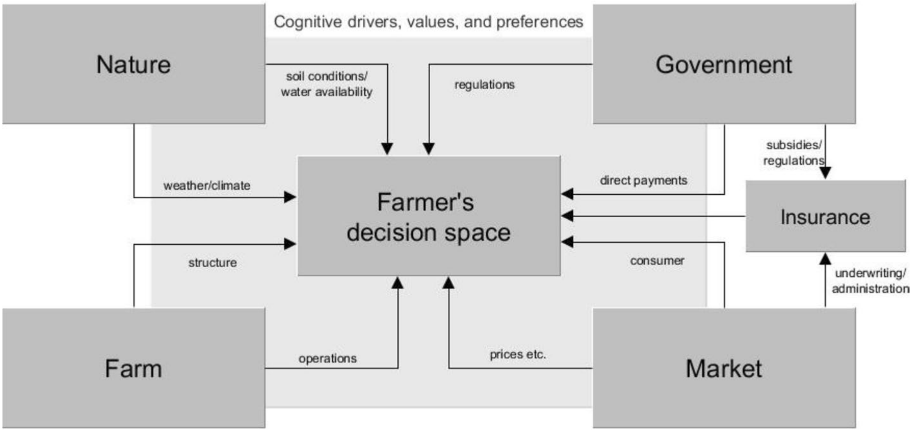

Fig. 1 Stylized diagram of assumed factors shaping decision spaces of Austrian farmers. The labeled arrows provide examples of influences, whereas the dotted arrows indicate relationships that are potentially relevant but are more likely to remain obscure in this approach. (*Source*: own design)

believes of farmers with respect to these different influencing factors are likely to remain implicit in this elicitation as well. Different elicitation methods are more suitable to investigate these variables. At this point in the development of the framework, the focus is the relative importance of the overall categories and their more specific aspects rather than on measuring the exact direction and extent of influencing factors. We do this to be able to unravel some of the complex interactions.

Through a mental model lens, we focus on cognitive representations of farmers' decision spaces with respect to DRM. We elicit these mental models indirectly, reconstructing them from text collected in qualitative interviews, as opposed to directly (e.g., asking interviewees to draw a diagrammatic representation of a certain system). In this way, we attempt to reduce prompted themes to a minimum, and by allowing farmers to report on what concerns them the most, we reduce the chance of influencing farmers' answers through our own categories or mapping them to themes initially introduced. Moreover, we believe that such an open and indirect way of eliciting perceived decision spaces will allow us to access the level of complexity as experienced by farmers, and thus only elicit cause-and-effect relationships that are most pertinent in their routines. It is the ability to address complex issues that distinguishes this mental model approach from studies based on standardized surveys. To take full advantage of this method, a clear and standardized coding procedure is crucial for transparent and robust data elicitation and analysis.

3.2 Sampling

We conducted 40 in-depth semi-structured interviews with Austrian farmers between October 2017 and March 2018. This study focuses on predominantly cash-crop-oriented cropping farms to emphasize a diverse set of DRM options. Grassland/animal husbandry, viticulture, and pomiculture rely on the same plant population for several years or even decades, limiting the applicability of DRM measures such as crop and breed selection, crop rotation, and periodical soil management and tillage. We limited the sampling to areas in Austria that are affected by precipitation deficits during the vegetation season. For the summer of 2017, the Austrian Meteorological Institute (ZAMG) (2017) identified regions in the north and east of Lower Austria and Burgenland as the ones most deficient in precipitation compared to the average precipitation from 1981 to 2010 as a reference period.

We used snowball sampling (Biernacki & Waldorf, 1981) to get in touch with farmers fitting these criteria. Several attempts at starting this process were necessary as the initial seed contacts did not lead to sufficient referrals. We tried to diversify based on location, farm size, and with respect to organic vs. conventional farms. We conducted most interviews face-to-face at the respective farms, with few exceptions where farmers visited us or talked to us over the phone. Interviews followed a semi-standardized protocol (see annex), pre-tested on five farmers.

3.3 Interview design

The interview protocol consisted of two components, a standardized section to establish farmers' profiles, as well as a section with exclusively open-ended questions adding prompted themes to account for certain topics that we wanted to cover such as financial risk management instruments. The full interview protocol can be found in annex 1. Each interview started with the broad question "What are the most difficult challenges to your farming endeavor?". Only if wheater-related risks and droughts were not mentioned in the answer, did we prompt for these topics. We then moved on to ask about the measures that farmers employ with respect to drought. We did not prompt for any measures at first, to gain insight on what measures farmers associate with DRM. If no further measures were offered, we prompted for hitherto unmentioned DRM measures. We used the elaboration on these measures to elicit the implied constraining and enabling factors without creating a prompting bias.

The interviews lasted on average 45–75 min. We recorded and transcribed all interviews and analyzed them with the qualitative data analysis software NVivo. The benefit of semi-structured interviews is that they create less bias by providing predetermined answer categories and allow the elicitation of complex relationships as perceived by the interviewees. The results thus reflect issues that are most salient and most important to the farmers. In general, this method for data collection is preferred over standardized methods when eliciting mental models (Morgan et al., 2002). Collecting data via semi-structured interviews are resource intensive and usually constrain sample size. Considering data saturation is thus crucial.

