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The resilience of family farms: Towards a relational approach

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ABSTRACT

Family farms play an important role in the European countryside, yet their number is steadily declining. This raises the question of what conveys resilience to family farms, i.e. the ability to persist over the long-term through buffering shocks and adapting to change. Within the current approaches to farm resilience, we distinguish between two perspectives: the first focuses on material structures and highlights the role of farm types and ecological dynamics. The second focuses on actors and highlights that farmer agency and wider social forces also play important roles. We argue that a third perspective, one focusing on relations, has the potential to overcome both the structure/agency and the ecological/social dichotomies. Indeed, a relational approach enables a closer analysis of how ecological and social processes interact to undermine or strengthen resilience. The approach also allows to identify the different relationalities that are enacted within a specific context, foregrounding diversity in farming. Furthermore, it highlights that relations are continuously made and remade, putting the emphasis on change, and on the wider patterns that enable or constrain change. A relational approach would thus contribute to overcoming a one-sided focus on states and stability, shifting attention to the patterns of relations that enable transformational change.

1. Introduction

There is increasing consensus that change is accelerating and becoming less predictable, as global interconnections lead to events having consequences beyond their immediate context (Freibauer et al., 2011; Rosa, 2013; Sardar, 2015; Steffen et al., 2015). For example, the banking crisis in the US in late 2007 has been tied to the sovereign debt crisis in Europe, which diminished public finances and spread austerity measures (Kitson et al., 2011). These measures reinforce the impact of neoliberal agricultural policies and market deregulation, e.g. of the European milk market in early 2015. But farmers not only face uncertainty about future policy and market developments, they also face the contradictory demands to increase food production to feed the rising world population while having to reduce the ecological impact of intensive production methods. Indeed, biodiversity is declining, soils are losing their organic matter, fresh water resources are being polluted (EEA, 2015). These contradictory societal demands are embedded in the broader need to reduce dependence on fossil energy, in the face of peak oil and of climate change (Weis, 2010). The latter affects agriculture through demands that it contributes to reducing greenhouse gas emissions, while at the same time having to cope with the impact of an increased frequency of extreme weather events, reduced availability of water for irrigation, and the impact of rising temperatures on crop and herd management. These multifaceted dynamics and often contradictory demands may combine with sudden events such as volatile markets or food scares to generate unexpected outcomes.

Facing these turbulences and uncertainties is challenging for farmers, and it comes as no surprise that the number of farms is decreasing. Indeed, in the EU-27 the number of agricultural holdings decreased by 20% between 2003 and 2010 (EC, 2014). However, the ability to navigate turbulent times is not just an issue for individual family farms – which make up 97% of farms in the EU (EC, 2013:9) – it also concerns rural areas and society more broadly. Indeed, farms play an important role in maintaining social cohesion, producing food, providing energy from renewable resources, offering recreational and health care services, and maintaining the cultural landscape (Renting et al., 2008; Seuneke and Bock, 2015).

Within the context of economic turbulences and ecological instability, the concept of resilience has gained prominence both in

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political rhetoric and in research. We build specifically on the concept of social-ecological resilience (see Holling, 2001) as it emphasizes the interdependency of social and ecological dynamics – two key aspects of farming – and emphasizes the need to adapt and change, rather than the ability to buffer shocks and return to 'normal'.[1] The widespread interest in the concept of resilience indicates a shift from seeking to optimize production activities within a framework that is seen as fairly stable, towards accepting the ubiquity of change and thus the need to focus on coping with shocks, and adapting to change. However, the different approaches to farm resilience seem to either privilege the material structures or to highlight that the agency of farmers and other social groups plays an important role. Thus, while the importance of interactions between the ecological and social domain is acknowledged, it remains a challenge to fully integrate both domains, while at the same time capturing the dynamics of on-going change.

The overall aim of this paper is to argue that a relational perspective allows for a more comprehensive approach to understanding the resilience of family farms. Focusing on relations enables a closer analysis of how ecological and social processes interact to undermine or strengthen resilience. Moreover, by emphasizing that relations could always be otherwise, a relational analysis allows to identify how, within a specific context, different relationalities are enacted by farmers. Finally, by highlighting that relations are continuously made and remade, the analytical emphasis is on change and thus the broader patterns that enable or constrain change for individual farms but also for the farming sector as a whole.

We start with a brief overview of social-ecological resilience and how it conceptualizes the interplay between persistence and change. We group the dominant approaches in two perspectives to characterize ways in which resilience thinking has been applied to agriculture and farming, not least based on how the ecological and social domain are conceptualized. A first group of approaches tends to privilege ecological dynamics, searching for empirical cause–effect relationships and often building on the assumption of rational decision-making by farmers and other actors. Studies within this perspective often build on variable-driven analyses, searching for structural factors that inherently convey resilience. A second group of approaches focuses on the influence of social dynamics and emphasize agency. Studies in this perspective focus on farmers' perceptions and how their choices influence the adaptation of their farms, but also on the role played by larger social forces. To overcome both the ecological-social and the structure-agency dichotomies, we propose a third perspective on farm resilience, one focusing on relations. Resilience is then understood not as a fixed asset but as emerging from the dynamics of enacted relations, relations that are continuously remade in interaction with the past and with the current context.

2. Resilience thinking

Resilience is a term that is increasingly popular, both in policy contexts and in scientific debates (Davidson, 2010; Walker and Cooper, 2011). Resilience thinking not only emphasizes that change is ubiquitous, it also highlights that the source, type, timing, duration and impact of change is often unpredictable. As such it emphasizes that to persist over the long term, a system needs to change:

> "A management approach based on resilience (…) would emphasize the need to keep options open (…) and the need to emphasize heterogeneity. Flowing from this would be not the presumption of sufficient knowledge, but the recognition of our ignorance: not the assumption that future events are expected, but that they will be unexpected." (Holling, 1973: 21)

The 'adaptive cycle' is a heuristic model used to capture the non-linear dynamics of social-ecological systems, and to illustrate qualitatively different types of change (Gunderson and Holling, 2002; Burkhard et al., 2011). It distinguishes between four phases: exploitation, conservation, release and reorganisation (Fig. 1). During the exploitation phase, the farming system is well attuned to its environment, and aims to increase its efficiency. While many marginal adaptations are implemented – represented by the squiggly line of small-scale adaptive cycles in Fig. 1 – the system remains within the same overall trajectory, i.e. within broadly the same production practices and rationality. Over time, efficiency of resource use is increased, operations streamlined, variability reduced, and stability increased. However, as the number of connections increases, the change potential decreases. Indeed, while fine-tuning connections increases efficiency for a while, eventually the system is over-connected, i.e. variables and processes are so tightly controlled that the system becomes rigid. This limits its ability to respond to change. A disturbance such as a drought or a drop in prices is then sufficient to trigger the release phase: the tight organisation is lost, connections broken and resources freed. While the release phase is linked to great uncertainty, it also enables creative experimentation, innovation and redirection. Eventually, new connections are established and resources used and linked in novel ways. This starts the reorganisation phase, which leads to a new adaptive cycle, with increasingly efficient use of resources through fine-tuning processes and connections. The adaptive cycle thus conceptualizes change as an ongoing process, not as an occasional event.

A social-ecological system is resilient if it can successfully

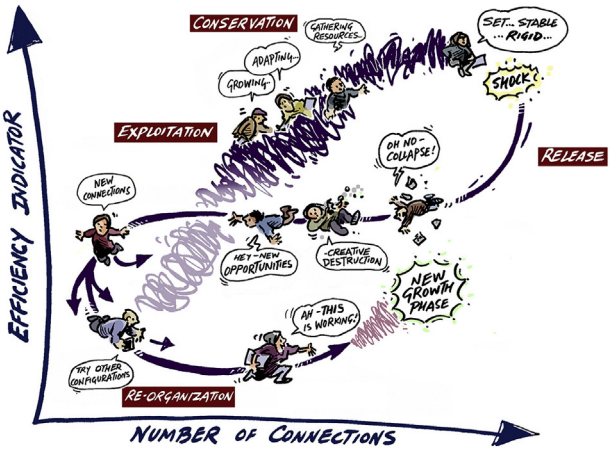

Fig. 1. For a farm to be resilient, it needs to be able to navigate the adaptive cycle. This includes long periods of marginal change where connections between resources are fine-tuned to increase efficiency. However, over time the system becomes rigid. Following a shock, connections are severed and resources released. The farm then needs to be able to navigate a period of rapid change, when previously explored opportunities are implemented. The farm undergoes a radical reorganization, before entering the next growth phase.
Illustration by Simon Kneebone for the authors (based on the adaptive cycle in Burkhard et al., 2011)

[1] As the concept of resilience has become popular, it now covers a wide range of definitions, meanings and connotations (see reviews by e.g. Brand and Jax, 2007; Walker and Cooper, 2011; Alexander, 2013). In this paper we only refer to the concept of social-ecological resilience, as defined by C.S. Holling and further developed within the Resilience Alliance.

navigate all four phases and two qualitatively different types of change (Fath et al., 2015). It needs to navigate relatively long phases characterised by steady growth and incremental change, where current strengths are exploited, but also turbulent phases of reorganisation and radical transformation, where new opportunities are explored (Scheffer and Westley, 2007).

To successfully navigate the adaptive cycle, a farm needs to be able to buffer shocks, to adapt and to transform (Darnhofer, 2014). Indeed, during the exploitation and conservation phase, a farm needs to be able to buffer a shock, such as a sudden price increase or the unavailability of a family member, without substantial changes on the farm. It also needs to be able to adapt to gradual change, induced by e.g. new policies, higher production standards, or shifts in the preferences of family members. Adaptations are often linked to the introduction of new technologies, exploring new marketing channels or changing consumer demands. While these changes enable an on-going adaptation of the farm, the underlying goals and the values remain unchanged. However, to navigate the release and re-organisation phase, a farm also needs to be able to transform. This relates to the ability to implement radical change, guided by new basic operating assumptions, new 'rules of the game', new ideas about what is desirable and why. For example, the conversion from conventional farming to organic farming can be such a transformation, if it is not limited to new production methods, but linked to shifts in perceptions, values and goals of the family members, as well as shifts in the configuration of social networks and market relations (Lamine, 2011).

