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## Sustainable agriculture and multifunctionality in South Australia's Mid North region

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### ABSTRACT

This paper discusses the pathways to agri-food sustainability in the context of the historical broadacre farming region of Mid North South Australia. Using notions of sustainable agriculture and multifunctional rural transitions to explore the geohistorical development trajectory of the region, it discusses the tensions and opportunities inherent to the future of farming in the Mid North and their impact on community development. We aim to contribute to a wider reflexion on the role of territoriality in the sustainable food transition debate, and its relevance in a traditionally productivist but marginal landscape. The paper proposes an extensive review of the historical, agricultural, socio-economic and institutional contexts of regional Australia before discussing the farming future(s) of the Mid North. We use a typology of 'modes of occupance' to reflect upon the compatibility between the emergence of differentiated multifunctional rural spaces in the Mid North and the realisation of agri-food sustainability transitions across its territory.

### KEYWORDS

Sustainable agriculture; agri-food transitions; multifunctional rural spaces; South Australia; rural policy; community development

## Introduction

Land was potential wealth and wheat was the proven means of reaping the potential. His wheat was not for his family and the village grist mill, it was wheat for the millions of the new industrial world. He farmed not as a member of an intimate, stable, localized society, but as a member of a world-wide, dynamic, competitive society. D.W. Meinig, *On the Margins of the Good Earth*, 121, 1962.

This study aims to critically examine the potential for a 'landscape approach' to agricultural sustainability and rural multifunctionality in the Mid North region of South Australia. The study proposes an analytical framework which combines a typology of agrarian territories or 'modes of occupance' (Holmes 2002, 2006), with a categorisation of the four 'fields of action' in agricultural sustainability practices (Weltin et al. 2018). The framework highlights the 'situated meaning' (Smithers, Joseph, and Armstrong 2005) of the interdependencies between sustainable agriculture and multifunctional

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rural landscapes and thus provides a basis for synergies amongst local development initiatives.

As in the rest of regional Australia, South Australian agriculture has been subject to restructuring processes, with a decline in the number of farmers, consolidation into larger holdings and environmental degradation caused by the pursuit of higher yields and larger volumes (Fielke and Bardsley 2013). Nevertheless, there is a strong sense of tradition in the farming community, rooted in broadacre family farming which shaped the occupational identities of farmers and the collective legacy of these farming communities. In this worldview, a 'progressive' farmer is a technologically advanced, market-oriented farmer (Bryant 1999). Experimenting with production techniques and farm management methods is thus embedded in the way farming is practiced in South Australia. In his historical account of 'The Shaping of the South Australian Landscape', Williams (1974, 267) noted that 'all these innovations and discoveries relating to the soil had their beginnings and were first elaborated in Australia – in the state of South Australia'. Addressing the issue of the future of South Australian farming, Fielke and Bardsley (2015a, 102) contended that 'any potential transition away from capitalism would also involve shifting South Australian world views in relation to agricultural production'. South Australia has thus long been a critical geographical space for understanding agricultural transitions in regional Australia.

The Mid North presents as an 'extreme case' of case study examination (Flyvbjerg 2006, 230) within the context of South Australia due to its historical legacy of export-oriented productivist wheat and sheep farming, its settlement structure, constituted of a geographically scattered system of small towns and farming communities, and its climatic conditions, located along a climatic line affected by climate change and subject to increasingly frequent and severe extreme weather occurrences (Nidumolu et al. 2012). The region has also witnessed a long-standing depopulation of its smaller communities (Smailes 1996). Issues concerning the economic, environmental and social sustainability of Australian agriculture are therefore exacerbated in the case of the Mid North.

We acknowledge that future agrifood transitions will be structured around more or less productivist landscapes (Argent 2002; Mackay and Perkins 2019; Roche and Argent 2015), with the pursuit of sustainable intensification likely creating landscapes characterised by large monofunctional production zones shaped by globalised agro-industrial practices and bolstered by bio-technological innovations (Holmes 2006; Mackay and Perkins 2019), a reduction of the ecological impact of production and the introduction of new, more resistant varieties including GM crops (Marsden 2013; McDonagh 2014; Russell and Omer 2015). However, for sustainable agriculture to become a coherent societal project at the scale of a territory, it requires 'socio-spatial arrangements and settings which speak also of consumption and community rather than only bulk production, material outputs and links to international trade' (Mackay and Perkins 2019). What Mackay and Perkins suggest is a greater articulation between productivism and multifunctionality locally able to revitalise place-making processes (Feagan 2007; Marsden and Farioli 2015; Winter 2003) in rural communities, and it is in this regard that this paper makes its most critical contribution.

## A landscape perspective on Australian agricultural transitions

Australian agriculture operates under a regime of liberalised, market-oriented ‘competitive productivism’ (Andrée et al. 2010; Dibden, Potter, and Cocklin 2009). This regime is strongly entrenched historically by decades of policy developments seeking to ‘open up agriculture to competition on world markets’ (Mackay and Perkins 2019, 3). The search for increased productivity has induced the adoption of precision farming (Mackay and Perkins 2019), the concentration of farmland and capital (Argent 2002), the displacement or abandonment of smaller holdings (Dibden, Potter, and Cocklin 2009) and the intensification in the use of chemical spraying (Lawrence, Richards, and Lyons 2013).

The openness of Australian agriculture to global markets is reciprocal. Lawrence, Richards, and Lyons (2013) estimated that Australia imports 17% of the starchy vegetables (mainly potatoes) that it consumes, some 19% of vegetables, and 34% of fruits. The latter brings to light a paradox of the Australian productivist model. On the one hand the production of food and fibre in Australia is sufficient for more than 90% of the foods consumed in the country, as well as enough to feed 40 more million people abroad (Lawrence, Richards, and Lyons 2013). However, Lawrence, Richards, and Lyons (2013) also noted that the food produced in Australia consists mostly of bulk commodities that are value-added elsewhere, and the food imported are mostly processed food as well as fruits and vegetables. The domestic Australian food demand is thus highly vulnerable to major disruption in the global food chain.

Other fallouts of the productivist model are the negative social and environmental impacts it has engendered throughout regional Australia (Fielke 2015; Hamblin 2009). Over time, the Australian Government has taken less responsibility for supporting farming communities in mitigating these negative impacts (Fielke and Wilson 2017), and it is increasingly farmers themselves who need to accept the risks related to ecological degradation (e.g. impoverished soils) and climate-related hazards (e.g. droughts, floodings or bushfires) as well as market fluctuations in commodity pricing (Fielke and Bardsley 2015a). This has often been done through increasing farm debt levels (Fielke and Bardsley 2013) and reducing the size of the agricultural workforce, with consequent negative economic and social impacts on regional communities.

In its current form, the Australian agriculture regime matches poorly with the expectations of what a sustainable food system entails. Hamblin (2009, 1200) previously characterised it as a

total impasse [...] between the desirability of retaining rural communities that have been settled within an agrarian landscape for one to two hundred years, and the dilemma of having to farm profitably against the constant pressures of competitive and unprotected markets.

In the case of Australia, there is a strong push to salvage the regime through science and innovation, especially regarding new techniques improving soil management whilst delivering high yields, such as no-till farming, crop rotations and chemical-free pest management (Rockström et al. 2017). The inertia of Australian agricultural policy in remodelling this regime pushes farmers to search for alternative solutions to implement locally more socially and environmentally sustainable practices at farm and community levels (Dibden, Potter, and Cocklin 2009; Fielke 2015; Fielke and Bardsley 2013).

One critical response to the negative regional impacts of the productivist regime has been a recurring reference to product diversification ‘as a solution to the economic woes of rural hinterlands’ (Hamblin 2009, 1201), although this has converted less into development of new agricultural products than into off-farm activities such as tourism and rural residential development (Argent and Walmsley 2008).