3.4 Data saturation

In general, there is no defined sample size for qualitative studies. However, there is a scientific understanding that 30–50 interviews is enough for such analyses (Burmeister & Aitken, 2012; Guest et al., 2006). To work with an adequate number of interviews with the aim to reach data saturation in our study, we followed the general principle of "no new data, no new themes, no new coding" as proposed by Guest et al. (2006). Mason (2010) phrased it slightly differently, however, following the same approach: that data saturation in qualitative research is reached when the collection of new data does not shed any further light on the issue under investigation. Based on this, we continued to interview farmers until the interviewer experienced identical/similar answers to the majority of prompted questions and subsequently moved to a different study region. There, we again conducted interviews until no additional insights could be gained. According to Bernard (2012), the number of interviews needed for a qualitative study to reach data saturation is a number that cannot be quantified; rather, a researcher takes what s/he can get. This concept was used to further define our sample size in a sense that interviews were conducted until March 2018 but not any later as growing season started by then and it was difficult to motivate farmers to participate in an interview.

3.5 Coding procedure

We elicited mental models in two rounds of coding. The first round served two objectives: first, to elicit the different management measures farmers associate with DRM, and second to identify the implicitly associated enabling and constraining factors for these measures. This round of coding was guided by predefined categories informed by behavioral theories but also paying attention to public and private institutional components, which are our particular interest. At this stage, we excluded two interviews due to strong differences in responses and production focus compared to all others, and subsequently worked with 38 interviews for further analyses.

In a second coding step, we explicitly focused on the quantitative occurrence of certain themes reflecting the dominant enabling and constraining factors of farmers' decision spaces. This serves to illustrate the decision space of Austrian crop farmers and hence the spectrum of factors influencing their actions. In an inductive process, we arrived at three broad categories of themes, each subdivided into 4–6 subcategories, i.e., 15 categories overall: (1) external enablers/constraints: factors that the farmer cannot control; (2) farm-related enablers/constraints: factors primarily related to farm management practices; (3) individual enablers/constraints: factors primarily determined by the farmer's personality and attitude.

Two researchers developed the main structure coding four interviews in parallel. Coding agreement was high at a mean of 98.19% and standard deviation of 2.24. One researcher coded the remaining 34 interviews, according to the agreed structure, adapting and fine-tuning minor aspects where necessary. We excluded prompted statements even though they might have been related to a coding category, to reduce overrepresentation of certain topics that were discussed in depth in the interviews for other purposes. Based on NVivo results, we calculated coverage percentages as text coded for one code relative to the total coded text per interview. Then, we summarized the percentages of all interviews for each code.

3.6 Farm and farmers' profiles

On average and compared to farm sizes across Austria, the farm size was large, with almost half of all farms larger than 100 hectares, and as many between 30 and 99 hectares. This is due to our focus on cropping farms, which tend to be the largest. Indeed, three quarters of interviewees mainly rely on crop production, five farms were holdings for animal husbandry (including forage cropping), and an equal number's principal source of income was vegetable/fruit production. About half of the farmers use conventional and half use organic farming practices, which is not representative for Austria where only just over 20% of farms operate based on organic principles. In addition, 80% of farms were purely agricultural holdings, whereas 20% were combined with some other form of business, e.g. selling products directly on the farm. This coincides with the fact that for most interviewees (85%), agriculture was their principal source of income. Compared to the Austrian average, 36% of farms serve as the principal source of income vs. 56% of farms providing a supplementary source of income (Ministry for Tourism & Sustainability, 2018); the large share of

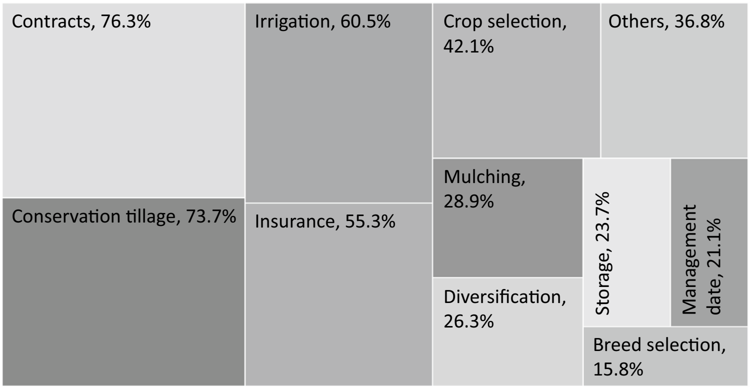

Fig. 2 Risk management measures affecting drought risk taken by interviewed farmers. The size of the squares indicates the relative frequency of each measure across interviews. (*Source*: own design)

principal-income farms in this study could also be explained by the focus on (large) arable cropping farms.

The analyzed interviews were conducted with 36 male and 2 female farmers between 25 and 61 years of age. Women who responded to our initial inquiry usually referred us to their husbands for any questions with respect to farm management. Even those who were legal owners were usually not in charge of running the farm. Twenty-six interviewees were both the owner and manager of the respective farm, whereas six were the managers only and seven were the managing successor of the respective farm. In 75% of cases, farm succession was open; for the other 25%, it was settled. Most interviewees (17) had graduated from high school, seven held a university degree, and the remainder held varying lower-level professional degrees.

4 Results

Here, we first present the DRM measures dominating farmers' mental models. Second, we describe a subset of measures, and their specific decision spaces in detail. Finally, we present an overview of the DRM decision space of the interviewed farmers.