Resilience thinking thus offers two main contributions. Firstly, it emphasizes that change is ubiquitous and often unpredictable, thereby challenging approaches building on equilibrium, stability, predictability and efficiency, which are at the heart of the modernisation of agriculture (Weis, 2010). Resilience thinking emphasizes that to persist, farms need to change. Indeed, while at times a shock can be buffered and the farm might 'bounce back' and return to its previous state, at other times it will need to 'bounce forward', i.e. transform. This offers alternative analytical insights by emphasizing the need to explore both path dependencies and path creation. It also points to the need of assessing farm strategies and public policies regarding the extent to which they enhance or erode farm and rural resilience in the face of unpredictable events (Scott, 2013).

Secondly, social-ecological resilience highlights the complex interdependencies between ecological and social processes, both of which are essential to understand family farms. For a farm to be resilient, it cannot privilege the social nor the ecological. Indeed, while farmers might demonstrate a high capability to cope with an economic crisis through further intensification of production practices, that capability might come at the expense of animal health, might jeopardize the provision of ecosystem services, or contribute to climate change (Knaus, 2009; Sundrum, 2015; EEA, 2015). Thus, while economic indicators may look solid, these might build on unseen processes of fragilization, which undermine the resilience of the farm.

3. Three perspectives of farm(ing) resilience

Large research programmes – such as social-ecological resilience – tend to be characterised by a variety of approaches spanning a range of theories, philosophies and research styles (Khagram et al., 2010). To highlight relevant differences in operationalizing the concept of resilience, we have grouped the diversity of approaches under two broad perspectives. Our intention is not to oversimplify or imply that there is a strict distinction between perspectives – indeed elements of the different perspectives are often found in multidisciplinary studies. Rather, by distinguishing between the biophysical-structural and the social-actor perspective, our aim is to highlight the complementarity of the insights they generate regarding the resilience of farms. We then propose a third perspective, and argue that a relational approach enables a stronger integration of the biophysical and social aspects that make up farming, as well as enables to put the ubiquity of change at the centre of attention (see Table 1).

We will discuss each of the three perspectives in turn, and illustrate the concepts using examples drawn from five empirical studies in France and in Austria. These studies were formally unrelated but have in common the focus on how farmers cope with change and adapt their farming practices. Four studies took place in south-east France: interviews with 14 organic farmers (producing fruits and/or vegetables) in Ardèche (in 2009); interviews with 17 mixed farms (fruit and vegetables) in the Biovallée, Drôme (in 2011); interviews with 42 vegetable farmers in the Drôme (in 2012 and 2013); and interviews with 35 fruit tree farmers in Ardèche and the Drôme (in 2014). One study took place in Austria: 14 conventional and 16 organic farmers were interviewed in Salzburg, most of which were dairy farmers (in 2014). The diversity within these studies (e.g. regarding farm sizes, farm types, geographical setting, disciplinary background of the researchers involved), and the transversal comparison of the insights generated through them, were instrumental in developing the conceptual arguments presented in this paper.

3.1. Focusing on structures

3.1.1. The search for measures of resilience

In this perspective, resilience is assumed to be linked to the structure of a system, i.e. the elements and the feedbacks between them. It translates into a focus on modelling a systems' behaviour and the search for objective measures to assess its resilience. To formalize the insights, a predictive theory of resilience would desirable, from which specific recommendations on how to increase resilience could be derived. Achieving this goal has remained a challenge. Indeed, early on Carpenter et al. (2001) noted that important aspects of resilience in social-ecological systems may not be directly observable, but must be inferred indirectly. They thus proposed to avoid the term 'indicators' of resilience and proposed 'surrogates' instead.

In the wider literature on resilience, there are several attempts to synthesize lessons from case studies to identify such surrogates. For example Folke et al. (2003) identified four 'critical factors' for building resilience and adaptive capacity in social-ecological systems; Anderies et al. (2006) proposed ten 'heuristics' to study and manage the dynamic evolution of linked social-ecological systems operating at multiple scales; Walker et al. (2006) advanced 14 'propositions' that are likely to play a role in the ability of social-ecological systems to absorb disturbances in either their ecological or their social domains; Cabell and Oelofse (2012) suggested 13 'behaviour-based indicators' for agroecosystems; Biggs et al. (2012) put forward seven 'generic policy-relevant principles' for enhancing the resilience of desired ecosystem services.

These syntheses indicate that despite sustained efforts to identify surrogates of resilience, developing a predictive resilience theory has remained elusive. While there is consensus on some broad principles (e.g. maintain diversity and redundancy, appropriate connectivity with the context, response diversity and self-regulation), there are few specific recommendations. Indeed, individual principles might point in opposing directions, depending e.g. on the context or the phase of the adaptive cycle (Holling, 2001; Cabell and Oelofse, 2012). Moreover, understanding social-ecological systems as complex adaptive systems, means that the relationship between resilience and surrogates is multidimensional

Table 1
Three perspectives of resilience, highlighting differences their modes of inquiry and their interpretation of concepts.

	Structures – farms	Social actors – farmers	Relations – farming
Analytical focus	Biophysical structure of the farm (e.g. size, type) and of the agro-ecosystem (e.g. soils, nutrient flows); also attention to social structures (e.g. markets, policies) Search for specific attributes of farms and agro-ecosystems that convey resilience within a given context	Agency of social actors (e.g. farmers, consumers, networks); critical analysis of the effect of power relations Understanding how farmers' perception of change, how learning processes, and how broader social forces influence farm adaptation or transformation	Integration of relations spanning biophysical processes and social forces As relations are continually reshaped (through ecological and social dynamics), resilience emerges from the ability to make and remake relations
Integration of ecological dynamics	Acknowledges complexity from feedbacks in ecological processes, yet in studies often a pragmatic focus on those biophysical entities that are amenable to quantitative modelling	Acknowledges influence of biophysical structures: they constrain, but do not determine action As ecological change is assumed to evolve over the long-term, within a study it is often treated as stable	Farming is a situation-specific web of ecological, technical and social relations Ecological factors (e.g. crops, pests, nutrients, climate) impose constraints and opportunities for how resilience can be enacted
Conceptualisation of actors	Cartesian rational actor; emphasizes instrumentalist means-ends rationality Methodological individualism leads to atomistic decision-maker Farmer is mostly passive recipient of transformative forces (e.g. ecological dynamics, markets)	Farming as socially constructed; thus focus on subjectivity, values, beliefs, perceptions, meanings, culture linked to farming Farmer as active participant in nested and overlapping social networks	Actors are not pre-existing but constituted through relations Human agency is contingent on the relationships built with – and partly enabled by – material factors
Conceptualisation of relations	Relations between ontologically independent entities Focus on flows of matter (e.g. nutrients) between physical entities	Relations between ontologically independent entities Focus on social relations between social groups, e.g. power, learning	Relations – rather than entities – are ontologically primordial Focus on interactions in space and in time, between humans and nonhumans

and may change over time (Carpenter et al., 2005). In other words, whatever principles or surrogates are identified, they are unlikely to be universal, and therefore they require a nuanced understanding of how, when, and where they apply, as well as how they interact with or depend on other principles (Biggs et al., 2012).

3.1.2. *Surrogates of farm resilience*

Within this perspective, empirical studies in agriculture often focus on the regional scale, e.g. the impact of irrigated agriculture on the water table in Australia (Walker et al., 2009); the impact of river management strategies on the incidence of extreme events in an agricultural basin in Hungary (Sendzimir et al., 2008); the impact of management choices on the amount of soil organic matter in grasslands in the Netherlands (van Apeldoorn et al., 2011); the exploration of alternative regimes and tipping points in coffee production (Vandermeer and Perfecto, 2012); or the extent to which rural livelihood strategies exhibit dynamics observed in ecological systems, e.g. non-linearity, irreversibility and hysteresis (Tittonell, 2014).

At farm level, empirical studies have focused mostly on the structures that enable flexibility, which is seen as key to the ability of farms to adapt over time (Darnhofer et al., 2010). Flexibility is often seen as being enabled by diversity, in its various dimensions (see Stirling, 2007). At the farm level the impact of a diversity of activities, of crops, of seed varieties, of marketing channels, of on- and off-farm income sources have received attention (see e.g. Dedieu et al., 2008; Darnhofer, 2010; Astigarraga and Ingrand, 2011). Indeed, for those farmers growing a limited number of field crops, adaptability and thus resilience can be increased by introducing new crops or by combining several marketing channels.

As the studies in France showed, some mid-size fruit farmers diversified by introducing additional fruit species or cultivars to develop direct sales. Some even started new activities, e.g. organic vegetables for new outlets, as a response to a lasting crisis in the regional fruit industry (Lamine, 2012). However, surveys within the French case studies showed that the decision to diversify is highly dependent on the available labour force, as more crops imply more labour and new skills (Navarrete et al., 2015; Dupré et al., 2015). The challenges linked to diversification were also highlighted in the Austrian study, where interviewed farmers pointed out that the need to coordinate between the diverse activities increases the labour load even further (Darnhofer and Strauss, 2014). Thus, while diversification is a broad strategy to strengthen resilience, its relevance and applicability depends on structural factors such as farm size, marketing channels and labour availability (Lamine and Navarrete, 2015).

