Examining innovation for sustainability from the bottom up: An analysis of the permaculture community in England

Damian Maye

Countryside and Community Research Institute, University of Gloucestershire, Oxstalls Campus, Oxstalls Lane, Longlevens, Gloucester, GL2 9HW UK e-mail: dmaye@glos.ac.uk

[Accepted for publication in *Sociologia Ruralis* on 23-Jun-2016].

Examining innovation for sustainability from the bottom up: An analysis of the permaculture community in England

Abstract

This paper applies the transitions approach to a novel food production context, via an examination of the food production side of permaculture. More specifically, it examines attempts by the permaculture community in England to interact and influence the Agriculture Knowledge System of the mainstream agri-food regime. Strategic Niche Management and Communities of Practice theory are combined to examine the ways in which the permaculture community has evolved and has sought to develop its agro-ecology message and influence the agri-food regime. Evidence of second order learning and networking with stakeholders outside the community of practice is limited. A tension between internal activities that reinforce a boundary between the permaculture knowledge system and the wider Agriculture Knowledge System are evident. Some external activities designed to cross boundaries are noted. However, activities designed to translate permaculture ideas into mainstream agriculture have had limited success. There is some evidence of interaction and lateral linkage with sub-regimes to enhance capacity but this is usually in individual capacities. Examining the evolution of radical niche innovations such as permaculture thus reveals the way that beliefs, values and epistemologies make the process of sustainability transition challenging and complex, particularly when different knowledge systems clash with one another.

Introduction

Innovation has become something of a buzzword in recent years, especially within food and rural and regional development policy (Bock 2012; Neumeier 2012; Kirwan *et al.* 2013; Esparcia 2014; Hinrichs 2014; Ingram, 2015; Tisenkopfs *et al.* 2015). Adams and Hess (2008, p. 1) note that 'innovation occurs when a new idea (or combination of old ideas) forms a different way of thinking or interacting'. In addition to this general definition, innovation also typically involves processes that are highly contested because they challenge current thinking and modes of development. Within agriculture the pressure to innovate is in response to the challenge to increase food production sustainably. This will not be easy given various external pressures, including a declining stock of key resources, energy prices, international trade relations and climate change. (Maye and Kirwan 2013). Approaches to agriculture are needed that extend beyond traditional sectorial agricultural boundaries, including sustainable alternatives that challenge the existing socio-technical regime (Seyfang and Smith 2007; Marsden 2013; Darnhofer 2015; Ingram and Maye 2016). Responding to agri-food sustainability challenges will require system-level changes, or what is more generally termed 'sustainability transitions' (Hargreaves *et al.* 2013; Feola and Nunes 2014).

Transition is a 'gradual process of change which transforms the structural character of a societal domain' (Rotmans *et al.* 2001, quoted in Brunori *et al.* 2013, p. 27; see also Hinrichs 2014). The transition approach argues that socio-technical regimes (i.e. systems of rules and principles) provide a frame of reference for actions/behaviours. Transition describes a process of changing socio-technical regimes. In an agri-food context, mainstream agriculture refers to prescribed agricultural practices within conventional systems e.g. arable farming. Mainstream agriculture and the wider agri-food regime is underpinned by a productivist logic with established supply chains and formal institutions and actors (Agriculture Knowledge System (AKS)) that have responsibility for fostering innovation (Ingram 2015). Transition to sustainability refers 'to a shift from the 'productivist regime', characterised by production growth, high yields, and input intensification, to a regime built around the principles of sustainable production' (Brunori *et al.* 2013, p. 28). However, transforming socio-technical regimes is not a straightforward or easy task. As Seyfang and Smith (2007) observe, sustainable alternatives are typically 'locked out' because socio-economies are locked in to established systems and ways of thinking. This is reflected, for example, in the way global markets, neoliberalism and technological artefacts dominate agri-food regime debates about transitions to sustainability in agriculture (Marsden 2013).

