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STRATEGIES OF FAMILY FARMS TO STRENGTHEN THEIR RESILIENCE

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ABSTRACT

Resilience thinking offers a framework to emphasize dynamics and interdependencies across time, space and domains. It is based on understanding social-ecological systems as complex and future developments as unpredictable and thus emphasises adaptive approaches to management. Transferring insights from resilience thinking onto farm management would allow to shift the emphasis from predicting the specifics of future possibilities, towards focusing on the factors that build the ability of the farm to respond to change. In this paper the four cluster of factors that have been identified as building resilience in large-scale social-ecological systems – i.e. learning to live with change and uncertainty; nurturing diversity; combining different types of knowledge and learning and creating opportunity for self-organisation and cross-scale linkages – are applied at the farm level. Suggestions on how these factors could be operationalised at the farm-level are derived from workshops held with family farmers in Austria. The results show that farmers understand change as unpredictable and unfolding, have a number of strategies to ensure the flexibility and adaptability of their farm, and build extensive networks to diversity information and income sources. The challenge is that these strategies, while ensuring adaptability and transformability, compete for scarce resources. The appropriate mix of strategies will thus depend on a range of situational factors, such as opportunities that arise, the preferences of the various members of the farm household, the family life cycle stage and the co-evolutionary processes between the farm and its environment.

Key words: farm household / adaptability / farming community / bricolage / autonomy

INTRODUCTION

Producing food while maintaining biodiversity and ecosystem services is one of the major challenges facing agriculture. With approx 45% of the European Union's surface (EU-21) being used for agriculture (Eurostat 2008a), farmers manage vast tracts of land, shaping ecosystems, habitats and landscapes. Many farming practices not only affect the ecosystems on-farm but also those off-farm, sometimes over large distances (Moller et al. 2008). So far farm management, a branch of agricultural economics, has mostly focused on efficient production of food and fibre while ensuring that pollution does not exceed legal limits. There has been little attention to 'externalities' such as social aspects (e.g. sustainability of rural communities, recreational value of landscapes) or ecological aspects (e.g. loss of habitats and biodiversity). Given the dearth of models integrating ecological, social and economic sustainability over various temporal and spatial scales, resilience thinking (Gunderson and Holling 2002; Scoones et al. 2007) holds great

promise to better understand the interlinkages and the challenges involved in moving towards sustainable food production, diverse agro-ecosystems and lively rural areas.

The farm is in many ways different from the social-ecological systems that have been the focus of resilience studies. The latter were mostly large-scale natural resources such as the everglades (Gunderson et al. 2002), reefs (e.g. Hicks et al. 2009), or rangelands (e.g. Walker and Abel 2002). The farm is not only smaller in scale, its ecological structure and processes as well as species composition are strongly influenced by the farmer. Also, economics play a larger role, as farmers need to ensure both the short-term and long-term economic survival of their farm. Although resilience thinking has so far rarely been applied to agriculture, there is no reason why it should not, as conceptually it encompasses all multiscale dynamic systems of humans and nature.

In this contribution I will focus on family farms. Family farms can be defined as those farms whose labour force is mostly provided by family members, and are owner-managed. These are distinct from corporate-owned or cooperative farms regarding their market integration (esp. the labour market) and regarding their management goal. Indeed, on family farms short-term profit seeking behaviour tends to be mitigated by a long-term commitment to farming as a way of life. I have also selected family farms because in most European countries the vast majority of labour on farms is provided by family members (not withstanding substantial differences, reflecting farm ownership and structure: from around 90% of annual work units in Slovenia or Austria to 22% in the Czech Republic (Eurostat, 2008b)). Finally, maintaining family farms is an important aspect of rural development policy, as these farms play an important role in local communities, rural economies, civic institutions and in maintaining the cultural landscape (Wilson, 2008; Renting et al., 2009).

But family farms are also a pertinent object of study because they have proven their resilience: many have been handed-down from one generation to the next, often for 200 years or more. As such they have persevered despite major political upheavals (e.g., wars, transition from monarchy to democracy) as well as drastic economic and policy changes (e.g., servants leaving the farms in the 1950s, state-controlled markets, various reforms of the Common Agricultural Policy), technological change (mechanization, agricultural chemicals, genetically modified organisms), and change in their cultural role (from food providers to a major source of environmental pollution, providers of recreational space within a multifunctional agriculture). The perseverance of the family farms has led to “the agrarian question” as it is one of the very few sectors of the economy that is still dominated by family production units, and where industrialisation, while having made significant inroads, has not supplanted family farms (Banaji 1980).