Another resilience principle is to avoid the pathology of 'command and control', i.e. a one-sided focus on controlling the system to ensure efficiency (e.g. expressed in high and stable yields), as such systems become isolated from their context and inflexible (Holling and Meffe, 1996). By allowing the range of natural variation, the agro-ecosystem retains its resilience to external perturbations. This can be implemented in various ways. For example vegetable farms in the Drôme promote beneficial insects, through buying biological auxiliaries from biocontrol suppliers, or through planting hedgerows and flower strips to offer habitats to antagonists close to the fields. Similarly, farmers closed nutrient cycles on-farm through appropriate crop rotations, or at the regional level by purchasing animal manure from neighbouring farms. However, building on natural processes – rather than controlling agricultural production processes through the use of synthetic agrochemicals – requires farmers to engage in on-going fine-tuning (i.e. a 'step-by-step' approach, see Coquil et al., 2014). Indeed, natural regulations and balances – between insect pests and predators, between mineralization from organic matter and nutrient uptake by plants – may take several years to establish and will shift over time.

The comparison between the empirical studies in France and Austria also showed that an important structural factor that affects adaptability is the farm type, as it has a strong influence on the time horizon over which change needs to be considered. Indeed, while vegetables varieties can easily be changed from one year to the next, fruit trees are managed over at least 10 years, often much longer. On a dairy farm, a newly built barn is an investment for at least 20 years; and while a dairy cow may be kept for five to eight years, the planning horizon is much longer if the cows are bred on the farm, as breeding requires sustained efforts over several generations. While still allowing for incremental adaptations, such structural factors explain inertia and time lags, and may well hinder transformative change.

3.1.3. Strengths and limitations

This perspective clearly focuses on the interactions between social and ecological domains. However, the empirical focus is on the structural features. In the context of farm resilience, this perspective takes into account the material structures of farms (e.g. farm size, farm type, diversity of activities, production practices, resource endowment) and how these affect ecosystem dynamics. Studies with an economic component also integrate social structures, such as markets, policies, labour availability and how these affect production practices and thus the ecological impact of agriculture. Resilience is seen as resulting from the interplay of the dynamics within and between these structural features (Fig 2).

The – often implicit – aim of empirical approaches within this perspective is to identify levers that enable farms to buffer shocks. Indeed, the focus tends to be on ensuring the efficient use of resources to maximise and stabilise yields. Exploiting the features of the farm and encouraging marginal adaptations to ensure it remains well adapted to the current context is typical for the growth stage of the adaptive cycle. The primary aim is to preserve and strengthens a specific configuration, and thus to avoid the 'collapse' of structure and function, which is likely to occur if critical thresholds are passed.

The strength of such variable-centred approaches is that they allow testing causal hypotheses. Also, through the use of a variety of quantitative methods (e.g. to model ecosystem dynamics), studies can shed light on how actions reinforced by short-term successes may, over the long-term, lead to undesirable ecological effects. Moreover, these models can be valuable to inform participatory processes (see e.g. Etienne, 2011). Furthermore, models that integrate both ecological and social variables can show how individual actions contribute to the dynamics of the system, and how the system influences farmers' actions (see e.g. Feola and Binder, 2010).

Given the mathematical structure of the models, the impact of material and social structures is usually deterministic. In ecological models cause–effect relations are seen as rooted in 'laws of nature' (even if knowledge gaps means that their exact nature remains partly unknown). In animal and plant production, biological processes are seen as determining agricultural crop and animal production (e.g. animal growth rates, nutrient uptake, yields, nitrogen leaching rates). This perspective thus tends to imply a clear relation between an underlying cause and a measurable effect.

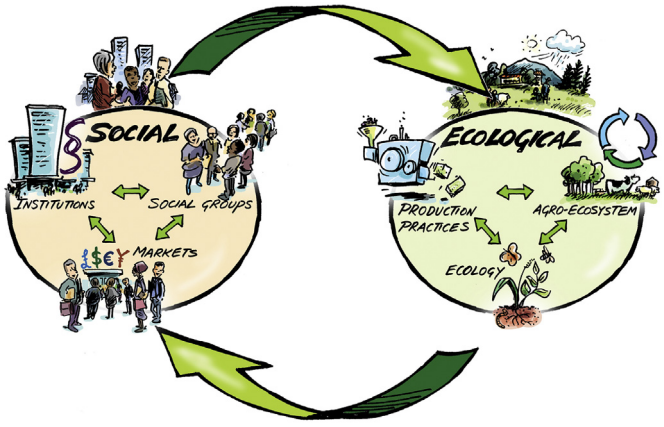

Fig. 2. Structural approaches to social-ecological resilience tend to emphasize the dynamics that emerge through the structural features of both domains. An example may be how farm characteristics and production practices influence nutrient flows or water management. The impact of social structures, e.g. labour availability, agricultural policies and markets demands on production practices and on the ecosystem are also included in a number of studies.
Illustration by Simon Kneebone for the authors.

Economic models – often implicitly – build on the normative assumption of rational decision makers. Farmers and regional actors are seen as having fixed preferences and clearly defined goals, and as choosing means suitable for realizing them. In their choices they are expected to be guided primarily by rational choice, i.e. informed by scientific insights, carefully weighing costs and benefits. This allows decision makers to ensure the efficient allocation of scarce resources, and to limit the environmental impact of production methods through responding adequately to ecological feedbacks. While empirical studies show that this is not necessarily the case (e.g. Walker et al., 2009; Sendzimir et al., 2008), it is usually seen as a regrettable deviation from what 'should' be done to ensure the resilience of the social-ecological system. By shifting from a descriptive to a normative approach, and by drawing upon unchallenged assumptions about the social world, studies within this perspective can effectively impose a technical-reductionist framework upon more complex webs of knowledge, values and meaning (Cote and Nightingale, 2012; Weichselgartner and Kelman, 2015).

3.2. Focusing on social actors

3.2.1. Mediating the influence of structures

In reaction to structural approaches that mainly focus on biophysical factors that are seen as determining farm resilience, a different perspective has emerged, which puts the agency of social actors at the centre of the analysis. This perspective emphasizes that while the dynamics of agro-ecosystems and broader social structures may drive changes, these change dynamics are also shaped by the perception and values of farmers and of other social actors. These affect the options that are understood as feasible and desirable, and thus the options that are acted upon. Farmers are not seen as passive recipients of transformative forces, as limited to responding to exogenous shocks. Rather, farmers are active agents in the process of change, they generate activities, attach meaning to production methods, actively create marketing opportunities, make sense of emerging opportunities, creatively adapt or transform their farms. In expressing his agency,[2] the farmer is constrained – but not determined – by the structure of the farm or its context. This perspective thus focuses on social actors and strives to understand how their agency strengthens or weakens farm resilience.

3.2.2. Influence of farmers' values and subjective perceptions

Putting actors at the centre of analysis has highlighted the diversity of practices within similar structures, and how farmers' values matter. For example in the Austrian study, diversifying activities on-farm (e.g. through direct marketing or offering 'holiday on farm' services) is widespread, as it is seen as a way to diversify family income, and to enable family members to express their interests and talents. Yet, some dairy farmers in the study argued that while they could offer such services – i.e. they had established guests through the work of the previous generation, had available resources such as labour and unused buildings, and saw the potential contribute to family income – they did not want to engage in these activities. They felt that they are not 'the right type of person' for direct marketing, or do not want to have guests around the farm the whole day (Strauss, 2015). Thus, even in a very similar structural context (topography, policies, markets, farm size), farms can differ significantly in their activities and how they implement these activities, i.e. their style of farming (van der Ploeg, 1994).

Moreover, farms that initially had similar activities and

[2] For a discussion of different conceptions of agency, see Emirbayer and Mische (1998).

structures are likely to follow different trajectories over time. The Ardèche study showed that among a group of fairly homogeneous small, diversified, organic vegetable farmers, some maintained their diversity over time and searched for appropriate marketing channels, building on the demand for quality food through CSA schemes, gastronomic restaurants, or traditional open-air markets. Other farmers, with similar structural conditions at the outset, entered a process of relative specialization to make it more "liveable". They enlarged their farm, limited their products range, mechanized, and started to add distant outlets to their established short supply chains (Lamine, 2012).

As these examples show, structural or objectively measurable factors do not determine the choices made by farmers, nor the trajectories of farms over time. Rather, the structures – both on- and off-farm, both material and social – constrain choices. But their influence is mediated by farmer's beliefs, and the potentials farmers perceive in a dynamically changing context.

3.2.3. Experiential learning and networks

Focusing on social actors also highlights that farmer choices, perceptions and values may change over time. As the above examples show, what is perceived as the 'appropriate' level of diversity in vegetables grown, is rarely stable. Farmers develop new marketing channels, organise their work differently and fine-tune production methods (Lamine et al., 2014). These changes result not least from farmers engaging in experimentation and learning. As Davoudi et al. (2013) have suggested, social-ecological systems can "*become* more or less resilient depending on their social *learning* capacity" (Davoudi et al., 2013: 311, emphasis in original). This shows that farmers are not passive recipients of external forces, that they do not simply apply recommendations from agricultural research transferred through extension services, but are themselves active in identifying problems and addressing them.

Indeed, farmers are well known to experiment (see Raedeke and Rikoon, 1997; Leitgeb et al., 2012; Meynard et al., 2012). They try out different varieties, tinker with production methods, look for new ways to market their products, and develop new services. In the Drôme study, a vegetable farmer tested alternative ways to limit the population of insect pests and weeds on a sub-plot. As the preliminary results were promising, the farmer tinkered with the method a bit more in the following year, and finally adopted the practice at the farm scale (Lamine and Navarrete, 2015). In the Austrian study, farmers not only experimented with alternative methods to medicate livestock (e.g. homeopathy, herbal medicine), but also tested new possible activities such as food processing or traditional handicrafts (Darnhofer and Strauss, 2015).

