Risk management and its role in enhancing perceived resilience capacities of farms and farming systems in Europe

Long-term challenges and short-term shocks are inevitable in agriculture and affect the management of any farm or business entity in the farming system. Systematic application of management procedures and practice to the tasks of identifying, assessing, and monitoring risks is often defined as risk management (RM) (e.g., Huirne et al., 2000). We broaden the definition of RM in the context of resilience, including not only strategies to deal with shocks but also with long-term pressures on economic, environmental, and social functions of farms and farming systems. While existing literature mainly considers RM in the context of challenges and risks for economic functions (e.g. Schmit and Roth, 1990; Barry and Ellinger 2012; OECD, 2018), we focus on diverse challenges to the economic, environmental, and social functions of farms and FS and include all RM strategies that can address those challenges. Furthermore, when conceptualizing RM from a resilience perspective, we explicitly highlight that RM should not just be aimed at ensuring short-term robustness, but also enhance capacities to adapt or transform in the medium and long run.

Previous literature provides extensive theoretical and indicator-based assessment of RM and its linkage to resilience in Europe (Dahms, 2010; OECD, 2018). Yet, little attention has been devoted to perceptions of RM, its various components, and its role in enhancing resilience capacities. This article synthesises five major lessons learnt about RM in the context of resilience in Europe based on three types of methodologies (Box 1, Tables 1, 2). In contrast to the majority of the existing literature, we extend the focus to farming systems (FS) and hence opt for a multi-actor approach, including actors that affect and are affected by farmers, e.g., cooperatives, processors, local government, and citizens. To this end, while a survey and interviews were conducted with farmers, focus groups targeted a broader set of actors in the farming system.

Table 1 Overview of the lessons synthesized based on the results of three empirical methods

Lesson	Survey of farmers	Interviews with farmers	Focus groups with stakeholders
Farmers mainly worry about long-term economic challenges, yet some non-economic challenges are equally relevant	Yes	Not addressed	Yes
RM portfolios of farmers are very diverse, and there is demand for RM strategies that target long-term pressures rather than shocks	Yes	Not addressed	Not addressed
FS actors perceive RM as enhancing resilience capacities, especially adaptability	Yes	Yes	Generally yes, with some exceptions across FS
According to farmers, learning was and remains crucial for improving RM and enhancing resilience in the future	Yes	Yes	Yes
Future development of RM strategies requires contributions by all actors in the farming system	Not addressed	Not addressed	Yes

Box 1: Applied methodologies

This article presents the results of three types of empirical research: a farm survey, risk management focus groups, and interviews with farmers. Each methodology was applied in eleven farming systems (FS) across Europe. The FS were selected to construct a sample of heterogeneous farms in terms of size (from <5 ha per farm in the Romanian FS to >1000 ha per farm in the German FS); specialization (we consider different types of livestock and mixed farms, as well as farms specializing in arable crops, perennials, fruits and vegetables); climatic conditions; and political frameworks. ***The farm survey*** (n=996) contained different question formats, including open questions, multiple-choice-questions, and Likert-type-scales, and was conducted in different modes depending on the FS, including face-to-face, phone, mail, and online modes. The survey aimed to capture perceptions of challenges, applied risk management strategies, as well as perceived past, present, and future resilience at the farm level. ***Semi-structured interviews*** (n=130) sought to identify the influencers on farmers' decision-making, explored how attitudes, beliefs

and external factors influence decision-making, identified the learning strategies that farmers adopt and assessed what enables or constrains learning. ***Focus groups*** followed a multi-stakeholder approach (i.e., farmers, farmers' associations and cooperatives, financial institutions and value chain actors) and aimed: (i) to assess how risk management enables or constrains resilience of the FS, and (ii) to develop pathways to improve risk management in the FS. While the same farm survey was used in all the FS, a list of questions and activities was prepared to guide both the focus groups and the interviews, in order to allow cross-farming-system comparison of the results. For instance, each focus group started by identifying the major challenges and risk management strategies in the respective FS. During the interviews, farmers were asked to share their experience of implementing a new practice or learning something new, including sources of information and ways of testing.

Table 2 Sample size across FS for each of the three methods.