4.1 DRM measures

We asked farmers what measures they took with respect to drought. Unprompted, 39.5% of interviewees first mentioned irrigation; the other percentages were 21.1% for soil management measures and crop selection, 7.9% for insurance, and 10.4% for other measures (diversification, plant protection, sowing rate, and additional fodder purchase). In addition, 5.3% of farmers initially highlighted that there is nothing they can do against drought at all. When prompted, 75% farmers confirmed the use of traditional commodity-based contracts as their preferred financial hedging instrument, although not explicitly to manage drought risk. Figure 2 shows the relative frequency of each measure taken across interviews, both prompted and unprompted.

Across interviews, there is no uniform understanding of what management practices are suited best or are the most effective for addressing drought. The complexity of DRM decisions, because they are so tightly linked to other management decisions and influenced by a wide variety of factors, did not allow for any clear distinction between farmers who manage drought risk more or better than others.

4.2 Factors determining individual risk management measures

Here, we present the prevailing risk management measures and the perceived decision spaces, where influencing factors are listed based on frequency of occurrence across the interviews.

4.2.1 Irrigation

First, 60.5% of interviewees irrigate their fields at least occasionally. Whether a farmer irrigates or not depends on whether water for irrigation and the associated water rights are available. Farmers preferably irrigate crops that fetch a high market price, for example, vegetables and soybeans, even though these crops prefer what is considered low-quality soil. If not for the prices, farmers would rather irrigate high-quality soil, which has a better water-holding capacity.

The perception of whether irrigation "pays off" is very important, as farmers consider irrigation a strenuous and tedious job, most importantly, because effective irrigation is achieved ideally during nighttime (i.e., between 10 pm and 4 am), and the infrastructure needs to be moved and reassembled, every few hours. Moreover, it requires regular checks with respect to its proper functioning. Thus, the location of fields (i.e., whether they are close together or far apart) and their sizes (i.e., whether they are large enough) may influence the choice to irrigate as well.

Currently, it is common practice to run irrigation machinery by diesel-driven on-field motor pumps. Only one sixth of irrigating farmers had an electrified irrigation system, and 5.2% of all interviewees experimented with independently developed methods, using a trailer (otherwise used for spreading manure) and directly flooding fields. While the Austrian government provides financial support for the installation of electrified irrigation systems, the initial costs of purchasing and installing the infrastructure are still high and remain a barrier for many to switch to such systems.

4.2.2 Soil management with a focus on tillage

Soil management is among the most important but at the same time most complex means of achieving sustainable farming. It serves several purposes including DRM. While there is a long list of measures pertaining to this category, we focus on those that Austrian interviewees mentioned, i.e., adapted tillage practices, mulching, and adapted soil management schedules.

Of the farmers interviewed, 73.7% either practiced reduced tillage or no tillage at all, yet only 20% mentioned this as a DRM option unprompted; 28.9% of farmers practiced mulching, whereas 21.1% shifted invasive soil management practices such as conventional tillage into fall, when their negative impact on soil water evaporation is reduced.

Soil characteristics determined the tillage practices employed. Heavy and moist soils need a deeper turnover than light soils. One farmer said he would rather do nothing than work his land under conditions that are too moist. Smaller farmers mentioned their dependency on large harvesting machines from machinery cooperatives; they are less flexible in respecting soil conditions because of that. Harvesting under moist soil conditions could lead to soil compaction, which can only be remedied with conventional tillage. In case of drought, plants suck water and nutrients from lower soil horizons, which may result in a depletion of nutrients in the lower soil; therefore, some farmers either applied tillage every 4–6 years according to their crop rotation or planned to restart including some tillage at least after some time. Tillage is even necessary for these reasons after harvesting crops such as corn, sugar beet, and potatoes.

Reduced tillage is considered less time consuming as less time is spent on the field. Many farmers mentioned the possibility of reducing costs for reduced tillage practices. Conventional tillage in particular requires much time and expensive tractor fuel. Farmers said that both labor and fuel expenses can be reduced in half by avoiding conventional tilling. However, only 5.3% of farmers explicitly mentioned the public financial incentives from the Austrian Program for Sustainable Agriculture (ÖPUL) to adapt soil management practices.

Reduced tillage has both considerable positive and negative side-effects as highlighted by many farmers. On the one hand, it increases the humus content (soil organic carbon), reduces soil water evaporation due to the improved water-holding capacity of organic soil matter, preserves/stimulates soil organisms, improves soil structure and hence further improves water-holding capacity, and reduces erosion. On the other hand, many weeds and plant diseases can only be controlled when they are deeply “buried” by tillage. Also, mulching might promote the growth of pests and diseases due to the moist and warm micro-climate in the mulching layer. This was one of the main concerns of organic farmers since their chemical weed management options are limited.

4.2.3 Crop selection

Of the farmers interviewed, 57.9% select drought-tolerant crops or breeds to manage drought risk. Most farmers considered the selection of alternative crops more effective than choosing certain breeds of a given crop, e.g., a heat-tolerant breed. From their experience, only a limited choice of drought-tolerant breeds (across all crops) is currently available, and planting them will not result in major improvements regarding drought risk. For example, a farmer would rather choose between growing rye and corn than choosing a drought-resistant corn breed. For grains, most farmers switched from summer crops to winter crops as the latter take advantage of the precipitation and humidity during winter and are not subject to summer drought.