It is widely recognised that family farms, in their management decisions, do not necessarily follow the logic of mainstream economics as embodied in most approaches to agricultural economics (Framar-Bowers and Lane, 2009). This is due to a range of factors, such as the tight interlinkages between the family and the farm (labour, living and working space), the social norms (e.g. to ensure that the farm is passed on to the next generation, reciprocal neighbourly help) and belief structures (local knowledge, risk aversion). Family farms might be constrained by these factors, but they are also an asset as they open a range of options outside the ‘cash economy’ which are not adequately captured by the mainstream economic models.

Given the dearth of conceptual frameworks that integrate ecological, economic and social aspects, it would be useful to assess whether the insights from resilience studies on how to manage social-ecological systems for resilience and sustainability can be applied to farm management. The aim of this paper is thus to explore the extent to which strategies of family farmers are similar to the strategies that have been recommended to strengthen the resilience of social-ecological systems. If the principles derived from resilience studies can be transferred on

to the farm level, they can be used to inform strategic farm management, so as to contribute towards the sustainability of farms, rural areas and ecosystem services.

The paper starts with a brief overview of the differences in the fundamental assumptions – especially regarding the nature of change – between conventional farm management and resilience thinking. Then, using data from a case study, I will examine the extent to which strategies and 'rules of thumb' used by family farmers fit the four key factors to build resilience that have been identified by Folke et al. (2003). I will conclude by pointing out the implications for strategic farm management.

CONCEPTUAL FRAMEWORK

To understand the fundamental difference in the approach to management that are at the core of agricultural economics based on the neo-classical economic theory and the management that would be needed to ensure sustainability and resilience, the characteristics and differences of the two approaches are briefly described.

Two broad approaches to farm management

As with other areas of mainstream economics, farm management emphasises the static issue of efficiently allocating scarce resources, rather than the dynamic issue of how farmer preferences, markets and institutions change over time. In doing so, it tends to overlook the fact that static and dynamic issues are often in conflict (Keen 2001:9) as static optimizing does not lead to adaptability. Also, the clear bias towards mathematical formalism tends to underestimate the inherent limits of mathematics to solve nonlinear differential equations (Keen 2001:264) and has obscured the social nature of human behaviour, including decision making. Conventional approaches to farm management, especially strategic management, thus display some shortcomings. For example, future developments are generally treated as predictable, even if they have a level of uncertainty attached to them. Indeed, risk is typically modelled as randomness and randomness is 'well behaved' so that statistical laws can be used to make predictions about random events (Beinhocker 2006). Also, the complexity of many real choices in agriculture tends to be underestimated: there are often multiple and conflicting objectives, several decision problems are linked, and the environment is dynamic and turbulent. The formal methods of analysis cannot adequately represent this complexity, leading to a reductionistic approach using mathematical models that assume linear interactions between sub-systems, presume systems to be near equilibrium, relationships to be constant and underestimate uncertainties that arise from errors in tools or models (Hardaker et al. 1997; Keen 2001; Beinhocker 2006).

Despite its limitations, the conventional approach to farm management underpins most academic work. It is fairly well suited to specific issues, such as supporting short-term management decisions (e.g. optimal crop mix), choosing between investment decisions that are equally acceptable to a farmer, or deriving policy recommendations in contexts where the general economic conditions are fairly stable, growth widespread, and changes slow and predictable (Hardaker et al. 1997; Foster 2005). However, on the long term it can be misleading to understand the agricultural system as fairly stable or change as being smooth and predictable. Indeed, complex systems – such as the economy – are characterized by episodic surprises, resulting from small events that are magnified through dynamic, nonlinear feedbacks into history changing outcomes (Manson 2001; Martin and Sunley 2007). In these periods of turbulent changes the economy will behave in nonlinear and adaptive ways, and will not be amenable to prediction over anything but the very shortest of terms (Beinhocker 2006:323).

Resilience thinking takes this complexity of social-ecological systems and their unpredictable developments as its starting point (Walker et al. 2002). This position shifts the attention from developing more sophisticated forecasting and risk assessment methods, to enabling a system to cope with surprise. The point is thus not to predict the specifics of future possibilities, but to define the conditions that limit or expand those future possibilities (Holling and Gunderson 2002:32), i.e. to design institutions to be responsive to change and better evolvers.