Farming system (FS)	Survey	Number of participants in the focus groups (1 focus group per FS)	Semi-structured interviews
Intensifying dairy farming in Flanders, Belgium	220	12	9
Large-scale corporate arable farming in the North-East of Bulgaria	30	6	13
Extensive beef cattle systems in Massif Central, France	50	8	7
Large-scale corporate arable farming in Altmark, Germany	30	6	12
Small-scale hazelnut farms in Lazio, Italy	60	6	12
Intensive arable farming in Veenkolonien, Netherlands	30	5	10
Private family fruit and vegetable farming in Mazovian region, Poland	70	9	9
Small-scale mixed farms in the North-East of Romania	122	5	14
Extensive beef and sheep systems in Central and Northeast of Spain	120	9	14
High-value egg and broiler systems, Sweden	64	5	12
Large-scale corporate arable farming in East England, UK	200	7	18

Lesson 1: Farmers mainly worry about long-term economic challenges, yet some non-economic challenges are equally relevant

Before discussing RM strategies, it is important to understand the most important challenges perceived by farmers. We asked farmers across all eleven FS about the major challenges they expect to face in the next 20 years by using a combination of open and closed survey questions (Spiegel et al., 2019).

In the open question, farmers were asked to list the three major challenges that they expect to face in the coming 20 years. We categorised the challenges along two dimensions: (i) the type of challenge (i.e. economic, environmental, social, and institutional challenges) and (ii) the time horizon (i.e. short-term shocks and long-term pressures). Our findings (Figure 1) reveal that farmers are most often worried about economic challenges and that they perceive long-term pressures (e.g., improving long-term profitability) as more challenging than short-term shocks (e.g., short-term price volatility). As for institutional long-term challenges, changing agricultural policies, Brexit and the Russian trade embargo are mentioned as the major long-term pressure and short-term shocks, respectively. Farm succession is the most cited social long-term pressure, followed by concerns about working conditions and changing social perceptions of agriculture, while lack of workforce contributes to social shocks. Unlike the other three categories of challenges, environmental shocks, namely extreme weather events and pests, weeds and disease outbreaks, are perceived as more challenging than long-term environmental pressure (e.g., climate change).

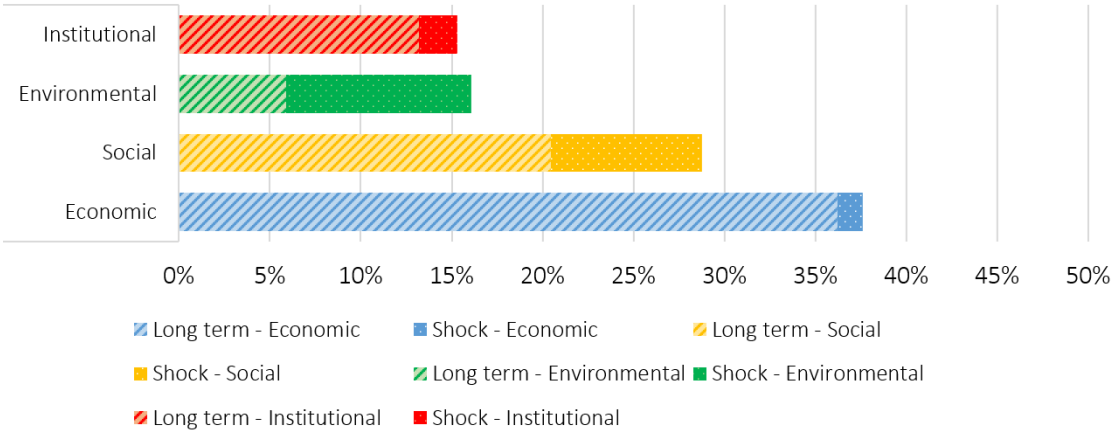

Figure 1 Share of farmers that mentioned different categories of challenges as relevant in the next 20 years. Source: Soriano et al., 2020

Note: Percentages are calculated from a total of 3,544 answers classified by country in: BE (20), BU (87), GE (72), ES (298), FR (124), IT (122), NL (1,703), PL (200), RO (315), SE (109), UK (494). Note that since each respondent could give several answers (or none at all), the number of answers is not proportional to the sample size as presented in Table 2.