Market prices were the most prominently mentioned factor influencing the decision of which crops or breeds are planted, as 76.3% of the farmers held commodity-based contracts with trading partners such as retailers and processing firms. These contracts often come with fixed terms regarding the planted area of the contracted crop or breed and the price farmers will receive. Even stricter conditions apply when farmers propagate seeds for the market, which is a highly profitable alternative compared to growing crops for other purposes, as breeding companies dictate both the exact area as well as the type of seeds for propagation. Another market-related influencing factor included marketing strategies, opportunities, and consumer behavior. One farmer explicitly mentioned that he would very much like to produce sorghum as a crop tolerant to drought that is easy to cultivate, but there was no demand for it due to the Austrian diet (which hardly includes sorghum).

Compared to market-related factors, weather conditions play a minor role for the selection of crops and breeds. One farmer mentioned that he cannot afford to produce drought-tolerant crops and breeds exclusively because they will yield lower average quantities.

Local environmental conditions including soil properties were frequently mentioned as factors influencing the selection of crops and breeds. This includes the location of the farm and respective climatic conditions and precipitation. A common statement was that the key to success is to know the conditions of your land in detail and organize your production accordingly. Farmers would rather plant crops with a higher water demand on better soils and vice versa. This can be slightly altered by irrigation but as mentioned earlier, irrigation itself depends on soil conditions. One farmer mentioned that one would take the risk of occasionally planting crops that do not match the existing soil and weather conditions to earn the higher market prices of that respective crop. In connection with soil conditions, crop rotation also influenced farmers' decisions on which crops to plant. The farmers paid major attention to preventing pests and diseases affecting crops planted consecutively and balancing soil nutrients. Other factors influencing plant selection were irrigation availability, required machinery, labor input, and personal preferences.

4.2.4 Insurance

None of the interviewees initially mentioned insurance as a means to manage drought risk. However, because drought insurance is the only financial measure that directly addresses drought, we prompted the topic after discussing production-based DRM measures. Of the farmers interviewed, 55.3% were insured against drought, as part of a multi-peril insurance package provided by the only crop insurance supplier in Austria. Only 7.9% had bought recently introduced index-based insurance products, where claim payments are triggered exclusively by meteorological and hydrological indicators and are independent from actual losses incurred. Since 2016, both the multi-peril and the index insurance premiums are publicly subsidized up to 55% by the Austrian government.

However, 5.3% of the farmers mentioned that, for the crops they plant, there is no drought insurance available. Currently, drought insurance is available for common winter crops only. One of the interviewees pointed out that the insurance company cut out summer crops because they feared that farmers would then plant more drought-sensitive summer crops. Yield-based products tend to discourage farmers from irrigating their crops. In contrast, farmers who commonly apply irrigation chose not to buy drought insurance. Also, for irrigation-intensive crops such as vegetables, there is currently no drought insurance available in Austria.

In northeastern Austria, where drought has only recently started to occur, all farmers held drought insurance and classified this measure as being more important and effective compared to farmers to the east of Vienna, who have lived with drought risk for much longer. One statement reflecting many farmers' attitude was, "It's not worth it," meaning that the expected pay-outs for damages do not equal the premiums paid for the policy. This suggests that farmers expect insurance to work more like a savings account than like a safety net. Only 13.2% of all farmers bought insurance primarily to feel safe.

4.3 Farmers' decision spaces

As shown in Fig. 3, 56.3% of farmers' decision space for DRM is dominated by four major influencing factors: natural influences (18.2%), private (15.4%) and public

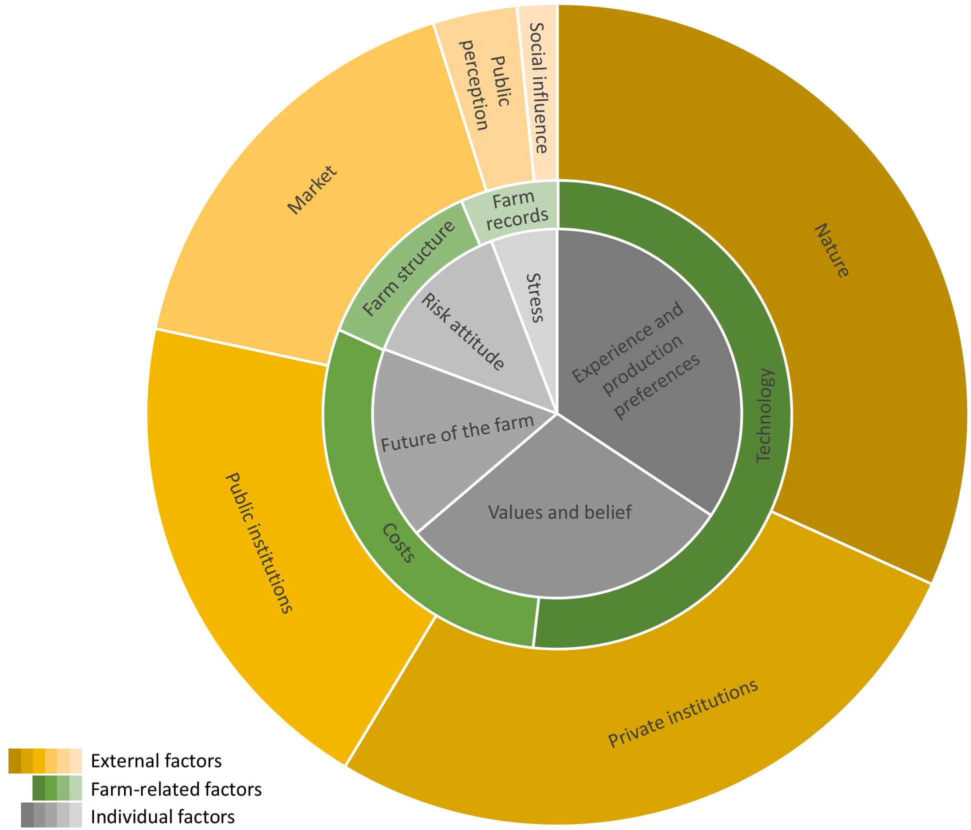

Fig. 3 Farmers' mental decision space, defined by external, farm-related, and individual influencing factors. Segment areas are representative of coding percentages, within factor levels and across the entire graph. (*Source*: own design)