Farmers may engage in experiments alone or collectively. Indeed, farmers are embedded in a wider social context, highlighting the role of networks. In the Ardèche study, many organic vegetable and fruit growers belonged to several, partially intersecting, informal networks in which they shared equipment, sometimes worked together, and in most cases collaborated to master the logistics involved in balancing diverse marketing outlets (Lamine, 2012). By cultivating networks and the 'strategic conversations' taking place in them, various aspects of observed changes in (in)formal institutions can be better understood, which can play a role in the extent to which experiments and new enterprises are successful (Balducci et al., 2011). The networks and the information flows they sustain thus enable farmers to 'read' their context, detect threats, assess opportunities, proactively discuss emerging options, and gauge the wider ramification of trends and sudden shocks. Indeed, keeping in touch with the dynamics of the wider context is essential to remain responsive to change (see Berkes and Berkes, 2009).

3.2.4. Power asymmetries and social justice

Analysing the wider social context has highlighted how powerful actors may limit options, and how the concept of resilience can be construed to mean very different things. Indeed, there is a burgeoning engagement by critical social scientists with the implications of various understandings of resilience (e.g., Leach, 2008; Davidson, 2010; Cote and Nightingale, 2012; Reghezza-Zitt et al., 2012; Hatt, 2013; Scott, 2013; Fabinyi et al., 2014). In the context of farm resilience, three related issues raised in this body of literature are particularly relevant: that resilience is often linked to a top-down technical-rational approach; that an apolitical stance privileges established social structures; and that the resilience rhetoric is easily co-opted by neoliberalism.

As MacKinnon and Derickson (2012) point out, while at the outset resilience was a descriptive concept, state agencies and expert knowledge often normatively define how resilience is to be achieved. As a result, many policy documents follow a technical-rational reasoning and define strategies 'top-down'. In agriculture, to face the impact of climate change, to promote a bio-economy, and to pursue 'sustainable intensification', policies and dominant research structures tend to favour technical approaches based on precision farming, sophisticated plant-breeding and high-level biotechnology to engineer drought resistant hybrid and GM seeds (Vanloqueren and Baret, 2009; Levidow, 2015). This techno-rationality implies consensus rather than recognize the value of diversity; it underestimates the impact of farm heterogeneity and social plurality; and it leaves little room for participatory approaches, for farmer knowledge, or for approaches building on agroecological practices (Leach et al., 2012; Levidow, 2015).

Moreover, the apolitical stance in much of the resilience literature implicitly reinforces the status quo by privileging established social structures, which are often shaped by unequal power relations, injustice and marginalization (Leach, 2008; Cote and Nightingale, 2012). This stance ignores the impact of currently dominant power relations in shaping how societal problems are defined, which problems are seen as salient,[3] and what approaches are preferred to address them (Smith and Stirling, 2010). Indeed, influential elites and powerful corporations have little interest in transforming established systems from which they benefit. It is thus not surprising that many policy documents, through their inability or unwillingness to imagine radically different futures, promote incrementalism and marginal changes, focusing on buffering shocks and 'bouncing back' (Beilin et al., 2012; Davoudi et al., 2013; Brown, 2014). By downplaying the transformative component of resilience thinking, they in effect limit the space for more radical responses. Indeed, transformative change would involve changes to dominant research and policy practices, and question dominant power relations.

Finally, by highlighting how much individual farms can do to strengthen their resilience, resilience thinking aligns well with neoliberalism (Joseph, 2013; Zebrowski, 2013). By shifting the responsibility towards the individual, it downplays the influence of market structures and policies on enabling or restricting a diversity of strategies. Yet, while the resilience of individual farms are not determined by the context, it is still enmeshed with the broader context and its resilience. As examples from Australia show, policies might well erode the resilience of farms by eroding rural support structures, by narrowing the farms' ability to implement alternative approaches, and by reinforcing maladaptive responses (Beilin et al., 2012; Sysak, 2013; Sinclair, 2014).

[3] As Hatt (2013:33) points out, the apolitical stance is actually ironic as "many of the forces that resilience thinking was attempting to redress were inherent consequences of a social system built around neoliberal capitalism".

3.2.5. Strengths and limitations

Going beyond the influence of biophysical structures on farm resilience, this perspective highlights the extent to which farming is socially constructed. It emphasizes how social actors mediate the influence of ecological and social structures on farm resilience, as exemplified in spatial and temporal heterogeneity of farming practices. The ability to buffer shocks, to adapt or transform is thus no longer primarily linked to the biological properties of crops and animals, to the structure of the agro-ecosystem or the physical characteristics of the farm. Resilience is just as much linked to the ability of the farmer to make sense of dynamic complexity and indeterminacy, and the ability to engage in on-going learning (Fig. 3).

This perspective reinforces the understanding that there cannot be clear, universal, causal if–then relations that explain why some farms have been able to navigate turbulent times while others were not. There cannot be a 'recipe for success', not only because of the unpredictability linked to complex structural interrelations, but also because individual farmers have different perception and thus see different opportunities as well as value the same opportunities differently. It reinforces the insight that farm resilience cannot be assessed based on fixed criteria, as this ignores the fundamental difference between a measurable 'thing' and its meaning to the decision-maker.

Moreover, by putting the actors at the centre of attention, this perspective encourages a critical assessment of social structures. This sheds light on issues linked to power, equity and social justice, which so far have been insufficiently theorized within resilience thinking. Focusing on actors highlight that the question should not just be 'the resilience of what to what?' but also 'whose resilience?' and 'who decides?' (Leach, 2008; Smith and Stirling, 2010; Cote and Nightingale, 2012). Indeed, the ability to change and the impact of change is rarely evenly distributed between farms, thus raising issues of justice and power. The literature on food sovereignty and agroecology amply demonstrates how much the question of what food to grow, and how to grow it is contested (Alonso-Fradejas et al., 2015; Levidow, 2015). In the same vein, critical studies of the modernization of agriculture (e.g. Weis, 2010), and of family farms (e.g. Woodhouse, 2010; Graeub et al., 2015) amply illustrate the social struggles around the type of farms and production practices that are privileged by the current neoliberal policies.

Through analysing power asymmetries and their stabilizing effect, this perspective highlights why change is often limited to incremental adjustments, maintaining farms within a trajectory, i.e. in the conservation phase of the adaptive cycle. Thus, by focusing on how current power relationships evolve to maintain their dominance, the analysis focuses on explaining stability and inertia. In other words, it does not sufficiently conceptualize change, especially radical, transformative change, which is at the heart of social-ecological resilience as it is essential to navigate the adaptive cycle.

Furthermore, in this perspective, which is rooted in social sciences, ecological dynamics tend to be poorly theorized. This may partly be linked to the time frame considered, as social processes are often seen as occurring at a faster rate than ecological processes. Thus ecological dynamics are often expected to remain the same. Yet, ecologists have pointed out that, especially close to a threshold, ecological change can be both rapid and radical (Scheffer and Carpenter, 2003). As family farming builds on both social and ecological dynamics, a closer integration would be desirable for a more comprehensive conceptualization of farming resilience.

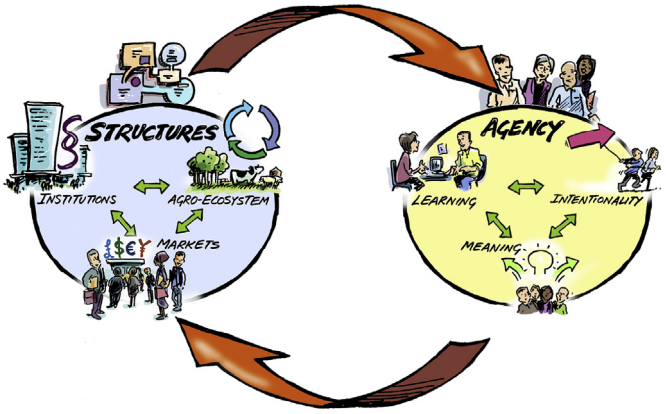

Fig. 3. The social-actor perspective highlights how the influence of structures is mediated by human agency. Thus farm resilience depends on the ability of the farmer to make sense of available options, and to navigate uncertainty by experimenting, learning, engaging in networks and collaborating.
Illustration by Simon Kneebone for the authors

3.3. Focusing on relations

3.3.1. Farming as emerging from relations

A relational perspective[4] on the resilience of farms can contribute to overcoming the conceptual distinction between the actor and his activity, between structure and agency, between the social and the ecological: focusing on relations – rather than entities – allows for a symmetric treatment and for integration. Indeed, relational theorists reject the notion that there are discrete, pre-given units that can be used as starting point of analysis (Emirbayer, 1997). The world is thus not conceived as consisting primarily of static 'things' (which may or may not be linked by processes), but as consisting of dynamic, unfolding relations.

In a relational perspective, farmers are understood as inseparable from the spatial and temporal contexts within which they are embedded, i.e. both their farm and the wider social and ecological context; but also the temporal context, i.e. building on and revisiting the past. As the farm and farmer are transformed through every relation and every process, it makes little sense to talk about farms and farmers apart from the relations within which they are involved (and vice versa). As such a farm can only be understood in terms of the relations in which it is entangled: the farm as it is now, is but a stabilized moment in a process of continual becoming (see Chia, 1999). To focus on relations, to convey the interdependency of farm, farmer and context, it seems helpful to refer to 'farming'. By using a verb rather than a noun, the emphasis is on relations and dynamics, rather than on separateness and stability (see Elias, 1978).