Innovation is a key driver of transition – it provides the means to potentially 'unlock' old styles of thinking. The transition approach identifies two types of innovation (Geels and Schot 2007; Brunori *et al.* 2013; Hinrichs 2014). First, incremental (first order) innovations, which are innovations (technological or social) that maintain the status quo; they are generated by the existing rules of the regime and 'fix' problems within the regime. They do not challenge the rules about how a system operates or how we behave as consumers/citizens. Second, radical (second order) innovations, which respond to contradictions within the regime and external pressures and, crucially, seek to change it; their socio-technical rules are generated *outside* the regime. Transition takes place 'when new techno-economic principles become a coherent whole and replace the old ones' (Brunori *et al.* 2013, p. 27). Organic agriculture in its early days was a radical innovation (Smith 2006; Goodman *et al.* 2012). Transition Towns are

another contemporary example of a radical sustainable alternative that challenges the socio-technical regime (Feola and Nunes 2014). These innovative grassroots networks are synonymous with 'socio-technical niches' as defined by Seyfang and Smith (2007; cf. Geels 2004; Elzen *et al.* 2012; Smith and Raven 2012) in that they operate on the margins of conventional agriculture, mainstream public funds and institutional support frameworks (Ingram and Maye 2016).

This paper applies the transitions approach to a novel food production context, via an examination of the permaculture community in England.[i] Permaculture is an international grassroots development philosophy and sustainability movement that advocates an agro-ecological design approach to community living and food production (Veteto and Lockyer 2008, p. 49; cf. Pickerill 2010; Ingram *et al.* 2014a). It offers a more radical and alternative rural future similar in spirit to the counter-cultural back-to-the-land movement (Halfacree 2007a/b). The *food production* side of permaculture and in particular attempts by the community to interact and influence the AKS of the mainstream agri-food regime in England is the point of interest here. In transition theory terms, the agricultural research, extension and education institutions are established sources for innovation (i.e. first order) and part of the productivist regime (Curry *et al.* 2012). Permaculture is an alternative (second order) approach to agriculture and food production which has emerged outside of the regime, with its own knowledge base and resources. Its agro-ecological approach to food production and sustainable living challenges the conventional wisdom of the mainstream regime. The paper aims to examine the evolution of the permaculture community in England as an example of an 'emerging transition' (i.e. 'transitions in-the-making', Darnhofer 2015, p. 17). Strategic Niche Management and Communities Of Practice theory are utilised to examine the ways in which the permaculture community in England has evolved and has sought to develop its agro-ecology message and influence the mainstream agri-food regime. Three research questions drive the analysis: first, what is the internal composition of the permaculture community in terms of social processes and network dynamics and how might they influence niche-regime interactions?; second, what methods and strategies has the permaculture community employed to translate permaculture methods to the mainstream agri-food regime?; and third, how effective has the community been in diffusing socio-technical practices, in linking with regime actors and in creating relationships between regimes to influence change? The next section of the paper introduces ideas from Strategic Niche Management and Communities Of Practice, which sit within transition studies and knowledge and learning systems literatures respectively. The permaculture concept and analysis of the community in England is then presented, focusing on attempts by the group (and its associated knowledge system) to influence and interact with the mainstream agri-food regime and interested publics.

Conceptualising sustainability transitions and niche-regime interactions

A series of approaches within transition studies have developed to understand and study sustainability transitions (Lachman 2013; Hinrichs 2014; Elzin *et al.* 2012; Darnhofer 2015). The most established approach is the Multi-Level Perspective (here after MLP), which conceptualises patterns of long-term change. Its main focus is socio-technical systems, which are situated at three analytical levels and labelled respectively as landscape factors, regimes and niches (Geels and Schot 2007). Transitions are non-linear processes and an outcome of

the interplay of developments at the three levels, with each level representing a heterogeneous configuration of elements (Darnhofer 2015, p. 19). In relation to agriculture, the socio-technical landscape represents pressures that are exogenous to niches and regimes below. These include external challenges, such as climate change and macro economic processes, which normally take place over a long time scale but create opportunities for change. Niches and regimes have no impact on the landscape level, but the landscape factors can impact these two levels below. The socio-technical regime is the locus of established practices and rules that stablise existing systems (*ibid.*), which in this case signifies the mainstream agri-food system and its current governance mechanisms. This 'regime' can be understood as being 'dynamically stable' and the dominant paradigm in terms of how things are organised. The third element, niche innovations, is the locus of radical innovations, which at present may not be directly putting pressure on the dominant paradigm to change, and yet have the potential to do so.