This conception of rural diversification deals essentially with the income basis at farm level. In contrast, scholars have suggested that addressing the future of agriculture at the landscape level would unfold a more systemic response to sustainability concerns. Roche and Argent (2015) proposed the notion of multifunctional rural spaces in order to associate the exploitation of farmland under the productivist regime with other activities related to environmental protection, cultural heritage and the consumption of the countryside for recreational purposes.

### Modes of occupance

The issue of sustainable agriculture cannot be separated from rural transformation processes (Robinson and Song 2019). The way emerging sustainable agriculture practices influence, or even transform, the territorial context they are embedded in needs to be further examined (Brunori, D’Amico, and Rossi 2019). The notion of multifunctionality provides a useful heuristic tool for such a landscape approach. This starts with the acknowledgment and characterisation of the diversity of territorial conditions found in any agrarian region, meaning that place-making processes and sustainability transitions are likely to be locally differentiated.

Similar to the ‘social landscapes’ identified by Barr (2008) for the State of Victoria, Holmes’ *modes of occupance* typology characterises the most representative uses of rural space across regional Australia (Holmes 2002, 2006). The typology expands the production-centric views of Australian rurality and caters for a more diverse range of possible territorial trajectories resulting from the three driving forces of rural change, namely production, consumption and protection (Holmes 2008). The typology distinguishes seven modes of occupance (Holmes 2006): a productivist agricultural mode (production values dominant); a rural amenity mode (consumption values dominant); a small farm or pluriactivity mode (mix of production and consumption values); a peri-metropolitan mode (intense contests between production, consumption and protection values); a marginalised agricultural mode (potential integration of production and protection values); and conservation as well as indigenous modes (protection values emphasised). Of course, as with most socio-spatial typologies, there will be some disparities even within sub-regions which are identified as dominated by a particular mode of occupance. Consequently, this paper analyses both the typical features associated with dominant modes of occupance across Mid North sub-regions and identifies potentially important exceptions which may be further examined through the sort of fine-grained research proposed by Holmes (2008).

Out of the seven modes of occupance, three are deemed particularly relevant to the Mid North context. The *productivist agricultural* occupance dominates the ‘agricultural heartland’ of the Mid North, featuring cereal cropping, sheep and livestock. The local economy is ‘locked in’ to agrarian occupations with enforced adoption of agricultural innovations as a driver; the communities are relatively prosperous but fragile (Holmes 2006). The *rural*

*amenity* occupation includes tourism and recreation areas often characterised by ‘a complex mix of amenity (residential, recreational and tourism), part-time, pluriactive, specialised, niche or factory-farming uses’ (Holmes 2008, 217). Holmes (2006) also includes in this category outliers in remote locations, attractive to members of alternative society and thus potentially a fertile ground for alternative lifestyles. This mode of occupation supports the ‘growth of small-scale, hobby-type operations associated with counter-urbanisation’ (Argent 2011, 185), but also promotes the production and transformation of food boosting the image and attractiveness of the regional hospitality industry, as well as providing branding outlets internationally, as is the case for the wine industry and gastronomic tourism in the high-amenity regions of the Barossa Valley and Adelaide Hills in South Australia (Thompson and Prideaux 2019). In the Mid North, this mode of occupation can be found in the Clare Valley and its vineyards in the south and the Southern Flinders Ranges/Wirrabara Forest area in the north-west, with its Orchards, quality food producers and producers’ market.

Finally, the *marginalised agricultural/pastoral* occupation dominates areas located on marginal land and climate along and beyond Goyder’s line. These areas have low productive potential and low resilience (Holmes 2006) due to poor soils and infrequent rainfall (Bjørkhaug and Richards 2008). To maintain economic viability, pastoral properties need to span great distances (Bjørkhaug and Richards 2008). The carrying capacity of these marginal lands is often over-stretched, with the economic hardships of farmers and communities linked to increased soil degradation and persisting ecological stress due to agricultural overcapacity. The resistance to change is ‘impeded by substantial financial, institutional, political and cultural barriers, strengthened by the continuing identification of landholders with their present lifestyles’ (Holmes 2006).

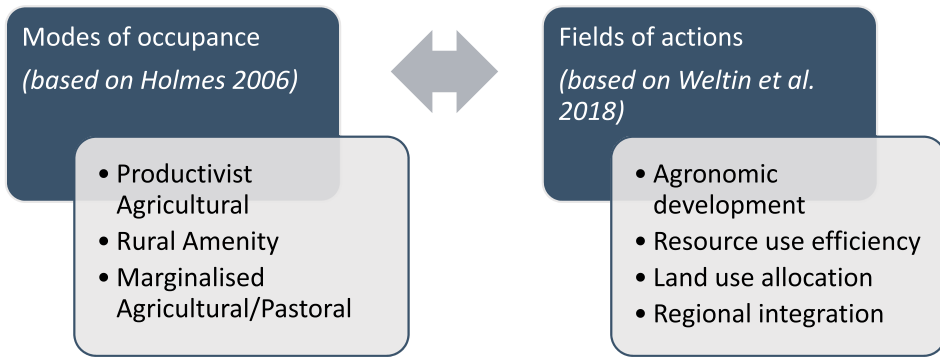
Notwithstanding the diversity found within these places (Roche and Argent 2015), working with typologies provides a starting point for a systemic and place-sensitive reflection about how the mobilisation of various social and natural resources may contribute to differentiated approaches towards sustainable agriculture in the region as a whole. It is especially valuable for rethinking the place of agricultural development within wider territorial development processes and the relationship between farming as a professional occupation, farm(land)s as landscape shapers and farmers as community actors.

### Fields of action for sustainable agriculture

Two main types of sustainable agri-food transitions have been the subject of scholarly attention: an *agri-industrial* one, based on intensive mono-cultural farming bolstered by bio-technological innovation (McDonagh 2014); and an *agri-ecological* one, grounded in socially embedded multifunctional farming practices and local consumption patterns (Goodman, DuPuis, and Goodman 2012). Moreover, the transition towards a “postcarbon” food and farming system’ (Hinrichs 2014) will necessitate a paradigm shift from industrial agriculture to more diversified agroecological systems (IPES-Food 2016). Food sustainability scholars globally have conceptualised this latter transformation of the agrifood sector, for instance using Geels’ multi-level sustainable transition model (Bui et al. 2016; Geels 2011; Geels and Schot 2007; Ingram et al. 2015; Marsden 2013). Less attention has been paid to agri-ecological transitions in Australia.

Sustainable agriculture in the context of this study entails a wide range of agroecological practices and models such as agroecology, conservation agriculture, biodynamic, organic or precision farming (Brunori, D'Amico, and Rossi 2019). In their review of the scientific literature on sustainable intensification, a rather novel term encompassing the diverse range of agroecological transitions, Weltin et al. (2018) categorised sustainable agricultural practices into four Fields of Action (FoA) that address agronomic development, resource use efficiency, land use allocation and regional integration. The Agronomic development FoA addresses the issue of land use optimisation at farm level with topics including adapted cropping, reduced tillage and soil conservation, biotechnology and genetic engineering or adapted grazing (Weltin et al. 2018). The Resource Use Efficiency FoA addresses the issue of structural optimisation at farm level with topics including fertiliser efficiency, water efficiency, soil management systems or residue use (Weltin et al. 2018). The Land Use Allocation FoA addresses the issue of land use optimisation at landscape level with topics including planning and zoning, land sharing or infrastructure development (Weltin et al. 2018). The Regional Integration FoA addresses the issue of structural optimisation at landscape level with topics including diffusion of knowledge and innovation, institutional improvements or networks and social capital (Weltin et al. 2018). This typology usefully frames sustainable agriculture as a social and place-based practice, and more precisely as the outcome of the active combination of multiple types of initiatives, both on and off the farm. The typology thus proposes an 'implementation-oriented conceptual framework' (Weltin et al. 2018, 69) to understand the practice of sustainable intensification. Weltin and colleagues make a point in stating that their study aims to 'demonstrate [the framework's] applicability for region-specific problem settings' (69).