3.3.2. Resilience as becoming

Taking a relational perspective, farming is understood as a deleuzian 'becoming'. Becoming – as opposed to being – is used to convey the idea that more than by stable qualities, human beings are characterized by their interactions with the multiples objects and beings in their environment (see e.g. Deleuze and Guattari, 1987; Deleuze and Parnet, 1996). Building on these approach, resilience is not a character or attribute of the farm, nor seen as primarily located in the capability of the farmer to navigate change, but in relations that are never stable, that must be enacted, performed every day. These relations are always and everywhere contingent, contradictory and unfinished, they are entangled in an

[4] This perspective builds on the 'relational turn' in sociology (e.g. Latour, 2005; Abbott, 2007; Crossley, 2011; Donati, 2011; Dépelteau, 2015) and in geography (e.g. Massey, 2004; Murdoch, 2006).

on-going production of openings as well as closures. This perspective emphasizes change and transformability, through highlighting the pervasive potential of relations to become otherwise (Balducci et al., 2011; Allen, 2012). Farming can always be actualized differently. Depending on the relations of which it is part, farming is "always loaded with possibilities and can be continually enriched with newer and novel meanings, understandings and applications" (Chia, 1999:220). This leads to a reformulation of farming resilience in terms of relational thinking (see Davoudi, 2012). It reemphasizes that resilience is not a 'thing' that can be seized, held or measured, it is not an attribute or property of a farm or a farmer. Rather, resilience is the emergent result of ever changing patterns of relations, relations that are material, social, cultural.

A metaphor may be helpful to reorient what it means to conceptualize resilience based on a relational approach. Building on Elias (1978), farming resilience can be seen as akin to playing a game of cards (Fig. 4). To focus on the relations, it is important not to see the 'game' as a static thing that is then 'played', to avoid reifying 'the game' as if it were separate from the players. It is not about assessing the skill of the player in isolation, or the impact of the hand of cards she has been dealt. Indeed, neither guarantees success. The success in a game of cards is not attributable to any individual move, nor to a pre-set strategy. It depends on how a player plays her hand, on how she integrates her past experience, on the relations between the cards she has, on her expectations of future moves, on the actual sequence of moves, on the relations between her moves and the moves by other players. While the metaphor has its limitations, it highlights the emergent and dynamic features of the relations that constitute resilience. As with playing, how farming resilience will unfold will depend on the history of the relations, on how the farmer, the farm and the context are constituted through these relations, and how these relations enable different futures.

Organic farming in Austria may serve to illustrate the ever-evolving nature of relations. Extensive organic farming represents a different farming logic – and thus a different pattern of relations – than intensive conventional farming. This not only includes relations on-farm, e.g. material aspects such as nutrient flows and relations of meaning linking individual farming practices. It also includes relations off-farm, e.g. knowledge exchange between organic farmers, or addressing societal demands such as a reduction of the environmental footprint. In Salzburg, such on-farm relations, combined with specific ecological, political, geographical and economic relations have enabled the spread of organic farming

Fig. 4. In the relational perspective, the emphasis is on the interactions that create ever-evolving situations. However, unlike a card game, the aim is less to win a specific round than to build relations that allow to keep playing.
Illustration by Simon Kneebone for the authors.

over the last 20 years, so that currently almost half of the Utilized Agricultural Area is certified organic. This context in turn enables specific relations e.g. joint initiatives between organic farmers, and marketing relations with supermarket chains seeking to address consumer demand for organic milk. The relations involved in farming in Salzburg – both material relations and those based on values and meaning – have contributed to ever-evolving situations on-farm and in the broader region, that constrained some development while making others possible.

3.3.3. Change as pervasive: the role of experimenting

Focusing on relations, especially on their provisional nature and thus the understanding of farming as constantly being remade, allows new insights into farmers' experiments. It reinforces their importance as central to learning about shifting relations, while at the same time highlighting that the experiments contribute to these shifts. For example, a farmer from the Austrian study told of experimenting with wrapping square bales of grass in plastic, as an alternate way to produce silage. However, the experiment went awry: mice bit through the wrapping, the grass fermented and was unusable as feed. As the farmer discussed the mishap with an organic farmer, the latter suggested composting. While the farmer had been vaguely interested in it, he started composting because of the (failed) experiment with silage. Later, he attended a course on composting and it became an important part of cycling nutrients on his (now organic) farm. The example shows that the relations between the farmer, the grass, the nutrient flows have all changed in a way that was unplanned and unpredictable. The aim was to find something that 'works' in a specific context, which was itself subject to change. This process of getting from a collection of ideas and objects to a coherent and meaningful whole is one of on-going dialogue between how elements can be put into relation, how the emerging object can be put to use, how new ideas can be integrated, how resources can be linked in new ways. In so doing, it transforms previous relations, creates a new context, and thus redefines what is seen as 'working'. The farm 'is' not resilient, but farming resilience is continuously remade in interaction.

This highlights that farmers' approach to experimenting is different from both engineering and from rational reasoning which seeks the most effective way to achieve a clearly defined goal (Duymedjian and Rüling, 2010; Johnson, 2012). When farmers experiment, the aim is rarely to produce a 'solution' to a clearly defined problem. Indeed, Farmers' experiments is more akin to 'bricolage' (see Innes and Booher, 1999; Cleaver, 2002). Bricolage is an on-going process, where heterogeneous objects and concepts are combined, where ideas are tinkered with until something is created that the farmer believes will work for a particular project at a particular moment. But in this process, the farmer also explores new ways of framing the situation and probes combinations of potential actions which may yield qualitatively new options. It is about seeing new possible relations between elements. Often, the 'bricoleur' does not have a clear end in sight, but rather a vaguely defined project, which is itself subject to change depending on what is available and what is seen as promising.

Farmers' experiments are thus not so much a scientific laboratory experiment, than they are a speculative method of knowing, of working with uncertainty (see Balducci et al., 2011; Hillier, 2011). Experiments that farmers engage in – individually or collectively – are designed to probe the future, to test new potential combinations, to assess whether a new activity or production method is promising for now or some time in the future. The experiments are thus not limited to their material dimension, they always also prod the limits of what is 'thinkable', questioning the assumptions that underlie both traditions and innovations. The experiments feed the imagination of different ways to farm, as much as they are fed by

these imaginations. They introduce new ways of framing old insights, as much as new ways of making sense of emerging trends (see Kaplan and Orlikowski, 2013). Experimenting is thus an attitude, a state of mind, as much as it is the material act of performing experiments.

As in the perspective focusing on actors, the relational perspective highlights the importance of experiments to engage in open-ended learning and taking advantage of unexpected outcomes. As such farmers' experimenting contributes to resilience, as it prepares the farm for the reorganisation phase of the adaptive cycle. Indeed, a relational perspective emphasizes on-going dynamics (as opposed to a bounded experiment), as well as serendipity, surprise and emergence. Change always has ramifications and implications beyond those initially imagined; plans, when they are translated into action, are always modified and adapted; actors improvise, fine-tune and adjust (Tsoukas and Chia, 2002). As such the relational perspective not only highlights on-going change as relations are being made and remade, but also the need to keep the ability to make new relations to take advantage of surprises and the unexpected.

3.3.4. Integrating social and ecological relations

In the context of social-ecological resilience, relational approaches, building on e.g. 'agential realism' by Barad (2007) or 'relational realism' by Carolan and Stuart (2016) can contribute to overcoming the divisions between nature and culture. By not privileging either the ecological or the social, their intermingling becomes the centre of attention. Similarly, in Actor-Network-Theory, agency is extended to include heterogeneous associations of human and nonhuman 'actants' (Latour, 2005). Recognizing that nonhumans (e.g., crops, technology, climate) are not mere passive objects to be used or managed in the pursuit of resilience opens new ways to explore how 'vibrant' matter can shape the manner in which the adaptive capacity of farming is expressed (Dwiartama and Rosin, 2014). Indeed, how farming re-enacts relations is contingent on those relations that are enabled by current biophysical conditions. Through a symmetric, balanced treatment of people and things, actor-network-theory has enabled the reconceptualization of society–nature interactions, thus revealing new interconnections between the social and the biophysical domains.

A relational approach allows to highlight how farming modifies and is modified by relations between a range of natural and social processes. For example in the Austrian study, the alpine pastures that are highly valued by ecologists for their unique biodiversity, are not 'natural': without cows grazing them in summer, many would revert to forest. Historically, this practice was developed due to a scarcity of feed: flatter areas in the valleys were used for cropping, so that other feed resources had to be developed and maintained. Nowadays feed can be imported from around the globe, leading to the abandonment of this labour-intensive practice. However, for many farmers, maintaining traditional practices is identity-forming, and new relations have been built between the alpine pastures, the cows, their milk, the bacteria (used to make cheese), the farmers, consumers, and (often) tourists. This example shows how farming is constituted through diverse relations between human actors and a broad range of ecological aspects of farming, and how these relations are fluid, always changing, interacting with other social and biophysical processes. The resilience of farming in alpine areas emerges from the ability to adapt and transform relations between ecological and social processes. These relations are not defined by stable flows of nutrients, of information, or meaning, but constantly redefined in response to a multitude of changes. A relational perspective thus not only highlights shifts in policy and market relations, or shifts in farmers' choices, but can equally integrate ecological relations and how they intermingle, change and are changed by social relations.

3.3.5. Strengths and weaknesses

The relational perspective reinforces the notion that farming resilience is not an essential attribute or property of a preconstituted farm or farmer. Rather, resilience emerges out of the configuration of relations (both tangible and intangible) and the dynamics of these relations (Fig. 5). Resilience is thus not primarily attributable to the actions of the farmer, the structure of the farm, nor to feedbacks within the agro-ecosystem, but fundamentally to the unfolding of relations that constitute farming. This calls for a shift away from what a farm has or what a farmer is able to do, towards the relations that are involved in the farming process, which includes biophysical relations on- and off-farm as well as broader social relations of power and of meaning. The question is thus less about the resources of a farm or farmer, but which relations are enacted between them.