The closed question asked farmers to assign a score, ranging from 1 (not challenging at all) to 7 (extremely challenging), to a pre-defined list of future challenges (Figure 2). The majority of farmers (39.4%) scored institutional challenges as the most important for their farms. Environmental challenges were scored as most challenging by 21.34% of respondents; economic challenges by only 16.74%. It is worth noting that the major challenges (at the top of Figure 2) are characterised by left-skewed distributions, meaning that hardly any farmers gave them low scores and indicating that these challenges deserve special attention when designing future RM strategies. Again, the top-three future challenges refer to long-term pressures. The results of both open and closed questions indicate that perceptions of the most severe challenges are shifting from an operational and short-term character towards structural and strategic issues that have a long-term impact on farm businesses, hence supporting our broadened interpretation of RM.

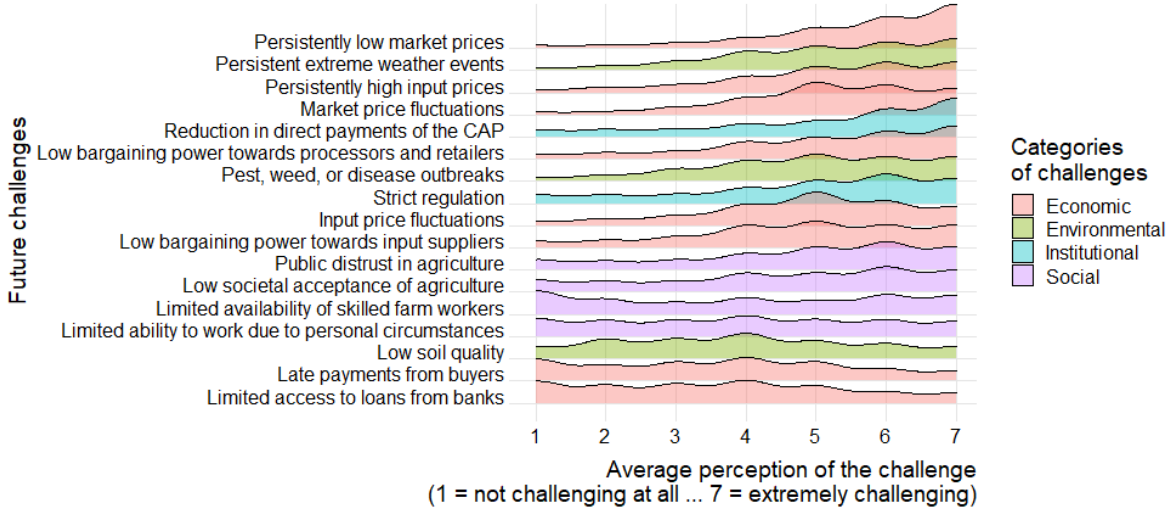

Figure 2 Distribution of scores given by farmers to different pre-defined challenges based on their relevance for the next 20 years. The challenges are sorted by their average score from the highest (top) to the lowest (bottom).

Lesson 2: RM portfolios of farmers are very diverse, and there is demand for RM strategies that target long-term pressures rather than shocks

Next, farmers were asked in the survey to select RM strategies that they implemented for their farms in the last five years based on a pre-defined list (Table 3). The list was based on an extensive literature

review (e.g. Flaten et al. 2005, Van Winsen et al. 2016, Meraner and Finger 2019), as well as on discussions in an interdisciplinary team of researchers. We found out that there is no RM strategy that is applied by the vast majority of farmers: the most popular RM strategies — maintain financial savings and be a member of a producer organization, cooperative or credit union — are only implemented by 58% and 53% of farmers, respectively. This reflects the broad range of perceived challenges and implies that no RM strategy is viewed by farmers as the ultimate remedy against all these challenges. On the other hand, we found that each RM strategy included in the pre-defined list is exploited to a certain extent; even the least popular RM strategies — open up the farm to the public and hedge (part of) production with futures contracts — are used by roughly 15% of farmers. This highlights the need for a multi-faceted approach to RM and a focus on developing a broad range of RM strategies that can contribute to tailored RM portfolios. Furthermore, we hypothesize that the observed diversity of RM instruments at the farm level is a resilience-enhancing attribute of the associated FS: due to heterogenous RM portfolios, farms would be affected to different extents in case of a challenge, buffering the negative impact on the FS.