The latter point was a major argument for deciding us to apply the FoA framework in this study. Indeed, the role of place in sustainable agrifood transition has been flagged by many scholars. Marsden (2013) suggested that the place-based and evolutionary dimensions of agrifood transitions need to be more carefully examined. The acknowledgment of the role of place in shaping these processes also means that 'pathways to sustainable intensification can be diverse and must be adapted to the location and context' (Scherer, Verburg, and Schulp 2018, 44). Pretty et al. (2018) pointed out that successful scaling up of sustainable intensification involves the retooling of a place's relational capital, in terms of trust, shared cognitive and institutional knowledge bases and linking initiatives in and across groups. Hence, the FoA typology also paves the way for a place-sensitive approach to sustainability transitions, each territory creating its own 'patchworked' version of sustainable agriculture based on its specific ecological and geographical conditions, agricultural knowhow and socio-economic legacy. Finally, Marsden acknowledged that many sustainable agrifood practices he listed, e.g. fair trade, animal welfare, organics, ethical foods or agroecology, 'are highly fractured and divided in their political opposition and articulation' (Marsden 2013, 131). On that front, the FoA typology emphasises that the implementation of agrifood transitions needs to be carefully designed and negotiated locally amongst actors in order for transitions to be sustainable over the long term. Our choice of applying the FoA typology, in combination with the modes of occupance as showed in Figure 1, to the context of the Mid North is thus aligned with our own ethos of striving for locally engaged research and our ambition to provide operationable knowledge to the Mid North communities.



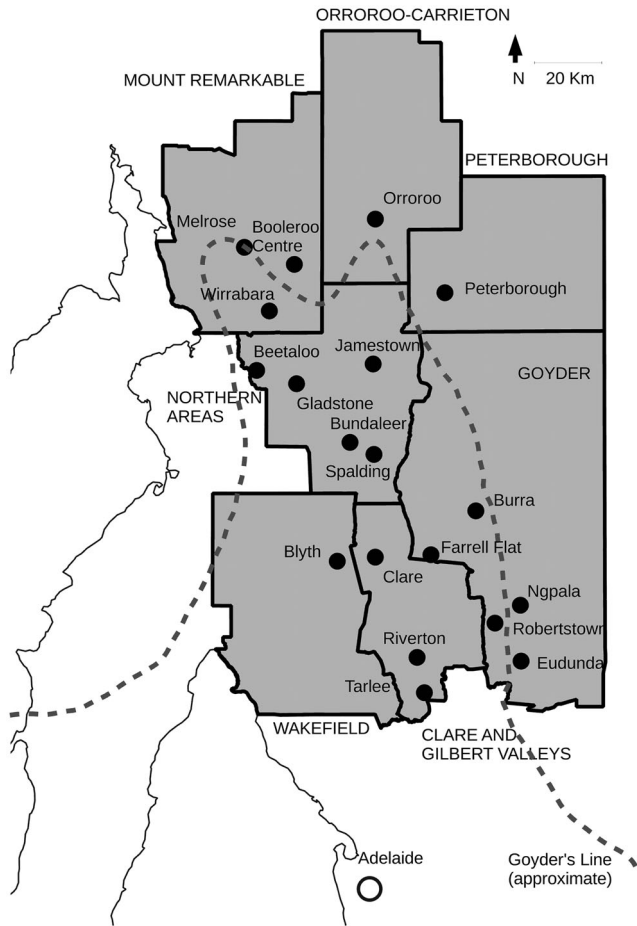
**Figure 1.** Integrating multifunctional thinking in agri-food sustainability transitions.

### Case study

For the purposes of this study, the ‘Mid North’ encompasses the seven local government areas identified in [Figure 2](#). Agriculture remains a major industry across the entire region, accounting for 15% of the GRP (\$812 m in 2016/2017) and 20% of the workforce. 80% of the land is used for agricultural production (Regional Development Australia 2018), essentially for broadacre wheat cropping, and cropping areas have increased by more than 5% since the early 1990s. In 2016, wheat (40%), barley (25%) and pulses (20%) represented the main cropped areas in the Mid North (GRDC 2016). The share of wheat cropping has diminished since 2008 at the benefit of pulses (GRDC 2016). Other types of production focus on specialty products such as orchards, olive oil, Carob, mushrooms, native species or microgreens that are sold to Adelaide or Barossa Valley markets. These producers are located in areas around the Southern Flinders Ranges and along the Clare Valley which correspond to the main rural amenity landscapes and more isolated ones are scattered across the Mid North. A key actor in South Australian agriculture is the Regional Agriculture Landcare Facilitator (RALF). The RALF works with farmers and industry groups to help collegially address key issues regarding sustainable agriculture in the region (Natural Resources Northern and Yorke 2020a).

During the second half of the nineteenth century, the geographical expansion of agriculture from the coastal areas into the semi-arid areas beyond Goyder’s climatic line (see [Figure 2](#)) paced the evolution of the land-use planning system of South Australia (Meinig 1962). Goyder was the State Surveyor of South Australia in this period. He drew the Line on a map in 1865 based on his own observations of rainfall patterns (Meinig 1962). The Line was meant to distinguish areas to the south suited for agriculture from marginal agricultural land to the north (Fielke and Bardsley 2015a). From that point on, the Mid North was shaped by multiple processes of advance and retreat of farming and settlement along and beyond this line. The increasing demographic pressure from new settlers arriving in the State and the increased demand for land, at a time of consecutive seasons of high rainfall in the 1870s convinced the State Government in 1874 to break through Goyder’s Line by selling land plots and allowing for cropping activities to extend further north (Fielke and Bardsley 2015a). Although the poor conditions for broadacre grain farming (Carson et al. 2017) eventually constrained the spatial expansion of agriculture, this moment in history left a lasting imprint on





**Figure 2.** Main administrative units and geographical areas in the Mid North (by authors).

the physical landscapes, creating more or less fixed delineations between the productivist agricultural areas within the bounds of Goyder's line, and the marginalised agricultural and pastoral areas on the fringes.

Broadacre wheat cropping has largely shaped the Mid North landscape since its colonisation by European settlers. The twentieth century nonetheless saw some important new developments. A major innovation in the aftermath of WWI was the 'gradual development of a grain-sheep complex based upon wheat and/or barley and leguminous pasture rotations', which diversified farm revenues and ameliorated the ecological resilience of the land (Meinig 1962, 211–212). The economic woes of the 1930s put many farmers out of business, although 'their properties were not abandoned [...] with other farmers purchasing this land through a federal government subsidised Marginal Lands Scheme aimed at increasing economies of scale' (Fielke and Bardsley 2015a, 104). Indeed, the designation in 1939 by the State Government of the northern half of South Australia as Marginal Lands supported 'a policy of structural reorganization of farms [...] with the aim of halving the number of holdings and doubling their size' (Williams 1977, 33). Sheep became even more of a farming staple during the 'wool boom' of the

1950s and new irrigation techniques made it possible for pasture, orchards and vineyards to develop around that time as well (Fielke and Bardsley 2015a). In more recent years, parts of the Mid North have become centres of agricultural consumption as well as production, linked to increasing tourism markets, lifestyle migration, and the South Australian Government's interest in the contribution of wine and regional cuisine to economic development (Carson, Carson, and Hodge 2014). This latter in particular emerged on the back of the combination of commodity price decline in staples industries (wheat and wool), high interest rates, recurring droughts and unseasonal rainfalls and ballooning farm debts created further strain on the South Australia farming community towards the end of the last century (Argent 2000).