Table 1 Coding structure and numeric coding results

Node name	Description	Examples	Number of codes	Coverage (%)	Coded interviews
External influences	Influencing factors outside a farmers' direct influence			***57.3***	
Nature	Incudes weather, soil properties (also resulting from location/region), water availability, and characteristics of the living matter (plants, pests…)	When you grow different crops at your farm and practices crop rotation, you can usually say that some crop will develop badly but any other will do better. Drought however affects all crops across the board and therefore is very difficult to handle	272	18.2	38 (100%)
Private institutions	Includes behavior and rules of retailers and breeding companies, insurance design, and resulting effects	The largest part or your products are sold to large-scale retailers and local processing firms. We always try to have yield-based contracts with our trading partners to secure prices. On the other hand, we also must comply with the contracted	191	15.4	38 (100%)
Public institutions	Includes public regulations and laws, for example linked to direct payments, and other subsidies	When everyone's production is publicly subsidized, everyone will continue to invest, and supply will increase without limits	180	11.3	37 (97.4%)
Market	Includes market mechanisms such as supply and demand, prices (and development), and any effect resulting from the interaction of private institutions	Futures provide secure hedging. When prices are not good, nobody will make a contract anyways. When prices are good, I will sign a contract. Then I also don't care if prices raise afterwards	159	9.6	37 (97.4%)
Public perception	Includes consumer behavior/preferences, farmer's image, and public acceptance of farmers/farming	We constantly have to listen to arguments where and how much subsidies we receive and that prices can be low as well	39	1.9	23 (60.5%)
Social influence	Includes ideas and production preferences influenced/informed by peers	There is a network of colleagues in our neighborhood intensely engaged in this topic	23	0.9	14 (36.8%)
Farm-related influences	Influencing factors within a farmer's influence			***22.0***	

Table 1 (continued)

Node name	Description	Examples	Number of codes	Coverage (%)	Coded interviews
Technology	Includes production techniques like crop rotation, mechanic weeding, and technology affecting decisions or options available	Now and then, plowing might be reasonable. Because we didn't plow for years, we now have the problem, that the subsoil is depleted. Plowing brings organic matter and nutrients into the subsoil	170	11.4	38 (100%)
Costs	Includes actual financial or time investment in technology or labor Costs entail an investment of either time, labor or any other effort that is then missing elsewhere	One has to buy seed and so forth. Up till a certain size it is not worth buying machines yourself, … All these expenses are not insignificant	138	6.6	36 (94.7%)
Farm structure	Includes size, spatial distribution of arable land, and production focus of the farm	We are not able to irrigate. Also, our fields are distributed over a large area and the average size of the fields is 2–3 ha. Of course, if we had fields of 10/20 ha in size, irrigation would pay off	35	2.6	22 (57.9%)
Farm records and expertise	Includes expertise and experience gained by trial and error, as well as on-farm data records related to weather or yield	We keep precipitation and temperature records and notice, that precipitation amounts altogether do not decrease but that timespans between precipitation events continuously extend	31	1.4	18 (47.4%)
Individual influences	Influencing factors related to the farmer as an individual			***20.7***	
Personal experience and preferences	Includes action-related statements based on personal preferences, heuristics and gut feeling and statements based on measures taken which differ from conservative management practices. This is very much related to adaptive and sustainable behavior, also reflects a certain amount of flexibility, diversification	Personally, I prefer long-growing breeds. They are better able to compete against weeds	125	7.1	34 (89.5%)

Table 1 (continued)

Node name	Description	Examples	Number of codes	Coverage (%)	Coded interviews
Values and belief	Includes value statements related to idealism for farming, identification with the job/farm/land, questions of justice and fairness	This is very sad for me. We feed mankind and receive a bagatelle. In fact, all of us farmers are just idealists	71	6.1	32 (84.2%)
Future of the farm	Includes both future of the farm and farming in general	In agriculture we are always at our limits. Everyone working outside on a tractor would like to survive without depending on subsidies and support measures	57	3.5	27 (71.1%)
Risk attitude	Fundamentally, like economic risk attitudes (risk averse, risk neutral, risk prone), but obviously more differentiated. For now, include external locus of control, i.e. perception of your own influence on outcomes	In reality, our business includes a lot of gambling. I live with that as I always did	96	2.8	32 (84.2%)
Stress	Includes stressful situations potentially linked to survival issues which might cause stress	Nobody likes to do that. Irrigation is very time consuming and stressful. You are only allowed to irrigate during the night times, you get specific times assigned. You constantly have to check the irrigation system. Family life is not fun anymore	23	1.2	15 (39.5%)

External, farm-related, and individual factors are presented with respective subcategories (=codes)

(11.3%) institutional influences, and technical influences (11.4%). Apart from technical influences, which are directly related to the farm, all of these are external influencing factors. Individual factors are less visible in the decision spaces. Table 1 provides the quantitative underpinning for these numbers, listing all coding categories and their rationale, illustrative examples, as well as the frequency of each code, the coverage in percentage of the entire text coded, and the number of interviews reporting the codes.