We propose that by taking a relational perspective it is possible to develop an understanding of resilience as emerging from the situated and dynamic entanglement of the ecological and the social. However, it not only enables the integrative treatment of social and ecological relations, it also highlights that change is on-going. Indeed, while farming might seem stable in some periods, there are always changes occurring underneath the surface. This applies to both ecological processes (e.g. nutrient leaching whose effect is buffered for a while, but eventually a tipping point is reached after which the impact of the loss becomes noticeable), and for social processes (e.g. shifts in how issues are framed, shifts in power relations). Thus, it is change that is normal and (apparent) stability that needs explaining. This perspective enables a more dynamic view of resilience, one focusing on change and navigating the adaptive cycle, rather than maintaining states and avoiding thresholds.

The relational perspective allows focusing on adaptability and transformability by highlighting that farming is always in the process of becoming as relations, juxtapositions, interactions, and meanings unfold. Farming is always being made, always unfinished

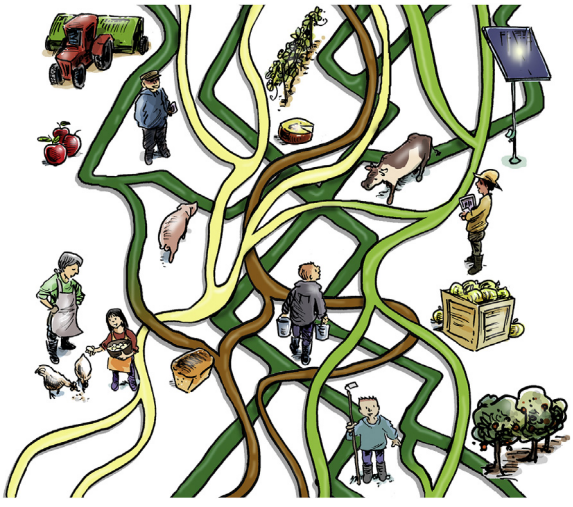

Fig. 5. Relational approach emphasizes that there are always excess possibilities, as exemplified by different 'styles of farming' or the coexistence of organic and conventional farms in a region. A relational approach also highlights that farming is an ongoing process of 'becoming': not only do relations change within a specific path, there is also path creation through bifurcation. Resilience is thus dependent on material and value relations on- and off-farm that are provisional, enacted, contingent and always under construction.
Illustration by Simon Kneebone for the authors.

and could always be different. The emphasis is on the relations and configurational patterns that enable on-going, creative and responsive change. This goes beyond approaches using a comparative-static approach between practices or relations 'then' and 'now', and approaches looking for mechanisms that explain change or stability. While the relational approach raises new methodological challenges, applications of Actor-Network Theory have shown how the 'vibrancy' of matter and the interaction between humans and nonhumans can be effectively captured (see e.g. Dwiartama and Rosin, 2014).

4. Conclusion: integrating insights on farming resilience

To help structure the discussion on what makes farms resilient, we have proposed to distinguish between approaches that focus on biophysical structures and their dynamics; and those that focus on social actors and their agency. Both perspectives have identified a range of factors that may strengthen or weaken farm resilience. The first perspective identifies both material and social structures that influence farm resilience. Empirical studies have shown the role of ecosystem dynamics in maintain the functionality of agro-ecosystems. They have pointed out that certain agricultural production practices may well move a farming system closer to a critical threshold. They have also shown that certain types of farms may be more prone to path dependency and find it more challenging to undergo transformational change. The second perspective focuses on the role of social actors. It highlights that farm resilience is influenced by what the farmer makes of the resources at her disposal, what options and potentials she perceives. Indeed, different farmers respond differently to uncertainty and change, not least based on their values, their experiments, and the networks they are involved in. This second perspective also highlights the importance of taking into account the broader social context, i.e. policies, norms or power asymmetries, and how they affect the ability of farms to adapt.

The insights on resilience generated by the two perspectives are complementary, but their integration has remained difficult, despite the explicit aim of social-ecological resilience to understand the interdependency of social and ecological dynamics. Moreover, both the structural and the actor perspective focus on what a farm is or what a farmer does, to explain what makes a farm resilient (or not). Through focusing on assessing states, the perspectives promote a somewhat static understanding of resilience. Especially the question of what enables radical, transformative change – which is needed for the reorganization phase of the adaptive cycle – has remained largely backstage.

We argue that a relational approach, which conceptualizes the relations (rather than entities) as foundational, allows a stronger integration of the social and ecological aspects that strengthen or weaken the resilience of family farms. Focusing on biophysical relations and on relations based on values, beliefs and meaning allows a better understanding of the drivers that shape the diversity of farming within a specific context, and shape changes in farming practices over time. Indeed, a relational approach highlights that patterns of relations are always changing, shifting the attention away from the analysis of (seemingly) stable states towards the process through which incremental and transformational changes are enacted. This includes relations enacted on a specific farm, but also the deep drivers embedded in the wider context – e.g. the relationalities embedded in productivism – and how these constrain the adaptability of farming practices. Indeed, different relationalities will offer different opportunities and constraints and thus different levels of flexibility to engage with change, and to shape change.

A relational perspective promotes a different approach to studying resilience through a fine-grained conceptualization of relations. Relations that are constantly modified, adapted, changed, diversified, merged, revisited, reinterpreted; relations that are constantly being made and remade through both human and material agency; relations that both sustain and corrode stability. This focus on relations shifts the understanding of resilience from being an attribute, to being a process that needs to be constantly re-enacted and performed through nurturing diverse and heterogeneous relations. A relational perspective also contributes towards a more balanced approach to resilience thinking, covering how farming can buffer shocks and 'bounce back' as well as how farming can be transformed and 'bounce forward', i.e. covering both path dependency and path creation. This approach thus allows identifying the relationalities that inhibit adaptability, but also those that encourage novel patterns of relations, and thus make different and diverse farming practices possible.

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References

Abbott, A., 2007. Mechanisms and relations. Sociologica (2), 1–22. http://dx.doi.org/10.2383/24750 [online].

Alexander, D., 2013. Resilience and disaster risk reduction: an etymological journey. Nat. Hazards Earth Syst. Serv. 13, 2707–2716. http://dx.doi.org/10.5194/nhess-13-2707-2013.

Allen, J., 2012. A more than relational geography? Dialogues Hum. Geogr. 2, 190–193. http://dx.doi.org/10.1177/2043820612449295.

Alonso-Fradejas, A., Borras, S.M., Holmes, T., Holt-Giménez, E., Robbins, M.J., 2015. Food sovereignty: convergence and contradictions, conditions and challenges. Third World Q. 36, 431–448. http://dx.doi.org/10.1080/01436597.2015.1023567.

Anderies, J.M., Walker, B.H., Kinzig, A.P., 2006. Fifteen weddings and a funeral: case studies and resilience-based management. Ecol. Soc. 11 (1), 21 [online] URL. http://www.ecologyandsociety.org/vol11/iss1/art21/.

Astigarraga, L., Ingrand, S., 2011. Production flexibility in extensive beef farming systems. Ecol. Soc. 16 (1), 7 [online] URL. http://www.ecologyandsociety.org/vol16/iss1/art7/.

Balducci, A., Boelens, L., Hillier, J., Nyseth, T., Wilkinson, C., 2011. Strategic spatial planning in uncertainty: theory and explanatory practice. Town Plan. Rev. 82, 481–501. http://dx.doi.org/10.3828/tpr.2011.29.

Barad, K., 2007. Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning. Duke University Press, Durham.