## Methods

The authors view the Mid North as an extreme case for the empirical investigation of food sustainability issues, mainly due to its specific geographical characteristics and the historical legacy of productivist monocultural farming in the region. According to Flyvbjerg, 'atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied' (2006, 229). In many instances, one could conjecture that the Mid North agrifood system challenges contemporary understandings of what constitutes a sustainable agrifood system.

The empirical material is based on the analysis of grey literature (reports, plans and other policy documents), field observations and informant interviews. The authors undertook their fieldwork over a period of several weeks on two occasions: October–November 2017 and November–December 2018. 25 semi-structured interviews were conducted during the fieldwork: 18 were one-on-one conversations at the interviewees' farm or home, seven group interviews included two or more members of the same farming family. On some occasions, the interview was conducted while or before driving around the property. The interviewees were mainly 'alternative' and traditional farmers, but a handful of other actors, such as Councillors or civil servants, were interviewed in order to better contextualise the gathered information about agricultural developments within the wider process of change in the community. An interview guide was developed with a set of questions addressing the following topics: contextual information about farming in the region, background information about the producer and the farm, marketing and sales, food quality, relation with other producers, relation with consumers and, finally, future development prospects. The interviews were recorded digitally, transcribed and subsequently coded inductively (i.e. with no predefined list of themes) and consolidated using the NVIVO software.

The interviewees were identified using various strategies: for alternative growers, we undertook online searches, browsing of Facebook pages and groups and recommendations from the Mid North Knowledge Partnership, a public engagement and knowledge dissemination organisation located in Burra and jointly set up by Flinders University (Adelaide) and Charles Darwin University (Darwin); for broadacre growers and community members, interviewees were identified based on MNKP recommendations. The interviewees were first contacted by mail or direct messaging on Facebook in order to ask their willingness to take part in the study. A one-page information sheet was made, including legal information and the scientific aims of the study, and handed over right before the interview started.

The grey literature was gathered through online searches on the official pages of the various Local Councils of the Mid North, the Natural Resources SA Northern and Yorke and the Primary Industries and Regions South Australia, as well as other sectoral or lobby organisations.

## Results

### *FoA 1: agronomic development*

Macdonald, Herrmann and Baldock's (2014) study of farm management practices showed that rotational practices, such as break-crops (oilseed, legume) and grass–legume pasture rotations, are dominant and that continuous wheat cropping is not a common practice anymore in the Mid North. Under such rotational practices, lower use of fertilisers nonetheless led to higher cereal yields (Macdonald, Herrmann, and Baldock 2014). However, a permaculturist based in Burra noted a trend towards less integrated farming in the region:

I mean they're just pretty successful. I think 30 years ago, they had much more integrated farming, there was a lot more cropping mixed with livestock. And now, because there's more money in continuous cropping, so you're putting fertilizer in too ... .. just pouring more in and getting bigger farms and bigger crops.

An interviewed grain farmer described rotation practices as 'fairly regimented' based on one year of canola or beans, two years of wheat and one year of barley. The farmer explained that the decision of 'swapping' the rotation and deciding the type of rotational plants to crop depends on how the season and commodity prices evolve. This was recently the case for lentils: although yields were deemed impressive, the recent drops of the global lentil prices left it out of the current rotation.

In many parts of the Mid North, sheep are seen as an adjustment variable for the main cropping activity. A grain farmer from Robertstown, a small town south-east of Burra located beyond Goyder's line, explained that 'We are in quite steep rough country and we crop what we can and run sheep on the rest'. He further noted that 'A lot of people, especially in marginal country have made more money out of sheep than cropping. In our country we're still making more out of cropping than sheep. So the cropping sort of rules the roost'. A farmer in Spalding noted a local shift in sheep herding due to enhanced profitability of the activity and leading to over grazing in some areas. Hence the balance between cropping and livestock activities largely depends on the local climatic conditions (e.g. more cropping in productivist agricultural mode and more livestock in marginalised pastoral areas), but also on external factors. In the more Marginal Lands, crop-pasture rotations are less intensively managed (Macdonald, Herrmann, and Baldock 2014).

However, some farmers have taken more unusual approaches to cropping-livestock combination. A farmer in Ngapala, located in the more favourable climatic areas west of the ridge extending from Burra to Eudunda which is considered the eastern edge of Goyder's Line, describes himself as 80% sheep and 20% cropping. He implements rotational grazing by fencing his lots and moving the sheep every 3–4 days. This technique has enabled him to run two mobs of 2000 sheep compared to the 400–500 mobs they ran initially. It has also given him better control over grass coverage, especially using perennial native grasses. Hence, the diversification to livestock is an opportunity to reintroduce and

maintain native grass coverage in the farming landscape, but necessitates new ways of organising grazing without exhausting the land cover. The Ngapala producer stated that his strict rotational technique enabled him to maintain cover on the ground and avoid bare patches on the paddocks and improve the resilience of the paddock during periods of tough weather conditions. A farmer near Spalding worried of the damage caused by the management of sheep on fragile soils: 'I see they damage the soil structure quite quickly. They've been here a long time, and they will stay but I am hesitant to run too many sheep. So we bring them in and move them out'. The choice of breed for the livestock is important as well for successful crop-livestock integration. An organic pastoralist from the northern semi-arid areas explained they chose a South African breed for their lamb as they suit their specific climate.

The suitability of soil for intensive cropping is prevalent in a farmer's decision to diversify production activities. A contractor in Gladstone, in the Mid North's cropping heartland, recollected that they initially had a mixed farm but abandoned sheep because their soil was good. He is now back into sheep herding after buying 'more land that's more suited to sheep'. So diversification into livestock is part of the expansion strategy of farmers. The use of rotational crops can also be advantageous for farmers diversifying into sheep. A lamb producer from Laura Hills, not of Gladstone, explained that the pea stubble that is not picked up by the cropping header makes a high-protein feed for the lamb which leads to 'incredible' growth rate in lamb development.

An important innovation in cropping was the uptake of the no-till technique instead of cultivation methods. This less invasive technique has helped stabilise soil erosion, but has also negatively impacted soil acidity (Government of South Australia 2018). The no-till method is a major innovation for sustainable dry land management as it significantly increased the year-round soil cover, offsetting soil erosion and improving moisture retention (Regional Development Australia 2018). The adoption of the no-till (including zero-till) method in the Mid North and Eyre Peninsula area was on par with the national averages with 72.3% in 2008, 60.4% in 2011 and 64.6% in 2014 (GRDC 2016). In 2016, the adoption surged to reach 79% compared to 70% nationwide. Only 0.2% of cropped areas were cultivated using conventional methods. Overall, the method has been especially instrumental in filling in the productivity gap between wet and dry years (Hughes, Lawson, and Valle 2017), which is crucial in the drought-prone Mid North, particularly in the marginalised zone. However, no-tillage is highly dependent on the use of herbicides and nitrogen fertilisers (Altieri, Nicholls, and Montalba 2017; Bellotti and Rochecouste 2014) which causes acidification (Government of South Australia 2018) and may be less favourably perceived in the rural amenity context, as further discussed below.