Natural influences comprise climate/weather, soil properties, water availability, and plant characteristics. They are fundamental to any decision and tightly linked to the technical possibilities available to farmers. These include production techniques such as crop rotation, mechanic weeding, irrigation, and available technologies, the effectiveness of which depends on the natural properties of the soil.

Institutional influences refer to the behaviors and rules of public and private institutions. This can be regulations and subsidies on behalf of the government such as compliance with specified harvesting, soil management, and sowing dates and periods to receive compensation payments for reduced tillage practices. Private institutional influences include restrictions or incentives in terms of product supply and demand imposed by retailers, breeding companies, and insurers on the private side, for example, the availability or absence of drought insurance for certain crops or the compulsory cultivation of a specified area of land with a certain crop as the base for a contract with a grain retailer.

Market-based influences (9.6%) are closely related to private institutional influences and together are the dominant factor in a farmer's decision space. This category subsumes more abstract references to the market rather than its actors, particularly price fluctuations.

Farmers frequently referred to costs (6.6%) associated with DRM decisions. These include both fixed costs (e.g., labor) and variable costs (monetary expenses for the production), even if the two are often distinct.

Personal experience and production preferences are of the same magnitude (7.1%). They reference the reliance of farmers on their gut feeling and years if not decades of work on the farm. Often such statements also reflect adaptive and sustainable behavior, flexibility, and innovative farming activities such as diversifying farming products or the introduction of new machinery.

Remarks indicating values and beliefs (6.1%) in the discussion of risk management refer to the idealism that is required in farming and related to the strong identification with farm life, but they also indicate ideas of what is considered fair. Closely related feelings are about the future of the farm (3.5%), which for many is uncertain. The general trend in Austria, where mostly small farms give up in the struggle to survive market liberalizations, reflects these farmers' outlooks.

Much less visible in our mental model are public perception (1.9%), stress (1.2%), and farm-related influences such as structural aspects (2.6%) including farm size and location, and farm records and experiments (1.4%). Social influences, that is, interactions with peers and information from other external sources, are rarely mentioned (0.9%) and infrequently covered. This is interesting as standardized surveys identify peers as important sources of information for farmers specifically with respect to DRM (Palka & Hanger-Kopp, 2020). In contrast, over 84% of interviewees expressed their risk attitude as factor influencing their drought risk management; however, rather implicitly. One farmer for example mentioned that he once tried to grow some new varieties, but did not achieve the expected yield and therefore now prefers to grow varieties with "safe" yields. Only 2.8% of all farmers explicitly addressed their personal risk attitude when explaining their drought risk management.

5 Discussion and conclusions

In this study, we explored farmers' decision spaces with respect to DRM using a novel analytical framework. Our method combines the concept of decision spaces with a mental model approach in an attempt to explore adaptive behavior from a different angle than standardized surveys and the associated frameworks for adaptive behavior and risk management. We addressed the following applied research questions: (1) Which DRM measures do farmers use? (2) What are the dominant constraining and enabling factors of DRM? Here, we first summarize and discuss the two applied research questions and then reflect on the benefits and limitations and potential development of the proposed framework.

38 interviews with Austrian farmres reveal in-depth information on the complex interlinkages of available DRM measures. These are usually not reflected in quantitative survey-based studies, which use predetermined sets of measures for drought risk measures. Our results support that it is very difficult to distinguish DRM measures and thus most climate adaptation measures from other risk management measures. Indeed, farmers consider production-related measures first, which are, apart from irrigation, not primarily DRM measures. This is in line with findings from Eitzinger et al. (2018), who find that farmers have a very holistic approach and their mental models are shaped by production risks in general (UNDRR, 2021).

Relying on irrigation as a DRM measure could become critical in regions under water stress, when agricultural water demand is competing with other sectoral water demands. Farmers in our study do not associate financial hedging, not even drought risk insurance, with DRM unless prompted. This is relevant, as such financial measures to manage climate risks, especially drought risk insurance, are increasingly promoted at higher levels of governance such as by the European Union (European Court of Auditors (ECA), 2019) and the World Bank (World Bank, 2021). Although many farmers have drought insurance, this is rarely a conscious or deliberate choice, as some drought coverage is automatically included in the basic agricultural insurance package for many standard crops. Few farmers had purchased additional coverage in the form of a recently introduced index-based drought product. Likely due to the complex linkages between different risk management methods and influencing factors, and/or the relatively small sample of our study, it was not possible to generate any kind of index or categories for ranking farmers based on the types of DRM measures taken.

The complexities of on-farm risk management measures highlight that any DRM decision implies effects and trade-offs for at least one but more likely several elements of the environmental system, e.g., soil quality, biodiversity, water availability, and water quality. Understanding DRM decisions is thus an integral aspect in achieving the sustainable development goals (SDG): most prominently SDG 15—Life on land, aiming to protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. However, SDGs on water, climate action, and zero hunger are also objectives that rely on managing drought risk in agriculture.