Even a cursory observation of recent developments will show that farmers are facing an increasingly turbulent environment. Shocks and stresses come from a variety of sources: food scares (e.g., BSE, avian influenza), increasing environmental and animal welfare regulation, private quality assurance schemes, more frequent occurrence of extreme climatic events, new pests and weeds linked to climate change, ageing of the population, changes in consumer preferences, demand for energy crops, volatility of commodity prices, or new technological developments (e.g. genetically modified crops). Given the tight interconnection of these various developments, as well as the spatial linkages due to globalization, the complex dynamics give rise to unpredictable, sudden changes. Under these economic, political and social conditions, it is unlikely that a management that focuses on efficiencies and economies of scale suffices to ensure the long-term survival of farms. Thus, in understanding farming as being subjected to the dynamics of complex systems, managing a farm is thus not about controlling or predicting the future, but about creating the conditions that enable productive, but largely unspecified future states (see Marion and Uhl-Bien, 2001).

Strategies to build resilience

Resilience thinking offers a vision of sustainability, which is not reduced to stability. Indeed, persistence is born out of both resistance to change and maintenance of current states as well as adaptive renewal leading to new states (Walker et al., 2004). We thus need to understand both which management strategies allow farms to persevere and those that allow them to adapt. In doing so, the focus is on transformative resilience (Walker et al. 2004) rather than shock resilience. In other words, the interest is not so much on examining the conditions that will lead a farm to collapse, but rather the factors that influence a farm's ability to respond to change in the ecological, social, economic and political environment.

Folke et al. (2003) and Berkes (2007) lists four clusters of factors that interact across temporal and spatial scales and that seem to be important in building resilience in social-ecological systems. These factors are: (1) learning to live with change and uncertainty; (2) nurturing diversity in its various forms; (3) combining different types of knowledge and learning; (4) creating opportunity for self-organization and cross-scale linkages. These factors will have to be reinterpreted to fit the specificities of family farms as a social-ecological system. On a farm, adaptation and change is done at the level of the enterprises realized on-farm, and the wider on- and off-farm activities in which the members of the farm family are involved. By reassorting the involved resources, by reconfiguring the farm activities, the farm can adapt and take advantage of new opportunities. Farming resilience thus aims at the farm as a system, at preserving its functions, not at preserving individual production activities on the farm. To explore whether the four factors can be found at the farm level, and if so, how they are operationalised will be explored using a case study.

CASE STUDY SITE AND METHODS

Farms in Austria are generally small-scale (average size is 17 ha) and run part-time, i.e. more than half of the family income is derived from off-farm work. The farm is inherited from the parents, and there are strong social norms attached to farming, especially the expectation to continue the family tradition and pass-on the farm to the next generation. Farm families thus tend

to have a strong 'sense of place' (DeLind and Bingen 2008) and commitment to the local community, many of whose members will be kins. These social ties are reinforced by practices such as reciprocal neighbourly help during peak labour times. The central role farms play to secure national food supply as well as their role in rural development has led, in the 1970s, to a policy of protected markets and subsidies for farms in mountainous areas. Even with the accession of Austria to the European Union in 1995 and the implementation of the Common Agricultural Policy (CAP), the commitment to maintain family farming and to ensure environmentally friendly production methods remained. Currently 70% of farmers in Austria participate in the agri-environmental programme and 14% of farmers are certified organic (Darnhofer and Schneeberger 2007).

To better understand the farmers' perception of the factors that allow farms to persist despite on-going changes, a participatory approach was selected, following the suggestions by Walker et al. (2002) and Cumming et al. (2005). Four full-day workshops were held in early 2007 with a group of 15 farmers, most of whom had certified organic farms. The participants were mostly arable farmers with animal husbandry playing a subordinate role. During the workshop, the farmers were asked to reflect on how their own farm had changed since the late 1950s (or as far back as they could remember), which changes in the economic and political framework was associated with the change. Reflecting on past experiences, the farmers were asked which attributes they identify as crucial to enable the farm to undergo these changes and to go on adapting in the future. The strategies identified by the farmers, as well as the examples they provided were then analysed regarding how they fit with the four clusters of factors identified by Folke et al. (2003).

RESULTS AND DISCUSSION

Learning to live with change and uncertainty

This factor points out the need to building a memory of past events, abandoning the notion of stability, 'expecting the unexpected' and increasing the capability to learn from crisis (Berkes 2007). At farm level, this factor is thus mostly related to the perception and world view of the farmer, and to the fact that farms should be flexible and adaptive.