### **FoA II: resource use efficiency**

The use of fertilisers was most contentious among smaller scale farmers aligned with the rural amenity mode of occupance, but the debate has also spread into the productivist and marginalised zones, and as such is a long way from being a dividing mark between 'old' and 'new' farmer attitudes. A Council Member from Peterborough, who can be described as strongly environmentalist, ranted against the careless attitude of farmers spraying their fields with little consideration of the potential harm to the local community. She also mentioned that farmers' response to criticism is that they are advised to spray in order to deal

with native grass. Another Council Member from Eudunda, herself a hobby organic farmer, recalled as she was advised by most to ‘just spray’ to deal with bindweed but was reluctant to do so due to the long-term consequences, ‘As soon as I start spraying, that’s 50 years down the drain’. These examples show the systemic importance of fertiliser usage in Mid North farming and its clashing with emerging agroecological and societal values, especially related to health and long-term environmental impact. Indeed, the use of fertilisers is embedded in the local traditional farming know-how, or as the RALF put it ‘You’re a progressive farmer and a good farmer if you put on high input farming’. Growing rotational crops can mitigate the negative ecological impact of fertilisers and even increase the efficiency of wheat cropping. The Robertstown grain farmer cited the example of Canola which has grown very popular among wheat farmers as a main rotational crop. Canola has a deep root system which prevents compaction in the soil. But because it requires a different set of fertilisers, it mildens the over-concentration of specific substances in the soil.

Some farmers are also experimenting with biomass as an efficient substitute for the use of chemical fertilisers. A large cattle farmer near Burra explained how they switched from using super phosphate to using their own cow manure as fertiliser. He noted the evident ecological impact: ‘Over the past 17 years or 20 years of the improvement of the ground is astronomical. Sometimes the manure is more valuable than the cattle’. Another farmer located near Farrell Flat explained how her son, who is an industrial engineer, has built a system to produce biological fertiliser. This has enabled them to reduce the use of fertilisers. She mentioned that other farmers are highly sceptical, but said that some are nonetheless carefully inquiring. Beyond the ecological impact, chemical fertilisers are a substantial running costs for farmers and finding cheaper substitutes would increase the viability of farm operations. Another farmer explained how leaving stubble residue in the paddock for several seasons increases the incorporation of organic matter in the soil.

Water management is key regarding efficient resource usage in the Mid North. Because the region is far from the main water irrigation source of South Australia, i.e. the Murray River, moisture control and efficient use of rain water are primary concerns. Interviewees mentioned that moisture conservation, especially during the hot summer, is central for the resilience of the paddocks, especially in the face of dry years, and reveals good or poor farming methods. A key determinant of moisture conservation is the implementation of sound grassland management strategies. A farmer in Spalding engaged in the local Land-care group explained how they fenced off areas to maintain native grasses by preventing them from being grazed. She further explained the resistance of the farming community in implementing novel grassland management methods: ‘There was a lot of pressure to improve your pastures by putting fertilizers and things out but our native grasses don’t like that. So, it was about shifting that balance back to valuing the native species that were here’. Several interviewees have pointed out the role of farmers in the landscape regeneration processes. The embracement of the no-till method and the planting of trees by farmers have reduced soil erosion and improved the conditions for growing crops across the region.

Improved on-farm grassland and woodland management practices have proven to be key milestones towards landscape regeneration in the Mid North. It reinstates the farming community as a progressive force for the multifunctional transition of the region, highlighting their role in environmental stewardship or as ‘custodians of the

land' as a farmer expressed it. However, these practices are offsetting each other at the regional level. The State's environmental monitoring report (Government of South Australia 2018) showed that although the cover of woody native vegetation has increased, it has taken place thanks to the 'gradual replacement of low native vegetation with woody native shrubs'. The main vectors for scaling up virtuous farm management practices are Landcare initiatives. Only three Landcare initiatives can be found in the Mid North: the Tarcowie group, south of Orroroo in a marginalised area, aiming at improving native vegetation and natural biodiversity; the Yacka Moorundie group, in Spalding, work with community engagement and environmental stewardship education, undertaking activities such as seed collection or plant/tree planting in a more productivist area; and the Upper Wakefield River catchment, south of Clare, targeting watercourse restoration, native vegetation management and weed control in an area of increasing rural amenity value. These initiatives often focus on improving the ecology of a specific natural amenity like a creek, but also lead to improved conditions for farming in the area. These initiatives, which rely on the voluntary participation of individual farmers and the engagement of community members in their own time, have failed to get replicated in other locales which limits the overall ecological benefits at landscape level.

A more radical action for efficient resource use is the conversion to organics. By definition, organic farming precludes the use of chemical fertilisers in farm management practices. Although South Australia has one of the largest organic farmed areas, it is a rare enterprise in the Mid North: there are only 13 certified NASAA<sup>1</sup>-registered organic operators, mostly in the grape/wine sector (and thus concentrated in the rural amenity area of the Clare Valley), and only three cereal and livestock producers overall. Only seven Mid North operators were certified through the Australian Certified Organic program. An alternative olive grower located on the Burra-Eudunda ridge explained the mindset of traditional farmers on this issue as follows: 'If you talk about organic farming, they don't dismiss it. But they know that they can't do it they know that they're locked into how they have to do'. The economics of organic wheat production is a constraining factor that has hampered more numerous conversions. The Robertstown grain farmer recalled a recent endeavour: 'There's an organic flour miller at Tarlee, sort of between Burra and Adelaide. He was growing organic stuff himself, and then he gave up because there's no money in it. He just makes flour out of it. I think that says a lot'. Converting to organics is a substantial financial investment for individual farmers in productivist areas because of the several year process it takes before being able to reap and of the unsure market place for such commodities as wheat. One of the interviewed wheat farmers from Spalding concluded that 'Look it's a good thing but we don't get paid for the extra cost and the lower yields'. However, pastoral farming in the marginal lands might be more suited for organic production as it relies essentially on extensive areas of native grasses for feeding the livestock. The interviewed pastoralist corroborated the importance of organics as a long-term farm management strategy: 'being organic does make you slightly more resilient, but like I said nearly everyone up here is organic. I can't think of anyone that isn't'. The difficulty of organic production to establish itself as a viable commercial and production alternative for broadacre farming in the Mid North, although more widely adopted in the rest of South Australia, shows the reluctance to get away from a system that has a proven record of bringing a fair level of prosperity for both farmers and communities, as the economic risks for individual farmers are deemed to high.

### **FoA III: land use allocation**

The division of land into districts or parcels, the settlement of townships and the construction of rail infrastructure in the Mid North have all been historically shaped and operationalised in order to sustain the global competitiveness of broadacre wheat farming. Hence the contemporary land-use zoning is still favouring the productivist agricultural mode of occupance: the parcels are large and land prices are high which means that only intensive monocultural activities are suitable in order to generate enough return on investment. Hence the expansion of broadacre farms into larger units is the main driving force behind land use allocation in the Mid North. Recollecting a discussion he had with his farmer son, the grain farmer in Robertstown said 'look you haven't bought any land for 10 years, you need to buy some if you don't keep expanding you're going backwards'.

Another particularity of the land use planning system that was pointed out in an informal discussion with a Council executive is that each farmhouse cannot be separated from the entire farmland allotment it is located in. This was deemed problematic as it prevents other styles of farming, more adapted to smaller areas typical of the rural amenity mode, to develop in the region. When broadacre farmers buy new farmland, the farmhouse located on this new farmland is often unused.

In other circumstances, these buildings can be valuable for farming families. When farmers have several adult children interested in farming and living on the land, the farmhouses acquired in the expansion phase are inhabited by the children's families. This eventually prepares the succession in the family farm as farmland is then divided among the children. After the succession and the division of the farmland, the process repeats itself: children will have to buy new land in order to get bigger and make broadacre operations more profitable.

Another case is when farmland is bought or inherited by persons that are not farmers themselves. Leasing the land to farm managers on a multi-year contract has become more common. A former farmer from Blyth noted that leasing is one way for new generation to stay connected with the land: 'they seem keener to hang on to the land, they're a bit emotionally tied to it and they will lease it'. For new generations, leasing is a way to keep their equity and get some income from the land without having to sell. For older generations, leasing to children can also be a way to keep some revenue streams for retirement. One of the farmers in Spalding noted that

So if they wanted to keep the land and have it as part of their future and have ownership of it and we lease it off of them in a commercial arrangement. And they get to stay there and retire happily. And not have that financial push to have to sell.