From a mental model perspective, environmental, technological, and market-related influencing factors dominate farmers' subjectively constructed decision space. Moreover, public institutional enablers and constraints are also very much on farmers' minds, including compliance to receive compensation payments and subsidies for measures supporting drought management (e.g., for electrified irrigation or drought insurance products). In contrast, personal attitudes, values, and believes, which would distinguish different worldviews, may be less important or remain largely undiscovered. Thus, the most important influencing factors in our study differ very much from those explored and exposed in more common survey studies cited in Sect. 2. This does not mean that risk perception is not a significant factor, as it may play into farmer's decision-making perhaps on a subconscious level that does not become evident in their mental models. However, it justifies asking, how important is risk perception as a driver in cases when the decision space is strongly constrained by other more tangible influencing factors, such as environmental, technical, and institutional ones? This describes for example farming and regulation in the agricultural sector in the EU and its Member States. It also corresponds with findings by Findlater et al. (2018), who identified risk perception as an underlying driver in the context of a South African agricultural sector, which is much less regulated than Austria. Our approach also allows the consideration of risk attitudes to some extent. However, it is more difficult to identify underlying values and beliefs this way, although they are implied sometimes, such as for example, financial and time constraints attached to DRM measures. These compare to aspects of adaptation appraisal in the MPPACC framework. We thus propose that the decision space approach using mental models is complementary to standardized surveys on adaptive behavior. It delineates the perceived external factors that constrain farmer's personal decision space, i.e., the space where risk perception, attitudinal factors, and values are able to operate. This space shrinks with higher and stricter regulations, extremer environmental conditions (e.g., climate, soil) and decreasing financial and technological resources.

This study is the first step in developing an analytical framework built around the mental model approach and the idea of decision spaces. The idea of decision spaces is different to many approaches in that it does not directly focus on the drivers of behavior but also illustrates the more tangible factors influencing and reducing the space where drivers, such as risk perception and attitudes, can take effect. While elsewhere this might be considered only in a descriptive fashion, if at all, we explore these factors as part of the mental model.

In this approach, the precise interview strategy (i.e., the formulation and order of questions, which includes prompting [or not] for certain themes) was key, and the exploration of decision spaces was purely inductive. This is exceptional as other qualitative studies have frequently used mixed approaches, thus prompting for certain components of a framework (e.g., Mitter et al., 2019), which could introduce a bias. At this point, we consider the qualitative analysis of decision spaces to be useful, but with room for improvement as to its more systematic presentation. The quantitative part is still of limited analytical value. More sophisticated approaches exist that may be valuable to explore (Eakin et al., 2019; Findlater et al., 2018; LaMere et al., 2020), and also the comparison with results from survey studies can be improved to yield more robust results.

Overall, the major limits of the mental model approach are the potential pitfalls of the elicitation method chosen, and the remaining question of whether a mental model is truly a representation of actual behavior (Jones et al., 2011), issues that may be equally true for standardized survey studies. Eliciting answers indirectly through qualitative interviews, we tried to avoid creating a bias by introducing our own themes and categories for enabling and constraining factors. A direct approach could have provided a chance to proceed more systematically and facilitated data analysis. It might have precluded availability bias by providing categories that have previously been found to be relevant. A combined approach might provide an ideal solution but requires considerably more time and resources on all sides involved. We believe that our indirect approach helps to reduce the second challenge of potentially missing the actual *models in use* to some extent, as it allowed farmers to talk about what they felt most comfortable and familiar with. However, there is no guarantee that both mental and actual behavioral models completely overlap. This also means that we cannot say what influencing factors ultimately determine their decisions. It is noteworthy that most often farmers will talk about restrictions on their decision space but often imply enabling aspects as the figurative other side of the coin, i.e., trade-offs that render decision-making even more challenging. Thus, to generalize our analytical approach beyond a country-specific policy context, the perceived direction of an influencing factor may not be relevant.

Because of the approach used, we cannot generalize these results beyond the farmers interviewed. Data saturation indicates that results are probably generalizable for the regions investigated. It was not our primary objective in this study to identifying generalizable results across countries; however, it would probably be difficult even for countries with a similar developmental status and a similarly structured and highly regulated agricultural sector. Studies using similar approaches, such as cited in Sect. 2, targeted countries with very different agricultural sectors and economies. Even were that not the case, the dependent variable is usually framed inconsistently, thus challenging comparability. Many qualitative studies on agricultural adaptation put little emphasis on the detail of the actual adaptation measures and contextual factors (Mitter et al., 2019), whereas others single out individual measures (Findlater et al., 2018). Another reason may be the somewhat different framing: DRM in this study vs. more generic climate change adaptation in many other studies (although measures tend to be the same). For instance, we found that a framework on trade-offs in adaptation to climate change in Sweden and Finland produced similar results on adaptation measures/decisions as presented here for DRM measures (Wiréhn et al., 2020). The lack of comparable results does not affect the applicability of this approach, which we believe has much potential to complement standardized surveys in a more systematic way and elevate the position of qualitative in-depth interviews in risk and adaptation research.

In practice, our results could help inform the development of DRM strategies that focus on ex-ante prevention and preparedness measures. They are relevant at multiple levels of decision-making: on the farm, nationally, and even internationally. For example, in the EU, such strategies are receiving increasing attention and will likely remain on the policy agenda given climate change projections and anticipated drought risk.