All farmers who participated at the workshops were acutely aware of the on-going change and of its unpredictable nature. They often contrasted the current uncertainty with the (relative) stability of the 1980s, where government intervention stabilized prices for agricultural commodities, technological progress had solved many challenges in farming and the unsettling effect of negative environmental impacts or of food scares were not yet on the agenda.

Most of the changes discussed were of the 'stress' type (i.e. slow changes over longer periods), such as: changes in social norms (e.g. off-farm employment of wives, taking vacations), demographic trends, expectations of society towards farmers, or the rise of environmental regulations. However, two shocks marked the last 20 years: the fall of the 'Iron Curtain' in 1989 (which opened the doors to the East and led to the accession of Austria to the EU in 1995) and the flood in 2004. Most of these changes are externally driven, i.e. farmers cannot influence them but need to adapt to them. Farmers thus seek to keep their farm flexible and to avoid committing a large share of resources to an activity that might turn out to be a dead-end as the wider context changes.

At the operational level, learning to live with uncertainty meant, among others, that debts needed to be kept at a reasonable level relative to the assets of the farm. A large investment (e.g. in animal housing) that is only possible through bank financing ties the farm to this activity for the duration of the credit (15-20 years). This is perceived by farmers to be too long: too much can change so that there is no guarantee that the investment will ever be profitable. However this

does not mean that large investments are not made. Farmers will find ways to take opportunities if they seem promising, but will do so without risking the foreclosure of their farm. Thus, farmers will invest if the risk is limited (e.g. prices for electricity from biogas plant are guaranteed by the government), if they receive support so that the level of own capital is limited (e.g. a packing plant for organic vegetables, supported by EU rural development funds), or if the investment is made by a group of farmers (e.g. creating a separate legal entity). Preferably, large investments are planned in a modular fashion, so that commitment is incremental and opting-out possible at various stages. The vast majority of changes will be realised in a smaller scale and the farm reorganised so as to avoid large investments (e.g. stopping specialisation in animal husbandry when the choice is between getting out of animal husbandry or investing in the animal housing).

For smaller investments, farmers will prefer a 'bricolage' approach. Bricoleurs use resources they are intimately familiar with to address new tasks as challenges and they use resources that are available on the farm, e.g. tools, materials, buildings. These are adapted and reorganised. For example one farmer decided to keep animal husbandry, but to switch from dairy cows to pigs. To avoid large investments and cash flow, he cut trees from his own forest and used the wood to adapt the animal housing. This did not result in an exemplary piggery, but the compromises and the use of on-farm resources limited the cash flow and thus limited the commitment to this one activity. If pig rearing and marketing proves successful, improving the design (e.g. to facilitate work flow) and up scaling is still an option.

Change is thus enacted by exploiting opportunities through continuous resource combination and recombination (Foster 2005; Chiles et al. 2007). Dominant farm activities, i.e. resource combinations, will thus emerge from a series of adaptations that need not have been planned as such beforehand. As circumstances change, an activity will become obsolete, will be eliminated and the resources will be used in a new way. In this context, strategy needs to be understood as an unfolding process, rather than a clearly defined plan that is implemented to the letter. To be able to manage a farm in this way, the farmer needs an open mind, needs to be willing to change activities or change the way the activities are implemented on his or her farm. This is not entirely self-evident, given the strong hold of traditional ways of performing tasks, or social norms on what a 'real' farm should look like.

Nurturing diversity in its various forms

Diversity provides the seeds for new opportunities; it increases the options for coping with shocks and stresses (Berkes 2007). At the farm level, there are various 'variables' that contribute to diversity, such as: biodiversity (incl. diversity of crops grown), diversity of economic opportunities, diversity of resources, diversity of communication and partners, diversity in relationship types (e.g. formal contracts, neighbourly help). This diversity needs to be actively honed. Coordinating and nurturing this ever-changing set of activities and relationships can be challenging and needs to be finely attuned with the abilities and preferences of the family members.

Diversity seems to come rather naturally to family farms, as all farmers are involved in a range of activities, both on- and off-farm. The diversity of crops is linked to the need to ensure an adequate crop rotation to safeguard soil health. Also, they not only grow commodities (e.g. wheat) but search for niche crops that tend to have less volatile prices. A number of farmers diversify their on-farm activities so as not to be dependent solely on crop production, e.g.: animal production, holiday on-farm, on-farm processing, composting of organic city waste, producing wood chips as heating material. Many farms will have at least one family member holding an off-farm employment, either permanently or seasonally (e.g. school teacher, office worker) or holding a contract (e.g. organic farm inspector, road side maintenance and snow ploughing).