However, this decoupling between growing and owning the land may also lead to seeking short-term returns on investment rather than implementing integrated farm management strategies accommodating both long-term environmental assessment and economic prospects.

The current land use zoning in many areas with rural amenity potential poses some constraints on the ability to develop small-scale farm operations not tied to cropping and livestock. For the Council member from Eudunda, finding the right piece of land was the starting point for moving into the region, and being able to develop her small-

scale operations: ‘We’ve got such an unusual sized piece of land, it’s a lot smaller, than like you said the usual cropping or grazing fields, that we think we’ve got something obviously unusual, something different which is a good thing’. A biodynamic farmer from Beetaloo in the Southern Flinders Ranges noted that the zoning system does not allow them to set up a farm retail shop on their property, ‘it can never be a payment thing here unless the zoning changes’. A neighbouring mushroom grower confirmed that ‘we are not allowed to do that out here’. The zoning system as it currently stands creates limitations for actors wanting to engage in alternative modes of production and seek to reinstall the farm as a meeting place for local society and an attraction point for the hospitality sector. The zoning system thus hinders the shift towards the ‘consumption’ driving force according to Holmes’ typology.

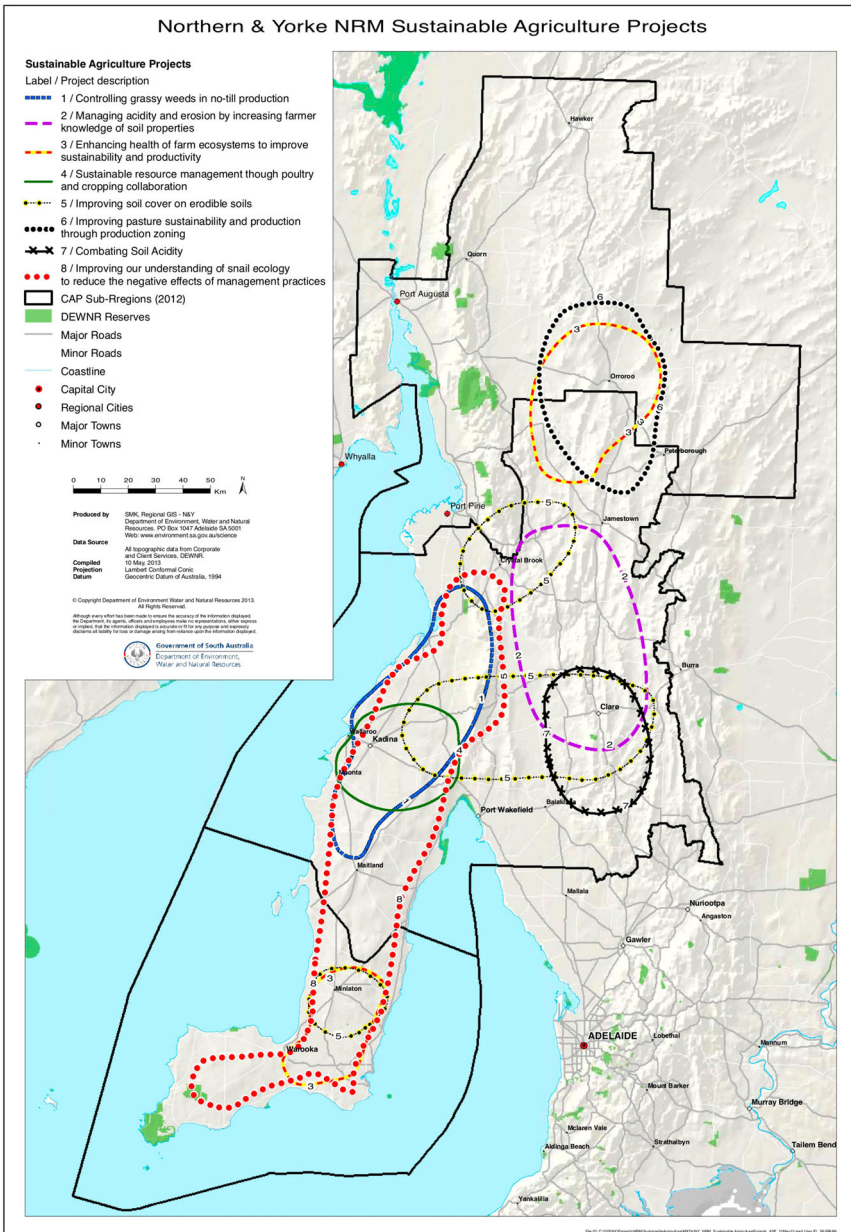
The final issue related to land use allocation deals with protected areas. Protected areas create amenity value out of natural and cultural landscapes that are highly valued by the community and sought after by visitors. However, the proportion of protected landscapes in the Mid North is low compared to other SA regions (8% compared to 30% state-wide in 2017) with little progress since the 1970s (Government of South Australia 2018). There are only few natural or conservation parks in the Mid North (Natural Resources Northern and Yorke 2020b), and with the exception of the Mount Remarkable national park south of Wilmington in the pastoral district, these parks are very small enclaves. The largest conservation park is found in the Wirrabara forest area in the Southern Flinders Ranges amenity region. The Martindale Hall and Spring Gully conservation parks are two small enclaves located in the other main amenity region of the Clare Valley. There are a handful of conversation parks, e.g. Red Banks, east of Burra, i.e. in the arid areas beyond Goyder’s Line. The central areas of the Mid North consisting in productivist land are largely devoid of protected areas.

#### **FoA IV: regional integration**

Regional authorities have emphasised the importance of knowledge mobilisation and application in the climate change adaptation of farming regarding scientific knowledge about more resistant plant varieties and rotational cropping techniques, but also organisational improvements that promote experimentation, sharing of information and education (Regional Development Australia 2018). The interviewee working at Natural Resources SA Northern & York, a state governmental agency coordinating environmental issues over a territory including the Mid North, acknowledged that their main role is to facilitate relationships between different stakeholders. A key actor in this facilitation process is the RALF whose role is to share information between groupings from different communities.

The agency also coordinates and funds initiatives promoting sustainable agricultural practices. As displayed in Figure 3, past initiatives have primarily addressed issues related to soil health and thus focused on offsetting rampant soil erosion and acidity (see Figure 2). The initiative #2 which encompasses most of the Mid North’s productivist agricultural land focused on increasing farmer knowledge of soil properties with the aim of better managing acidity and erosion. As noted earlier, the adoption of the no-till technique has reduced soil erosion but has increased acidity due to fertiliser usage. Hence this initiative aims at informing farmers about how to limit the negative impact of no-till. Initiatives





**Figure 3.** Sustainable agriculture project supported by Yorke and Mid North natural resources management (Source: Landscape South Australia Northern & Yorke).

#3 and #6 which apply to the Mid North’s more marginalised pastoral lands around Orroroo engage with farmers in order to support the sustainability transition of local farming by providing knowledge about zoning.

However, the main vector of regional integration is through the creation and diffusion of experiential knowledge. Historically, Mid North farmers have been reluctant to embrace scientific knowledge but rather trust the experience of their peers when testing new crops

or techniques at scale. A farmer near Burra adamantly acknowledged that watching what other producers are doing is ‘the only way to learn’. If this way of learning through tacit knowledge exchange locally is efficient, a precondition for this is, according to a farmer from Spalding, the presence of early adopters who are willing to take the risk in the first place. The articulation between scientific knowledge and the farming community is undertaken through local farming system groups, similar to the one our Spalding interviewees belong to, whose role is to ‘tak[e] that national and state-wide research and making it local’. In addition, the RALF acknowledged that ‘community groups still play a real role in information sharing’. Previously Agricultural Bureaus were meeting places for farmers to share their experiences within their community. These bureaus were financed by the State and interviewees suggested that recent cut-downs in the funding would negatively affect the cohesion of the local farming community. This need for cohesion is especially needed in times of extreme weather. Grant programs such as ‘Tackling Tough Times Together’ provide seed-funding for projects improving the well-being of communities, and especially farmers.