Beilin, R., Sysak, T., Hill, S., 2012. Farmers and perverse outcomes: the quest for food and energy security, emissions reduction and climate adaptation. Glob. Environ. Change 22, 463–471. http://dx.doi.org/10.1016/j.gloenvcha.2011.12.003.
Berkes, F., Berkes, M., 2009. Ecological complexity, fuzzy logic, and holism in indigenous knowledge. Futures 41, 6–12. http://dx.doi.org/10.1016/j.futures.2008.07.003.
Biggs, R., Schlüter, M., Biggs, D., Bohensky, E.L., BurnSilver, S., Cundill, G., Dakos, V., Daw, T.M., et al., 2012. Toward principles for enhancing the resilience of ecosystem services. Annu. Rev. Environ. Resour. 37, 421–448. http://dx.doi.org/10.1146/annurev-environ-051211-123836.
Brand, F., Jax, K., 2007. Focusing the meaning(s) of resilience: resilience as a descriptive concept and boundary object. Ecol. Soc. 12 (1), 23. http://www.ecologyandsociety.org/vol12/. iss1/art23/.
Brown, K., 2014. Global environmental change: a social turn for resilience? Prog. Hum. Geogr. 38, 107–117. http://dx.doi.org/10.1177/0309132513498837.
Burkhard, B., Fath, B., Müller, F., 2011. Adapting the adaptive cycle: hypotheses on the development of ecosystem properties and services. Ecol. Model. 222, 2878–2890. http://dx.doi.org/10.1016/j.ecolmodel.2011.05.016.
Cabell, J.F., Oelofse, M., 2012. An indicator framework for assessing agroecosystem resilience. Ecol. Soc. 17 (1), 18. http://dx.doi.org/10.5751/ES-04666-170118 (online).
Carpenter, S., Walker, B., Anderies, J., Abel, N., 2001. From metaphor to measurement: resilience of what to what? Ecosystems 4, 765–781.
Carpenter, S., Westley, F., Turner, G., 2005. Surrogates for resilience of social-ecological systems. Ecosystems 8, 941–944. http://dx.doi.org/10.1007/s10021-005-0170-y.
Carolan, M., Stuart, D., 2016. Get real: climate change and all that 'it' entails. Sociol. Rural. 56, 74–95. http://dx.doi.org/10.1111/soru.12067.
Chia, R., 1999. A 'rhizomic' model of organizational change and transformation: perspective from a metaphysics of change. Br. J. Manag. 10, 209–227. http://dx.doi.org/10.1111/1467-8551.00128.
Cleaver, F., 2002. Reinventing institutions: bricolage and the social embeddedness of natural resource management. Eur. J. Dev. Res. 14, 11–30. http://dx.doi.org/10.1080/714000425.
Coquil, X., Béguin, P., Dedieu, B., 2014. Transition to self-sufficient mixed crop-dairy farming systems. Renew. Agric. Food Syst. 29, 195–205. http://dx.doi.org/10.1017/S1742170513000458.
Cote, M., Nightingale, A.J., 2012. Resilience thinking meets social theory: situating social change in socio-ecological systems (SES) research. Prog. Hum. Geogr. 36, 475–489. http://dx.doi.org/10.1177/0309132511425708.
Crossley, N., 2011. Towards Relational Sociology. Routledge, London.
Davidson, D., 2010. The applicability of the concept of resilience to social systems: some sources of optimism and nagging doubts. Soc. Nat. Resour. 23, 1135–1149. http://dx.doi.org/10.1080/08941921003652940.
Davoudi, S., Brooks, E., Mehmood, A., 2013. Evolutionary resilience and strategies for climate adaptation. Plan. Pract. Res. 28, 307–322. http://dx.doi.org/10.1080/02697459.2013.787695.
Darnhofer, I., 2014. Resilience and why it matters for farm management. Eur. Rev. Agric. Econ. 41, 461–484. http://dx.doi.org/10.1093/erae/jbu012.
Darnhofer, I., 2010. Strategies of family farms to strengthen their resilience. Environ. Policy Gov. 20, 212–222. http://dx.doi.org/10.1002/eet.547.
Darnhofer, I., Fairweather, J., Moller, H., 2010. Assessing a farm's sustainability: insights from resilience thinking. Int. J. Agric. Sustain. 8, 186–198. http://dx.doi.org/10.3763/ijas.2010.0480.
Darnhofer, I., Strauss, A., 2014. Resilience of family farms: understanding the trade-offs linked to diversification. In: Proceedings of the 11th European IFSA Symposium - farming systems facing global challenges: Capacities and strategies, held 1-4 April 2014 in Berlin (Germany), pp. 1777–1787 (Weblink).
Darnhofer, I., Strauss, A., 2015. Organic Farming and Resilience. Case Study Report Austria. Rethink Project, p. 55 (Weblink).
Davoudi, S., 2012. Resilience: a bridging concept or a dead end? Plan. Theory Pract 13, 299–333. http://dx.doi.org/10.1080/14649357.2012.677124.
Dedieu, B., Chia, E., Leclerc, B., Moulin, C.-H., Tichit, M. (Eds.), 2008. L'élevage en movement: Flexibilité et adaptation des exploitations d'herbivores. Quae, Versailles.
Deleuze, G., Guattari, F., 1987. A Thousand Plateaus. Capitalism and Schizophrenia. University of Minnesota Press, Minnesota.
Deleuze, G., Parnet, C., 1996. Dialogues. Flammarion, Paris.
Dépelteau, F., 2015. Relational sociology, pragmatism, transactions and social fields. Int. Rev. Sociol. 25, 45–64. http://dx.doi.org/10.1080/03906701.2014.997966.
Donati, P., 2011. Relational Sociology. A New Paradigm for the Social Sciences. Routledge, London.
Dupré, L., Lamine, C., Navarrete, M., 2015. Short Food Supply Chains, Long Working Days: Paradoxes, Tensions and Professional Satisfaction in Organic Farming. Paper presented at the XXVIth ESRS Congress, held in Aberdeen, 18–28 August 2015.
Duymedjian, R., Rüling, C.-C., 2010. Towards a foundation of bricolage in organization and management theory. Organ. Stud. 31, 133–151. http://dx.doi.org/10.1177/0170840609347051.
Dwiartama, A., Rosin, C., 2014. Exploring agency beyond humans: the compatibility of Actor-Network Theory (ANT) and resilience thinking. Ecol. Soc. 19 (3), 28. http://dx.doi.org/10.5751/ES-06805-190328 [online].
EC, 2013. Structure and Dynamics of EU Farms: Changes, Trends and Policy Relevance. EU Agricultural Economics Briefs No. 9. DG Agriculture and Rural Development, Brussels (weblink).
EC, 2014. Agriculture in the European Union. Statistical and Economic Information, Report 2013. DG Agriculture and Rural Development, Brussels (weblink).
EEA, 2015. The European Environment – State and Outlook 2015 (SOER 2015). An Integrated Assessment of the European Environment. European Environment Agency, Copenhagen (weblink).
Elias, N., 1978. What Is Sociology? Columbia University Press, New York.
Emirbayer, M., 1997. Manifesto for a relational sociology. Am. J. Sociol. 103, 281–317. http://www.jstor.org/stable/2782992.
Emirbayer, M., Mische, A., 1998. What is agency? Am. J. Sociol. 103, 962–1023. http://dx.doi.org/10.1086/231294.
Etienne, M. (Ed.), 2011. Companion Modelling. A Participatory Approach to Support Sustainable Development. Edition Quae, Versailles.
Fabinyi, M., Evans, L., Foale, S.J., 2014. Social-ecological systems, social diversity, and power: insights from anthropology and political ecology. Ecol. Soc. 19 (4), 28. http://dx.doi.org/10.5751/ES-07029-190428 [online].
Fath, B.D., Dean, C.A., Katzmair, H., 2015. Navigating the adaptive cycle: an approach to managing the resilience of social systems. Ecol. Soc. 20 (2), 24. http://dx.doi.org/10.5751/ES-07467-200224 [online].
Feola, G., Binder, C.R., 2010. Towards an improved understanding of farmers' behaviour: the integrative agent-centred (IAC) framework. Ecol. Econ. 69, 2323–2333. http://dx.doi.org/10.1016/j.ecolecon.2010.07.023.
Folke, C., Colding, J., Berkes, F., 2003. Synthesis: building resilience and adaptive capacity in social-ecological systems. In: Berkes, F., Colding, J., Folke, C. (Eds.), Navigating Social-ecological Systems. Building Resilience for Complexity and Change. Cambridge University Press, Cambridge, pp. 352–387.
Freibauer, A., Mathijs, E., Brunori, G., Damianova, Z., Faroult, E., Girona I Gomis, J., O'Brien, L., Treyer, S., 2011. Sustainable Food Consumption and Production in a Resource-constrained World. Third SCAR Foresight Exercise. European Commission, Standing Committee on Agricultural Research (Weblink).
Graeub, B., Chappell, M.J., Wittman, H., Lederman, S., Bezner Kerr, R., Gemmill-Herren, B., 2015. The state of family farms in the world. World Dev. Press. http://dx.doi.org/10.1016/j.worlddev.2015.05.012.
Gunderson, L., Holling, C.S. (Eds.), 2002. Panarchy. Understanding Transformations in Human and Natural Systems. Island Press, Washington.
Hatt, K., 2013. Social attractors: a proposal to enhance 'resilience thinking' about the social. Soc. Nat. Resour. 26, 30–43. http://dx.doi.org/10.1080/08941920.2012.695859.
Hillier, J., 2011. Strategic navigation across multiple planes. Towards a Deleuzian-inspired methodology for strategic planning. Town Plan. Rev. 82, 503–527. http://dx.doi.org/10.3828/tpr.2011.30.
Holling, C.S., 1973. Resilience and stability of ecological systems. Annu. Rev. Ecol. Syst. 4, 1–23. http://dx.doi.org/10.1146/annurev.es.04.110173.000245.
Holling, C.S., 2001. Understanding the complexity of economic, ecological and social systems. Ecosystems 4, 390–405. http://dx.doi.org/10.1007/s10021-001-0101-5.
Holling, C.S., Meffe, G., 1996. Command and control and the pathology of natural resource management. Conserv. Biol. 10, 328–337. http://dx.doi.org/10.1046/j.1523-1739.1996.10020328.x.
Innes, J.E., Booher, D.E., 1999. Consensus building as role playing and bricolage. J. Am. Plan. Assoc. 65, 9–26. http://dx.doi.org/10.1080/01944369908976031.
Johnson, C., 2012. Bricoleur and bricolage: from metaphor to universal concept. Paragraph 35, 355–372. http://dx.doi.org/10.3366/para.2012.0064.
Joseph, J., 2013. Resilience as embedded neoliberalism: a governmentality approach. Resilience 1, 38–52. http://dx.doi.org/10.1080/21693293.2013.765741.
Khagram, S., Nicholas, K., Bever, D., Warren, J., Richards, E., et al., 2010. Thinking about knowing: conceptual foundations for interdisciplinary environmental research. Environ. Conserv. 37, 388–397. http://dx.doi.org/10.1017/S0376892910000809.
Kaplan, S., Orlikowski, W., 2013. Temporal work in strategy making. Organ. Sci. 24, 965–995. http://dx.doi.org/10.1287/orsc.1120.0792.
Kitson, M., Martin, R., Tyler, P., 2011. The geographies of austerity. Camb. J. Regions, Econ. Soc. 4, 289–302. http://dx.doi.org/10.1093/cjres/rsr030.
Knaus, W., 2009. Dairy cows trapped between performance demands and adaptability. J. Sci. Food Agric. 89, 1107–1114. http://dx.doi.org/10.1002/jsfa.3575.
Lamine, C., 2011. Transition pathways towards a robust ecologization of agriculture and the need for system redesing. Cases from organic farming and IPM. J. Rural Stud. 27, 209–219. http://dx.doi.org/10.1016/j.rurstud.2011.02.001.
Lamine, C., 2012. Changer de système: une analyse des transitions vers l'agriculture biologique à l'échelle des systèmes agri-alimentaires territoriaux. Terrains Travaux 20, 139–156 (weblink).
Lamine, C., Garçon, L., Dupré, L., Navarrete, M., 2014. Trajectoires de petites exploitations en France et en Italie: des facteurs de résilience multiples mais souvent fragiles. Paper presented at the 'Colloque Petites Paysanneries' held 19–21 November 2014 in Nanterre (France).
Lamine, C., Navarrete, M., 2015. Transitions Towards Ecological Production. Case Study Report France. Rethink project, p. 43.
Latour, B., 2005. Reassembling the Social. Oxford University Press, Oxford.
Leach, M. (Ed.), 2008. Re-framing Resilience: a Symposium Report. STEPS Working Paper 13. STEPS Centre, Brighton.
Leach, M., Rockström, J., Raskin, P., Scoones, I., Stirling, A.C., Smith, A., Thompson, J., Millstone, E., Ely, A., Arond, E., Folke, C., Olsson, P., 2012. Transforming innovation for sustainability. Ecol. Soc. 17 (2), 11. http://dx.doi.org/10.5751/ES-04933-170211 [online].
Leitgeb, F., Kummer, S., Funes-Monzote, F.R., Vogl, C.R., 2012. Farmers' experiments