This diversity is preferred by the farmers, despite the challenges involved in coordinating the different activities and avoiding conflicting demands for labour and time. Not only do diverse sources of income buffer the farm from price swings by ensuring that they come from unrelated sectors, they also ensure a connection to a variety of social networks.

Farmers thus actively foster this diversity, not least by being experimenting with new activities (e.g. testing specialty crops that were not previously grown in the area such as medicinal herbs or vegetables), new crop management techniques, new animal types or breeds or searching for alliances to implement a cooperative project (e.g. packing plant for potatoes and carrots to circumvent middlemen). If the policy incentives or the market demand materialise, then the experiment can be up-scaled and may lead to a new activity on- or off-farm.

From the social point of view, this diversity is important to allow each family member to find activities that correspond to his or her personal preferences and inclinations. Indeed, if previous generations of farmer hand a strong sense of filial duty, the younger generations are expecting a certain level of 'job satisfaction'. This is a key component to quality of life, and the farmers unanimously agreed that the one essential aspect to ensure farm succession is for the parent to enjoy farming and pay attention to quality of life, or the children are unlikely to take over the farm if they see it only as drudgery.

Combining different types of knowledge and learning

This factor is related to the ability to combine scientific information with traditional knowledge, and the ability to share insights, to bring together parties with different relative strengths in terms of knowledge and backgrounds and thus to create learning environments (Berkes 2007). At the farm level, this can be found in the variety of information sources that farmers tap into and use to make decisions, in the variety of networks they are involved in, and their ability to build on past experiences and traditions.

Farmers are constantly faced with the challenge to bridge the scientific world and the practical 'real-life' world and integrate information from both sources. Farmers are well acquainted with recommendations for crop and animal production derived from scientific research as this is the information they have received during their education in a vocational technical school, and currently receive through extension agents, trade journals, at agricultural fairs and seminars. However, based on the environmental consequences of recommendations provided in the 1980s, and given that most recommendations involve purchasing products from the agribusiness industry, farmers have learned to be wary. Conversion to organic farming is partly related to identifying an alternative to being dependent on industrial products and attempting to use resources on the farm and closing cycles. This requires the ability to observe the soil, the crops, the animals to identify their needs; to test corrective measures, search for alternative techniques or develop new implements; and to implement the most promising one. Farmers thus routinely combine knowledge built from their own observations and experiments with information provided by science, appreciating their complementarity. For example, the farmers are well aware that the winters are not as cold anymore, allowing field work to start approx. two weeks earlier than the traditional date, and relate it to scientific reports of climate change. Similarly, farmers will combine results from ethological studies with their own observation of animal behaviour, and will discuss these observations with other farmers. The draw back of this approach is that it is time intensive, which is especially a problem with part-time farmers who are under pressure to stream-line operations.

More challenging than issues related to technical knowledge, are the issues related to knowledge on social competencies. These are not part of the educational curriculum and are neglected in the type of scientific information provided to farmers. However, abilities such as open communication, providing reflexive feedback, constructive conflict management and

understanding group dynamics are key success factors to ensure a smooth development of the extended farm household, business partnerships and the rural community.

Combining different types of information and sharing that information in various networks is thus seen by farmers as an important ingredient, not only at farm-level but also a the community level, both of which are intimately linked. It allows to revise one's notion as new information becomes available, to identify partners for joint ventures, and to strengthen the social fabric of the community.

Creating opportunity for self-organisation and cross-scale linkages

This factor relates to the ability of the community to maintain the local capacity for social and political organisation, rather than relying on external intervention (Berkes 2007). This involves the ability to build cross-scale bridges and partnerships so as to be able to respond in new ways, to sustain a self-organised process or build innovative institutional arrangements. Within farming this factor plays out both at the farm level and the link between the farm and the wider community.

At the farm level, farmers strive for self-organisation through a range of strategies, such as bricolage (i.e. relying as far as possible on their own resources), through closing nutrient cycles (e.g. planting legumes as nitrogen fixating plants), through searching for synergies (the harvested legumes are brought to the biogas plant, and the digested material is then put back on the fields), or through keeping redundant resources so as not to rely on external resources when activities need to be adapted. Furthermore farmers are striving to increase their autonomy especially as far as energy is concerned. A number are striving to produce as much energy on their farm as they consume (e.g. electricity through solar panels on the large roof surfaces available on a farm, heating using the wood from the own forest).