Social media platforms have become increasingly integrated in how farmers communicate outwards. Twitter is especially embraced by broadacre farmers as a way to share ideas and have some visibility upon what farmers currently experiment with. However, the RALF sees the large popularity of Twitter amongst these farmers as a sign of social isolation due to the shrinking of communities, a direct consequence of the agricultural restructuring processes. Our interviews suggest that Facebook and Instagram are more adopted by ‘alternative’ farmers more aligned with rural amenity modes of occupance. These platforms are preferred because they are more widely used by people in the community and consumers and are thus especially used for marketing purposes.

Finally, these ‘alternative’ growers cannot draw from the local farming knowhow to get the knowledge necessary for the development of their operations due to the dominant position of broadacre family farming in the Mid North. Several of those we interviewed mentioned that they did not have any experience or education in horticulture when starting. Learning in those cases takes place by connecting with groupings or associations of like-minded farmers nationally. The native plants growers from Eudunda have been active in SANFA, the South Australian Native Food Association. The association helped them to mobilise knowledge about plants but also about what is happening in the native food industry overall. In doing so, the growers are able to anticipate future demands in specific food products.

### **The peculiar case of the Clare Valley**

The FoA typology essentially addresses endogenous change in regional agriculture, i.e. actions initiated by actors of the agrifood system. The agrifood transition literature has however emphasised the role of urban consumers in demanding foodstuff that are more aligned with societal values and sanitary standards related to, among many, animal welfare, healthy diets or climate change. This demand for more sustainable food acts as a potent exogenous driver of change shaping regional agricultural practices. For many rural areas, the production of specialty and high-quality food has become a powerful driver to establish and project an image outwards, a central piece for developing agritourism, with a potential multiplier effect it may engender for the local economy (Kneafsey

et al. 2013; Mundler and Laughrea 2016), as well as the reinstatement of local agricultural knowhow in the regional identity and its alignment with fast-changing societal values in an increasingly urbanised Australia. Agrifood transitions in this case are less associated with technical improvements in agriculture than as social innovations improving production-consumption relationships, the latter often taking place as small-scale niche practices in ‘amenity’ places. However, such developments do not fit within the FoA typology due to its design essentially addressing sustainability issues in agricultural production rather than food consumption.

What became apparent throughout our field work is the lack of traction from the wine district of the Clare Valley, one of the major wine growing areas of South Australia (Fielke and Bardsley 2015b) as a vector of change towards agrifood sustainability. One reason might be that, contrarily to other SA wine districts, the shaping of this amenity region led to the disappearance of local orchards which hampers the development of a complete offer for gastronomic tourism, as is the case in other wine districts. This was confirmed by the founder of the Seven Hill market:

It’s all just about the grapes really, about the wine they’ve always had their focus on the wine. [...] They didn’t really see the food industry is that important, where is it should be tied together. [...] I think lots of people now are expecting that if you go to a winery, there is food now.

The mushroom and micro-green producer from Seven Hill also noted

It’s really dissimilar to the Barossa and the McLaren Valley area because in those places the wine thing happened. But for some reason not all the orchards went. They’re still almond groves [...] and same with Barossa, there still apples, pears, peaches, plums.

In her study of the nearby Barossa valley, clammed between the south-east edge of the Mid North and the Adelaide metropolitan region, Sigala (2020) pointed out that wine tourism may be an effective tool for generating added-value for economic development and community wellbeing through new forms of local, multi-actor governance. This has not happened yet in the Clare Valley as it was turned into a monocultural grape-growing and wine-making industry region. However, most prime wine-making regions across the world are also providing a richer gastronomic experience by complementing good wine with high quality local food to the visitors. The wine-food nexus creates a *terroir* (Barham 2003) bringing together the knowhow of various actors in the regional agrifood system and embedding agrifood practices in the sense of place. Beames (2003) identified the lack of inter-industry cooperation between the wine industry and the tourism industry as an obstacle to the realisation of such wine-based amenity regions. The presence of farmers’ markets is also a way to connect visitors to the local food experience. Thompson and Prideaux (2019) suggested that farmers’ markets give tourists the opportunity to engage with producers and learn about the local food culture in order to relate to the sense of belonging and identity of that particular place.

Several farmers mentioned the case of a restaurateur in Auburn who uses essentially local produce as a good practice. The Black Springs lamb farmer, who sells to this restaurateur, for instance acknowledges:

Well, his big thing is he’s a locavore sort of fellow—everything he uses is within a 100 mile radius, which is reasonably big but ... he’s all about local and the story behind how things

are raised and produced. He's really good. If there were 10 more chefs like him in the Claire Valley, life would be easy. I'd be selling heaps of lamb.

The inclusion of the wider range of actors involved in the local food industry of the Mid North, from producers to retailers and intermediaries, e.g. restaurateurs, food processors or butchers, is thus necessary in order to turn the Clare Valley from a wine-making region to an amenity region, by making it possible to inscribe the gastronomic experience into a wider narrative about regional identity. Clearly the absence of an established network of local food actors in the region hampers this development. As the Mid North is pushing strongly to develop tourism for the entire region, it seems important to find ways to include 'alternative' farmers in these initiatives as their produce may play a substantial role in embedding the hospitality industry in the regional economy.

### **Concluding discussion: delivering sustainability and multifunctionality in the Mid North**

Examining the Mid North's agricultural landscapes through the notion of 'modes of occupation' allowed us to reflect on the different styles of farming that are already embedded in the Mid North: the broadacre wheat-sheep landscapes form the geographical, social and economic core of the region; pastoral landscapes in the North delimit the edge to intensive agriculture and territorial development; and producers located in the high amenity areas of the Clare Valley and Southern Flinders Ranges produce 'everyday' or specialty food of high ethical and ecological value, albeit mainly for visitors and Adelaide consumers. The latter 'alternative' style of farming is present in the broadacre heartland as well, but consists essentially of pockets of individual farmers whose practices are not fully integrated in the local agricultural knowhow. The 'modes of occupation' perspective emphasises that undertaking sustainable agrifood transitions in the Mid North will necessitate mobilising territorially differentiated approaches. It is also neither likely, nor desirable, that multifunctionality may be achieved by these modes separately.

The framework of Fields of Actions applied to the Mid North has enabled us to systematically analyse how contemporary agricultural practices may contribute to agrifood sustainability transitions. It corroborated the assumption that farm-level practices in broadacre farming, i.e. from the productivist agricultural mode, form the bulk of sustainability-oriented actions recorded in the Mid North. Sustainability practices are also highly fragmented, consisting essentially in uncoordinated actions from individual farmers or community members, with more integrated collective landscape approaches being confined to a certain few places, and often sustained by the actions of a few individuals. These sustainability actions tend to focus on the promotion of intensification methods that reduce the ecological impact of farming. However, this approach leads to trade-offs that are difficult to address and negotiate locally. The most pressing case is the no-till method which reduces soil erosion but also causes soil acidification due to the use of chemical fertilisers. We can see how this fragmentation may lead to tensions at the landscape scale. For instance, the pursuit by broadacre wheat farmers of actions aiming at mitigating their most pressing environmental concern, i.e. soil erosion, constrains the ability of other producers to undertake their 'version' of agrifood sustainability, e.g. organic farming. Achieving agrifood sustainability at the landscape level thus necessitates coordinated actions between farmers and communities from different modes of occupation.