in Cuba. Renew. Agric. Food Syst. 29, 48–64. http://dx.doi.org/10.1017/S1742170512000336.
Levidow, L., 2015. European transitions towards a corporate-environmental food regime: agroecological incorporation or contestation? J. Rural Stud. 40, 76–89. http://dx.doi.org/10.1016/j.jrurstud.2015.06.001.
MacKinnon, D., Derickson, K., 2012. From resilience to resourcefulness: a critique of resilience policy and activism. Prog. Hum. Geogr. 37, 253–270. http://dx.doi.org/10.1177/0309132512454775.
Massey, D., 2004. Geographies of responsibility. Geogr. Ann. Ser. B 86, 5–18. http://dx.doi.org/10.1111/j.0435-3684.2004.00150.x.
Meynard, J.M., Dedieu, B., Bos, A.B., 2012. Re-design and co-design of farming systems. An overview of methods and practices. In: Darnhofer, I., Gibon, D., Dedieu, B. (Eds.), Farming Systems Research into the 21st Century: the New Dynamic. Springer, Dordrecht, pp. 407–432. http://dx.doi.org/10.1007/978-94-007-4503-2_18.
Murdoch, J., 2006. Post-structuralist Geography. A Guide to Relational Space. Sage, London.
Navarrete, M., Dupré, L., Lamine, C., 2015. Crop management, labour organization, and marketing: three key issues for improving sustainability in organic vegetable farming. Int. J. Agric. Sustain. 13, 257–274. http://dx.doi.org/10.1080/14735903.2014.959341.
Raedeke, A., Rikoon, S., 1997. Temporal and spatial dimensions of knowledge: implications for sustainable agriculture. Agric. Hum. Values 14, 145–158. http://dx.doi.org/10.1023/A:1007346929150.
Reghezza-Zitt, M., Rufat, S., Djament-Tran, G., Le Blanc, A., Lhome, S., 2012. What resilience is not: uses and abuses. Cybergeo Eur. J. Geogr. 621. URL. http://cybergeo.revues.org/25554.
Renting, H., Oostindie, H., Laurent, C., Brunori, G., Barjolle, D., Moxnes Jervell, A., Granberg, L., Heinonen, M., 2008. Multifunctionality of agricultural activities, changing rural identities and new institutional arrangements. Int. J. Agric. Resour. Gov. Ecol. 7, 361–385. http://dx.doi.org/10.1504/IJARGE.2008.020083.
Rosa, H., 2013. Social Acceleration: a New Theory of Modernity. Columbia University Press.
Sardar, Z., 2015. Postnormal times revisited. Futures 67, 26–39. http://dx.doi.org/10.1016/j.futures.2015.02.003.
Scheffer, M., Carpenter, S.R., 2003. Catastrophic regime shifts in ecosystems: linking theory to observation. Trends Ecol. Evol. 18 http://dx.doi.org/10.1016/j.tree.2003.09.002, 848–656.
Scheffer, M., Westley, F., 2007. The evolutionary basis of rigidity: locks in cells, minds, and society. Ecol. Soc. 12 (2), 36 [online]. http://www.ecologyandsociety.org/vol12/iss2/art36/.
Scott, M., 2013. Resilience: a conceptual lens for rural studies? Geogr. Compass 7, 597–610. http://dx.doi.org/10.1111/gec3.12066.
Sendzimir, J., Magnuszewski, P., Flachner, Z., Balogh, P., Molnar, G., Sarvari, A., Nagy, Z., 2008. Assessing the resilience of a river management regime: informal learning in a shadow network in the Tisza River Basin. Ecol. Soc. 13 (1), 11 [online] URL. http://www.ecologyandsociety.org/vol13/iss1/art11.
Seuneke, P., Bock, B., 2015. Exploring the roles of women in the development of multifunctional entrepreneurship on family farms: an trepreneurial learning approach. NJAS – Wageningen J. Life Sci. 74–75, 41–50. http://dx.doi.org/10.1016/j.njas.2015.07.001.
Sinclair, K., 2014. Transformative Change in Contemporary Australian Agriculture. PhD thesis. School of Environmental Sciences, Charles Sturt University.
Smith, A., Stirling, A., 2010. The politics of social-ecological resilience and sustainable socio-technical transitions. Ecol. Soc. 15 (1), 11 [online] URL. http://www.ecologyandsociety.org/vol15/iss1/art11/.
Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., Ludwig, C., 2015. The trajectory of the anthropocene: the great acceleration. Anthropocene Rev. 2 (1), 81–98. http://dx.doi.org/10.1177/2053019614564785.
Stirling, A., 2007. A general framework for analysing diversity in science, technology and society. J. R. Soc. – Interface 4, 707–719. http://dx.doi.org/10.1098/rsif.2007.0213.
Strauss, A., 2015. Bewusst gestalten: eine akteursorientierte Sicht auf die Wahl der Betriebsstrategie. Yearbook of the Austrian Society of Agricultural Economics 24, 39–48.
Sundrum, A., 2015. Metabolic disorders in the transition period indicate that the cow's ability to adapt is overstressed. Animals 5, 978–1020. http://dx.doi.org/10.3390/ani5040395.
Sysak, T., 2013. Drought, Power and Change: Using Bourdieu to Explore Resilience and Networks in Two Northern Victoria Farming Communities. PhD thesis. Dept. of Resource Management and Geography, University of Melbourne.
Tittonell, P., 2014. Livelihood strategies, resilience and transformability in African agroecosystems. Agric. Syst. 126, 3–14. http://dx.doi.org/10.1016/j.agsy.2013.10.010.
Tsoukas, H., Chia, R., 2002. Organizational becoming: rethinking organisational change. Organ. Sci. 13, 567–582. http://dx.doi.org/10.1287/orsc.13.5.567.7810.
van Apeldoorn, D.F., Kok, K., Sonneveld, M.P.W., Veldkamp, T., 2011. Panarchy rules: rethinking resilience of agroecosystems, evidence from dutch dairy-farming. Ecol. Soc. 16 (1), 39 [online] URL. http://www.ecologyandsociety.org/vol16/iss1/art39/main.html.
van der Ploeg, J.D., 1994. Styles of farming: an introductory note on the concepts and methodology. In: van der Ploeg, J.D., Long, A. (Eds.), Born from within – Practice and Perspectives of Endogenous Rural Development. Van Gorcum, Assen, pp. 7–30.
Vandermeer, J.H., Perfecto, I., 2012. Syndromes of production in agriculture: prospects for social-ecological regime change. Ecol. Soc. 17 (4), 39. http://dx.doi.org/10.5751/ES-04813-170439 [online].
Vanloqueren, G., Baret, P., 2009. How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations. Res. Policy 38, 971–983. http://dx.doi.org/10.1016/j.respol.2009.02.008.
Walker, B.H., Gunderson, L.H., Kinzig, A.P., Folke, C., Carpenter, S.R., Schultz, L., 2006. A handful of heuristics and some propositions for understanding resilience in social-ecological systems. Ecol. Soc. 11 (1), 13 [online]http://www.ecologyandsociety.org/vol11/iss1/art13/.
Walker, B.H., Abel, N., Anderies, J.M., Ryan, P., 2009. Resilience, adaptability, and transformability in the Goulburn-Broken Catchment, Australia. Ecol. Soc. 14 (1), 12 [online] URL. http://www.ecologyandsociety.org/vol14/iss1/art12/.
Walker, J., Cooper, M., 2011. Genealogies of resilience: from systems ecology to the political economy of crisis adaptation. Secur. Dialogue 42, 143–160. http://dx.doi.org/10.1177/0967010611399616.
Weichselgartner, J., Kelman, I., 2015. Geographies of resilience: challenges and opportunities of a descriptive concept. Prog. Hum. Geogr. 39, 249–267. http://dx.doi.org/10.1177/0309132513518834.
Weis, T., 2010. The accelerating biophysical contradictions of industrial capitalist agriculture. J. Agrar. Change 10 (3), 315–341. http://dx.doi.org/10.1111/j.1471-0366.2010.00273.x.
Woodhouse, P., 2010. Beyond industrial agriculture? Some questions about farm size, productivity and sustainability. J. Agrar. Change 10, 437–453. http://dx.doi.org/10.1111/j.1471-0366.2010.00278.x.
Zebrowski, C., 2013. The nature of resilience. Resilience 1, 159–173. http://dx.doi.org/10.1080/21693293.2013.804672.