At the community level, the ability to self-organise is strongly linked to social competencies. As noted in the previous section, farmers in the workshops have noted that social competencies have not received enough attention, so that they have to rely mostly on personal strengths of a few individuals and trial-and-error. However, they see the ability to cooperate and build networks as a key for future survival, as with increasing economic pressure, smaller farms can only survive if they cooperate with one another, e.g. by purchasing machinery together. Farmers pointed out the role of a sorting pant and a biogas plant they own in common for the economic sustainability of farming. The key challenge in running these plants are more at the inter-personal level, than at the technical or economic level.

Cooperation is also key to avoid the isolation of working on one's farm and to maintain the social fabric of the rural community. Farmers point out that engagement in community institutions, such as the local fire brigade, the church group, the local hunter association, the farmer association or the chamber of agriculture strengthens social cohesion. Having strong and diverse networks is a key to recruit participants in community initiatives such as restoring a row of abandoned wine cellars or planting traditional varieties of fruit trees along roads. The common ground built in these community initiatives are key to reaching consensus in difficult situations such as when farmers had to negotiate who will donate what land towards building a one hectare wetland habitat. Farmers are thus well aware of the importance of social capital, but they point out that the increasing economic pressures tends to translate to time pressure which restricts the time available for building networks, maintaining social cohesion and engaging in community activities.

However, it is a successful initiative that allows to learn what works and what does not, as well as the personal strengths (and weaknesses) of the involved partners. Based on these experiences and personal ties, a collaborative approach is built over time, enabling better problem solving. For example, the farmers reported that the biogas plant would never have been built, if it was not for the experiences they had gathered in the sorting plant project (e.g. whom to

trust, to restrict the core group to a small number to avoid endless discussions). As with any large project the biogas plant took a long time to plan, and, now that it is built, requires changes to fine-tune the operation. As not all goes as expected, personal frustrations need to be kept in check to allow for an efficient solution to be found. These discussions often turn around the choices of out-contracting services (higher flexibility, less economic risk, but increases dependence) vs. purchasing the required machines (higher cash requirements up front, but increases autonomy and self-reliance in the work flow). These debates reveal the tensions between autonomy and cost-effectiveness

A similar balance needs to be struck between autonomy and cross-scale linkages. Engagement in the chamber of agriculture or in a farmer association is an important cross-scale linkage as it allows access to information from central structures, e.g. about upcoming changes in agricultural policy. Farmers also ensure that they engage in cross-scale linkages outside the agricultural sector, through activities such as direct marketing, composting or suppling firewood. This allows them direct contact with other stakeholders in the rural area and thus access to a different network and information.

CONCLUSIONS

The results from the workshops with Austrian farmers show that the four clusters of factors identified as strengthening resilience of social-ecological systems can be transferred to farming, i.e. that family farmers are engaged in the type of strategies that build resilience. The analysis of the farmers' strategies shows that there are synergies between the factors. For example 'building cross-scale linkages' can support the 'combination of different types of knowledge'. Similarly 'self-organisation' will support learning-by-doing, an important source of experiential knowledge. There are also obvious positive feedback links between 'learning to live with change' and 'nurturing diversity'. Despite these synergies, the strategies also compete for scarce resources, not least labour time. This requires farmers to strike a (dynamic) balance between strategies, searching for those that will allow to strengthen several factors synergistically.

The results from these workshops should not be understood as a definitive or comprehensive list of strategies for building farm resilience. Rather, they show that the farmers who participated in the workshops are well aware of the fact that change is on-going, that many changes are unpredictable and sudden. They have developed strategies to buffer surprise as well as harness the potential inherent in change.

Resilience thinking offers a valuable framework allowing to emphasize dynamics and interdependencies across time and between social and ecological domains. Adding an economic component, as it plays a key role for farms, may support the needed shift from focusing on sophisticated forecasting and risk assessment methods, to focussing on how a system can cope with on-going change and surprise. Indeed, in the turbulent times that inevitably result from complex dynamics, a farm managed with a one-sided focus on efficiency is unlikely to be resilient. The goal is thus to take advantage of current opportunities, while managing the conditions that expand future possibilities, i.e., ensure adaptability and transformability.

Integrating insights from resilience thinking into farm management might thus allow to address two shortcomings of mainstream approaches: their lack of appreciation for the complexity and dynamics of the real world in which farmers need to take decisions; as well as their relative disregard of both ecological and social aspects and their interrelations within social-ecological systems.

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