Table 3 Risk management strategies implemented by farmers in the last five years and perceived as important for the next 20 years. Source: Soriano et al., 2020

	Share of farmers implemented RM strategy in the last 5 years*	RM strategy is perceived as relevant in the next 20 years**
Maintained financial savings for hard times	58%	
Member of a producer organization, cooperative or credit union	53%	+
Learned about challenges in agriculture	50%	+
Had access to a variety of input suppliers	50%	+
Worked harder to secure production in hard times	47%	
Implemented measures to prevent pests or diseases	44%	+
Used market information to plan my farm activities for the next season	37%	+
Cooperated with other farmers to secure inputs or production	37%	+
Had an off-farm job	32%	
Diversified in other activities on my farm	30%	+
Invested in technologies	27%	+
Used production or marketing contracts to sell (part of) my production	27%	+
Bought any type of agricultural insurance	27%	
Diversified in production	25%	+
Improved flexibility in the timing of my production	25%	
Improved cost flexibility	22%	
Member of an (inter)branch organization	18%	+
Opened up my farm to the public	15%	
Hedged (part of) my production with futures contracts	13%	
Increase efficiency (technology, specialization, better management)***	?	+
Preservation / Protection of the environment***	?	+
Consumer orientation***	?	+

(*) Based on the closed question: Please tick the boxes of all the risk management strategies you have been implementing in the last 5 years. No percentage in the first column means that the strategy was not listed in the survey.
(**) Based on the open question: Considering the next 20 years, what do you expect to be your 3 most important strategies to deal with challenges on your farm? Farmers' answers were categorized according to the RM strategies list provided in the closed question.
(***) These RM strategies were not included in the pre-defined list, which is why information on their implementation in the past is missing.

In order to capture future perspectives on RM, farmers were asked to name the three most relevant RM strategies for the next 20 years. Responses were categorized on the basis of the list used to collect information about RM strategies implemented in the past 5 years, as explained above. Hence, Table 2 compares RM strategies implemented in the last five years and RM strategies perceived as relevant in the next 20 years, identifying strategies that are expected to gain importance in the future (marked with "+") or to lose their relevance.

Three RM strategies (increasing efficiency, preserving the environment, and being more consumer-oriented) were not included in the pre-defined list of RM strategies leading to missing data on their implementation in the past, yet these strategies were frequently mentioned as being relevant for the

future. Focus on these RM strategies in the future is in line with our findings on perceived future challenges, since all three strategies are primarily oriented towards long-term pressures. The fact that financial savings, agricultural insurance and futures contracts are not considered to be important in the future is a rather striking result, especially in light of their implementation in the past. Financial institutions providing or administrating these three RM instruments might hence need to reconsider their future role in the FS.

Lesson 3: Farming system actors perceived RM as enhancing resilience capacities, especially adaptability

In line with our broader definition of RM, we define resilience beyond ensuring the robustness of a system by also addressing a system's capacities to adapt and transform and the ability to ensure the provision of the system functions in the face of increasingly complex and accumulating shocks and stresses (Meuwissen et al., 2019). In order to study whether risk management is perceived as resilience-enhancing, farmers were introduced to our definition of resilience capacities, including illustrative examples (Box 2), and asked to assess past (last 5 years), current, and future (upcoming 5 and 20 years) levels of resilience of their farms based on a 7-item-Likert-scale (1 – not resilient at all to 7 – highly resilient). The resilience assessment was based solely on farmers' subjective perceptions and not supported by any additional objective indicators, e.g., statistical ex post assessment of farm performance. Next, we checked for Pearson correlation coefficients between the diversity (i.e., the number) of RM strategies implemented during the last 5 years and farmers' subjective resilience perception. We found a significant positive correlation between the number of RM strategies implemented in the past 5 years and perceived current and future resilience. Moreover, the estimated correlation coefficients differ across the resilience capacities with adaptability being correlated with the number of RM strategies to the strongest extent. Although it might seem counter-intuitive that RM is not perceived as primarily enhancing robustness, it is important to note that we did not ask about the coverage or duration of implemented RM strategies, focusing solely on their number. The fact that a farmer combines multiple RM strategies (even with lower coverage) might hint towards a farmer's openness to diverse practices and hence a willingness to respond to a challenge via adaptation.

Box 2: The three resilience capacities

Robustness is the farm's capacity to withstand challenges; adaptability is the capacity to change the composition of inputs, production, marketing and risk management in response to challenges but without changing the structures and feedback mechanisms of the farm; transformability is the capacity to change the internal structure and feedback mechanisms of the farm significantly in response to challenges that make business as usual impossible.

Illustrative examples of the three resilience capacities at farm level provided in the farm survey

Staying robust: a baker wants to earn a decent income. Currently he faces extremely high wheat prices. The ability to earn a decent income, even when the wheat prices are extremely high, makes the baker robust.