Appendix 1: Interview protocol[1]

Standardized component		
Farm		
Farm size	Wieviele ha Land bewirtschaften Sie?	< 10 ha 10–29 ha 30–99 ha > 100 ha
Production focus	Was ist Ihr Produktionsschwerpunkt?	Nutztierhaltung Marktfruchtbau Gemüse-/Obstbau Futterbau
Farm sources of income		Rein landwirtschaftlich Kombination mit Gewerbe (z.B. Gasthaus)
Full-time versus Part-time		Haupterwerb Nebenerwerb
Organic versus conventional		Bio Konventionell
Marketing focus		Ab Hof/Direktvermarktung Erzeugergemeinschaft Händler Andere Form der Vermarktung
Nachfolge		Geregelt Offen
Demographics, roles and education		
Geschlecht		Männlich Weiblich
Alter		
Rolle im Betrieb		BesitzerIn BetriebsleiterIn NachfolgerIn Other
Höchste abgeschlossene Bildung		Pflichtschule Matura Hochschule/Uni Lehre/Mittlere Reife Meisterprüfung Landwirtschaftliche Fachschule
Open-ended questions		
Risk perception		

[1] Can be turned into supplementary material upon acceptance.

Standardized component		
Farm		
Challenges/ priorities	Welche Herausforderungen bereiten Ihnen als Landwirt Schwierigkeiten? Können Sie diese Herausforderungen gewichten?	
Weather extremes and drought	Welches Wetter bereitet Ihnen Schwierigkeiten? Spielt Trockenheit eine Rolle? Wenn ja/nein: warum?	
	Was ist bei Dürre schwierig?	
Climate change	Haben sich (in dem, von Ihnen wahrgenommenen Zeitraum) die Witterungsverhältnisse geändert? Wenn ja: wie und wann?	
Drought risk management		
Adaptation behavior	**Welche Maßnahmen setzen Sie um mit Dürre umzugehen?** **> Warum diese Maßnahmen?**	**Main question (unprompted)**
Coping capacity (self-efficacy)	Wie aufwändig ist das? Wieviel kostet das (Arbeitskraft, Energie, Maschinen, …)?	Prompt if not previously mentioned
Adaptation intentions	Sehen Sie in Zukunft noch weitere oder andere Maßnahmen? Was beachten Sie bei längerfristiger/zukünftiger Planung?	
Participating in environmental subsidies scheme	Nehmen Sie am ÖPUL teil? > Bei welchen Maßnahmen? > Warum diese?	
Prompting for additional options		
Soil management	Wie bearbeiten Sie Ihre Böden? Warum so? Spielt eine wassersparende Bearbeitung eine Rolle? Wieviel kostet Bodenbearbeitung (Zeit, Treibstoff, Maschinen, …)?	

Standardized component **Farm**	
Irrigation	Bewässern Sie? Ist Bewässerung eine Option? Warum (nicht)? Wie/was bewässern Sie? Woher beziehen Sie das Wasser? Wieviel kostet Bewässerung (Arbeitskraft, Energie, Maschinen, …)?
Crop selection	Welche Faktoren berücksichtigen Sie bei Sorten-/Kulturwahl und Fruchtfolge? Ist Dürre relevant? Pflanzen Sie hitze-/trockenheitstolerante Sorten? Fallen bei der Sorten-/Kulturwahl und Fruchtfolge und Rücksicht auf Risiken/Dürre Kosten an?
Insurance	Sind sie gegen Wetterrisiken versichert? > Sind sie gegen Wetterrisiken versichert? > Würden Sie andere Maßnahmen setzen, wenn Sie versichert wären? Ist Versicherung eine sinnvolle Möglichkeit, Risiken zu reduzieren? Wie finden Sie das Angebot der Hagelversicherung? Haben Sie im Dürrefall schon einmal Gelder von der Versicherung bezogen?
Financial security	Sind Sie im Fall von Einkommensverlusten finanziell abgesichert? > Wie?
Price hedging instruments	Haben Sie Liefer- und Vorvertrage, Warenterminkontrakte? Haben Sie Lagermöglichkeiten?
Public compensation	Haben Sie schon einmal Gelder des Katastrophenfonds bezogen? > Wie funktioniert die Schadensabwicklung?
Institutional change	2016 wurde das Hagelverischerungförderungsgesetz geändert. Es werden jetzt alle Versicherungsprodukte subventioniert, dafür gibt es keine Kompensation mehr aus dem Katstrophenfonds. Wie sehen Sie diese Änderung? Setzen Sie, seit Sie versichert sind, andere Maßnahmen als davor? Warum?
Public subsidies	Werden Sie bei den von Ihnen gesetzten Maßnahmen aus öffentlicher Hand unterstützt (finanziell, durch Information, …)? Wie könnte Ihrer Meinung nach eine sinnvolle und zweckmäßige Unterstützung beim Umgang mit Dürre aussehen? Wünschen Sie sich (neben/statt der Subventionierung von Versicherungsprämien) andere Unterstützung aus öffentlicher Hand?
Prompting for sources of information	

Standardized component **Farm**	
Sources of information (may imply trust)	Woher beziehen Sie Informationen, um Entscheidungen für Ihren Betrieb zu treffen (z.B. Warndienst der LK, Wetterradar der Hagelversicherung)? > Sind das für Sie zuverlässige Quellen?
Participation in interest groups	Sind Sie in einer Interessensvertretung/einem Verein aktiv (Bauernbund, Landwirtschaftskammer, Verbände, NGOs, Partei, …)?
Social norms	Tauschen Sie sich mit Kollegen aus? > Wie?

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