But what Weltin's typology also revealed was that there are, in the same region, major differences in decision-making rationales amongst actors: productivist farmers are more concerned about economic viability and resource efficiency at farm level while other farmers are more inclined to integrate landscape values and outcomes in their individual decisions and daily operations. These different understandings about what sustainable farming practices entail builds on the role played by various modes of occupation in community development processes: broadacre farming has traditionally been, and still is, the backbone of the local economy, whilst other styles of farming are more marginal and their perspectives less embedded in local practices. Knowledge exchanges also tend to take place within closed circuits, and instances where actors from different modes of occupation co-create knowledge and share views about sustainable farming are limited. Especially broadacre farming appears to be 'locked in' their ways of understanding what 'good' farming is. On the other side of the spectrum, it seems that the wine-making district of the Clare Valley, although striving to improve its image as a gastronomic destination for visitors, is also, to some extent, locked in its mono-industrial mindset. The integration of actor networks enmeshing the diversity of regional practices found in the different modes of occupation may unlock new learning opportunities and innovative attitudes for achieving a more integrated Mid North food system.

In [Table 1](#), we review how the key challenges and prospects of agrifood transitions identified by scholars translate to the Mid North case. If technical and technological innovations are still perceived as the primary lever for individual farmers to improve their practices and achieve prosperity, the overall sustainable development of Mid North agriculture relies on new social practices improving collective responsibility. During the course of our fieldwork, it became apparent that the issue of social sustainability is hardly mentioned and only marginally addressed in the Mid North.

Addressing the social dimension of agricultural production necessitates 'putting back meaning' in sustainable intensification processes, especially as 'land-use changes are inextricably linked to the multiple social and political contexts within which they occur' (Loos et al. 2014). Agroecology as a global movement rejecting conventional agri-industrial practices is remote to the concerns of traditional Mid North farmers. However, the application of agroecological approaches to the management of soils, crops and livestock and their embeddedness in the societal, environmental and food system issues may be instrumental in creating synergy effects between what are essentially isolated practices (Lampkin et al. 2015). The emphasis of agroecology on "system redesign" rather than "input substitution" (Lampkin et al. 2015) could provide interesting insights even on future productivist practices that provide wider socio-ecological 'good'. Our understanding is that a greater articulation between the knowledge bases of actors representing the different modes of occupation would enhance the introduction of novelty in the local farming knowhow. For broadacre farming, this would enhance their ability to integrate 'consumption' values in farm management strategies. Indeed, as 'alternative' farmers are strongly interacting with (mostly) urban consumers, they are more attuned to the changes in consumption attitudes regionally, especially in Greater Adelaide, but also internationally. This greater permeability between knowledge bases would enable, for instance, traditional farmers to better anticipate future shifts in the demand of wheat or wool especially when targeting high-end markets and to better understand the systemic impact of farm-level ethical choices at farm level for the rest of the community.

**Table 1.** Challenges and prospects for Mid North farming.

Challenges	Prospects
A technical, exclusive view of biodiversity in conservation agriculture antagonistic to farmer interests (Bardsley et al. 2019)	Connect agricultural and natural biodiversity issues (Bardsley et al. 2019)
Resource and regulatory limits on intensification. (Bardsley et al. 2019) management practices favouring high productivity during good years increase farm vulnerability during bad climatic years (Hughes, Lawson, and Valle 2017)	Adapting cropping systems to the increasingly unreliable climate conditions. (Hughes, Lawson, and Valle 2017)
Expected decrease in wheat yields due to climate change, about 2–10% in the Mid North (Hughes, Lawson, and Valle 2017)	Changes in farming practices and crop varieties may counter some of the pressure induced by climate variability (Australia 2015)
High local discrepancies in the adoption of virtuous farm management techniques undermines landscape approach	No till technique can be more widely applied
Drier climate: projection for the mid north and York +1.4 degrees and –12% rainfall by 2050 (Government of South Australia 2015)	Opening of GMO use in SA will likely see the planting of drought-resistant crop varieties
Shift from conventional to organic brings economic uncertainty for individual farmers during transition phase.	Land use policies needs to be reformed to let other styles of farming and farmers settle in the Mid North resulting in multi-functional mosaic landscapes and regional diversity (Bardsley et al. 2019)
Farm concentration and leasing disconnect farming as an economic occupation and farmers as actors in community development	Crop diversification fitting niches in the evolving marketplace of values-based global urban diets (Bardsley et al. 2019)
Supporting local specialty food production	Native vegetation and perennial crops maintain soil cover, retain moisture and enhance carbon sequestration (Campbell et al. 2018)
Developing new market outlets for ‘non-bulk’ food producers and linkages with the hospitality industry	Biofuel and green chemistry offer stable value chain alternatives to sustain broadacre farming
	Support low-technological experimentations (e.g. grazing rotation) improving soil management
	Learn from agroecological methods combining diversification on the field (variety mixtures, rotations, polycultures, agroforestry, and crop–livestock integration) and at the landscape level (hedgerows, corridors, etc) (Altieri, Nicholls, and Montalba 2017)
	Proximity (an hour-drive) to the established Barossa Valley limits the potential for the Clare Valley to shift from a wine-making to a full-fledged gastronomy-driven amenity region.

Each region has specific territorial conditions. Hence, realising the ‘local version’ of agri-food sustainability and multifunctionality requires planning, visioning and collaboration across a wide range of regional actors (Fielke and Bardsley 2015b). To ensure perennial family farming as an institution of the Mid North territory, efficiencies could be gained, for instance, through the development of ‘new associations’ and collaborative arrangements among farmers at landscape level (Fielke and Bardsley 2015b). If agricultural development is indeed only grounded in economies of scale through increasing farm size, then corporate agri-businesses would increase in size and number, at the expense of even large family farms, as they are more efficiently tooled to exploit economies of scale (Fielke and Bardsley 2015a, 116). Previous research on Australian broadacre farms has shown larger farms perform better because of differences in technological adoption rather than returns on scale (Sheng et al. 2015). Hence, access to knowledge and capital to enable technology adoption can be seen as the main determinants of farm productivity and resilience. Individual experimentations and peer-based learning, i.e. learning through farmer-to-farmer exchanges about practices that have proved to work in such specific geographical configurations, become central mechanisms for agricultural sustainability at farm and landscape levels simultaneously. By revitalising a connection to the land and a sense of place, the prioritisation of family farming may have positive impacts for the social sustainability and community development (Fielke and Bardsley 2015b).

Finally, the year 2019 has offered two major policy developments that will impact the agrifood transition of South Australia. First, the moratorium on the ban of genetically modified crops in South Australia has been lifted. The moratorium for both the production and transportation of genetically modified crops was in place since 2003 in South Australia (Anderson 2019). The use of genetically modified crops will affect the long-term changes in agricultural and natural biodiversity of the State. Due to the propensity of the Mid North to be affected by successive years of drought, the switch to drought-resistant crops will likely be the next major ‘agronomic development’ and ‘resource efficiency’ decision taken by broadacre farmers. These individual decisions, if taken *en masse*, will likely affect the ability of ‘regular’ broadacre farmers, as well as farmers from other styles of farming, to pursue their operations. The switch to genetically modified crops will thus create new tensions in agricultural and rural change towards a landscape approach. The second major policy development from 2019 is the adoption of the New Landscape South Australia Act (Government of South Australia 2020). The Act enforces the creation of Landscape Boards in the nine regions of the State. The coordination of actions in the Mid North will be reinforced by the inclusion of the areas around Burra, previously part of the Murray-Darling Basin Region, to the Northern and Yorke region. The Act advocates that ‘the sustainable management of our landscapes helps to promote prosperous long-term businesses, thriving native species and ecosystems, and resilient communities’ (Government of South Australia 2020). An acknowledged objective is the creation of an institutional framework supporting community engagement in a whole-of-landscape approach, especially linked to the resilience in the face of extreme weather. The Act also reinstates the role of land owners in managing the landscape and the need for more coordinated collective action among them.

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