Adaptation: to deal with extremely high wheat prices, the baker adjusts his production strategy by changing the bread composition. He uses less wheat and cheaper grains to produce his bread.

Transformation: the baker thinks that it is time for a radical change. He decides to open a tearoom as part of his bakery. Next to selling bread, the baker serves coffee, tea, and cake to customers in the tearoom. This radical change shifts the business focus.

In order to ensure that survey respondents correctly understand our concept of resilience, specific attention was paid to resilience questions during the pilot stage.

The focus groups confirmed the results of the farm survey and add further insights at the FS level. Although farming system actors generally perceive RM as enhancing all three resilience capacities, robustness and adaptability are believed to be supported more than transformability capacity. In the German, Italian, and Swedish FS, RM is even perceived as constraining transformability. This can be explained by two factors:

i) existing circumstances that hinder the FS capacity to implement radical changes (i.e., agri-environmental conditions in Italian FS or path dependency in German FS); and ii) the low level of interest of the actors in the FS to carry out practices that entail major changes (e.g., actors tied to traditional practices in Swedish FS). Only stakeholders from the British FS believe transformability to be similarly enhanced by RM as adaptability and more so than robustness. This might be explained by the fact that due to Brexit, every actor in the FS is prepared for inevitable adaptation or transformation. These results suggest that the perceived role of RM goes beyond solely enhancing robustness and hence justify our analysis in the broader context of the three resilience capacities.

Lesson 4: According to farmers, learning is crucial for improving risk management and enhancing resilience in the future

According to our definition of RM, all three sources for our analysis find that learning about challenges in agriculture as a RM strategy that was frequently implemented in the past and remains important in the future (Table 3). Every second farmer in the farm survey reported that she learned about future challenges. Yet, learning is also an important guiding component of RM, in terms of understanding the strategies needed to manage challenges in the context of changing circumstances. In the focus groups stakeholders named peer learning, training, and advisory services as major ways to improve RM and to enhance resilience, farmer interviews provided further insights in this regard. Analysis of the interview data identified a range of learning strategies and attributes across all three resilience capacities (Urquhart et al, 2019) (Table 4).

Table 4 Learning strategies and attributes (i.e., farmer characteristics that determine learning behaviour) across resilience capacities[1].

	Learning strategies	**Learning attributes**
Robustness	• obtain agricultural education • experimentation and adopting tried-and-tested practices • seeking out information • observing other farmers • adapting practices to new regulations	• confidence in own decisions • relying on own experience • commitment to prevailing ways of working • reluctant to take risks • ability to be reflexive
Adaptability	• peer-to-peer learning (farm visits, experimental fields, events, farming neighbours, farmers abroad) • consulting non-farming experts • experimentation • engaging in social networks • horizon scanning – anticipating future changes and challenges • actively seek out new information	• open to new ideas & innovations • motivation to engage with others • eagerness to learn • ability to be flexible • critically assessing sustainability of current practices • confidence in the future of the sector • willing to take risks • ability to convert knowledge into action • valuing the opinion of others
Transformability	• seeking out new contacts or knowledge networks • drawing on experience working abroad or in other sectors • experimentation	• change in values/attitudes • able to have a vision of the farming system, not just own farm • willing to take risks • having entrepreneurial spirit • willing to change farm activities radically • high levels of self-efficacy

[1]Interview transcripts were thematically coded to identify learning strategies mentioned by farmers, and the attributes demonstrated in the interview narratives. These were then mapped across the three resilience capacities identified in Meuwissen et al. (2019).

For instance, **robustness-enhancing learning** includes farmers learning from their own experience; reflecting on past experiences in order to adjust their current activities in response to shocks and stresses. Such farmers are committed to maintaining the status quo of the farm. While robustness-oriented farmers are willing to experiment, they prefer to wait until others have tried out new practices, as they are reluctant to take risks. For example, a robustness-oriented farmer is likely to make small adjustments in response

to challenges, such as switching to buying young stock instead of breeding stock themselves in order to reduce costs, enabling the farm to cope with moderate financial stress.

Conversely, **adaptive learning** requires farmers to be open to new ideas and innovations, remain flexible, and be willing to take risks and engage in social networks to learn from others. These farmers are able to assess their current practices critically and make changes where needed. They are likely to learn through farm visits, experimental fields, their farming neighbours and farmers abroad (through social media or overseas visits). They are also willing to experiment with new technologies or innovations on their farm and will be horizon scanning to anticipate future changes and challenges. Findings suggest that these farmers are also better able to adapt personally to shocks and stresses.

Transformative learning describes a process where people gradually change their views on the world and themselves (Muro and Jeffrey, 2008) – it often occurs in the face of a 'trigger' or crisis to which people need to respond (Maarleveld and Dabgbégnon, 1999: Pahl-Wostl, 2002: Dougill et al., 2006) with the Covid19-crisis being an excellent example of such a trigger. These dilemmas or crises cannot be dealt with using existing knowledge or actions. Farmers that are able to transform their farm business are willing to change their farm activities radically in order to grow or to improve the business, or to enable their farm to become sustainable. They have high levels of self-efficacy and are willing to change their activities if needed, often resulting in a shift in their way of thinking or their attitudes. They will actively seek out new contacts beyond their current social networks and will be at the forefront of innovation. A farmer demonstrating transformability may well be one of the first in a region to begin growing a new crop or to adopt a new technology. However, less pro-active farmers may also be forced to transform radically (or exit the sector) when faced with extreme shocks or stresses that make their existing business model untenable.

Lesson 5: Future development of RM strategies requires contribution of all actors in the farming system

Our focus on the FS level is motivated by the fact that RM strategies involve a number of stakeholders, such as financial institutions, business advisors, cooperatives, unions, agronomists and research/education institutions. In this regard, FS actors in the focus groups were asked about potential options to improve RM. The suggestions obtained were later categorized in terms of the actor(s) that mainly contribute to the improvement. Almost in every FS, participants agreed that every single actor can contribute to RM improvement, yet, in different ways (Soriano et al., 2020). For example, financial institutions can provide the financial means for implementing costly RM strategies and increase the number of employees with deep knowledge of the specificities of the FS; value chain actors can boost the use of contracts by experimenting and through training programmes, hence contributing to the learning process; and farmers' associations can improve RM by making a joint effort in collecting and spreading information on good practices such as sustainable farming, optimal timing of crop treatment, or the adoption of new technology (SURE-Farm Business Brief, 2019). This result suggests the need for closer collaboration between different actors and alignment of their diverse short- and (more important) long-term aims.

Calling on every FS actor, we conclude with three policy and business recommendations. First, we recommend the adoption of our broad interpretation of RM. The role of RM goes beyond maintaining the status-quo and towards enhancing long-term adaptive and transformative capacities of FS. This broader interpretation not only highlights the importance of RM in enhancing the three resilience capacities, but also allows more comprehensive analysis and design of RM. Second, we recommend facilitating the development of (novel) RM strategies that target long-term pressures. Here, an efficient learning process, including knowledge exchange, training and support for innovation, is crucial. Third, despite the focus on long-term pressures among the participants in our study, one should keep in mind that RM should remain tailor-made, and there is no ultimate remedy for any FS against any challenge. This advocates for both diverse RM strategies and targeted and well-coordinated actions to improve RM.

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SUMMARY

In facing future challenges, risk management (RM) is essential for European farming systems (FS). This article synthesises lessons learned on RM based on a farm survey, interviews with farmers, and focus groups involving a range of FS actors. In contrast to previous literature, we broaden the definition of RM to include strategies that target long-term structural challenges, as well as expanding the level of analysis from the farm to the FS level. The results were consistent across the different methods. We found that farmers mainly worry about economic challenges: in particular long-term pressures. We also found that European farmers have implemented diverse RM strategies in the past 5 years, and that no single strategy has been applied by the vast majority of farmers. In line with perceptions of future challenges, there is a demand for the reorientation of RM strategies towards long-term pressures, rather than short-term shocks. FS actors were found to perceive RM as enhancing resilience capacities, especially adaptability. The results of interviews distinguished between major learning strategies and the attributes of farmers for enhancing robustness, adaptive, or transformative capacities. Focus group discussions revealed that the future development of RM strategies requires contributions by all FS actors.

Keywords: sustainability, challenges, farm survey, stakeholders, learning.

Pull quotes

- Perceptions of the most severe challenges are shifting from an operational and short-term character towards structural and strategic issues
- There is no RM strategy that is applied by the vast majority of the farmers
- Every single actor can contribute to RM improvement