Transitions occur 'as a result of dynamics at the different levels which reinforce each other creating a "window of opportunity"' (Lachman 2013, p. 271). Thus, landscape factors destabilise regimes and niches, constructed in 'protective space', gather momentum and increase in importance within the system. Niches are the main focus for change; however, there is no guarantee they will develop sufficiently to materially influence the dominant regime. Understanding the relationship between niches and regimes is therefore key to understanding the nature of transitions, notwithstanding the pressures that may also be exerted on an existing regime from the landscape level. In practice, how change happens is also dependent on timing, as well perhaps as on luck. This includes the relative strength and stability of the niche in relation to the regime and concomitantly how well developed the niche is (e.g. how realistic an alternative to the existing regime is it?). This highlights the importance of understanding the processes of network building and actor alignment, in that 'the rules of [any] socio-technical regime are sustained through network interactions, inter-organisational fields, and social worlds' (Wiskerke 2003, p. 431).

The MLP thus provides a generalisable model and heuristic framework to position radical innovations and to examine potential interactions relative to the mainstream regime. MLP is a 'multiple' approach in that it is able to account for a wide range of actors and institutions that may be operating at different levels as well as being either internal or external to the society/region/regime involved. However, the MLP has been criticised on the basis that although it appears straightforward it is actually highly complex, with greater attention needed to examine dynamics between levels and between actors at the same levels (Lawhon and Murphy 2011; Smith and Raven 2012; Lachman 2013; Darnhofer 2015). There are a number of events and relations that need to be accounted for, for example, including the social, political and spatial dynamics that shape sustainability transitions. Moreover, MLP was essentially designed to examine technological innovations.

Attention within transition studies is therefore increasingly focused on further analysis of interactions between levels and better understanding boundary interactions. This forms a core focus of this paper, which utilises a sub-set of MLP, Strategic Niche Management (here after SNM), to study permaculture as an emerging sustainability transition, in combination with ideas from Communities of Practice (here after COP). Transition studies have not previously combined SNM and COP approaches but they offer useful synergies to examine

niche-regime interactions. SNM is particularly useful to scrutinise what we mean by 'niche' and to better understand 'niche interactions', which includes work by Seyfang and Smith (2007) and Seyfang and Haxeltine (2012) that links SNM to grassroots social innovations (see also Morris *et al.* 2014). It is a form of evolutionary theory that focuses on the governance of niches (Seyfang and Haxeltine 2012). It argues that innovative approaches with the potential to contribute to sustainable development may not have the capacity to compete with established networks, without some form of financial, institutional and/or policy support. As Lachman (2013, p. 272) notes, 'the core idea behind SNM is learning-by-doing and doing-by learning in order to gain insights from transition experiments as to the (general applicable) requirements regarding the breakthrough of niches into the mainstream…' SNM examines how new technologies and approaches can be understood and encouraged to achieve societal goals e.g. sustainability. It seeks to understand *how niches can emerge through collective engagement and practice*. SNM thus provides a focus on how innovations are developed at the local level and how they may impact the regime. Seyfang and Haxeltine's (2012) work on the UK's Transition Towns movement is useful to characterise what is meant by 'niche' from an SNM perspective. They define niches as:

> '…a protected space where suboptimally performing experiments can develop away from regime selection pressures. [They] comprise intermediary organisations and actors, which serve as 'global carriers' of best practice, standards, institutionalised learning, and other intermediating resources such as networking and lobbying, which are informed by, and in turn inform, concrete local projects (experiments)' (*ibid.*, p. 383).

Three important processes for successful niche development are identified (*ibid.*; see also Kemp *et al.* 1998). The first is *expectation management*, which is about how the niche presents themselves to external audiences and whether they deliver on the promise they make. They suggest 'expectations should be widely shared, specific, realistic and achievable'. The second is *building social networks* – networking activities work best to support niches if they involve different stakeholders who can then draw in their organisational resources to support niche development. The third is *learning*, and this is most effective when it contributes to 'second-order learning' (i.e. participants involved question the logic and recognise constraints of the regime). A successful niche innovation is one that diffuses socio-technical practices. They need, in other words, to communicate effectively with wider audiences. There are three ways in which a successfully developed niche diffuses (Seyfang and Haxeltine 2012, p. 384):

- *Replication*: projects are replicated within the niche resulting in change as a result of an aggregation of small projects;
- *Scaling up*: whereby projects grow in scale and attract more participants; and
- *Translation*: where niche ideas are translated into the mainstream.

The diffusion of technological, market-based innovations (e.g. the latest mobile phone or computer tablet) is different to grassroots innovations, such as permaculture, local food projects or furniture recycling schemes, which are practice and values-based. The creation of a space to develop ideas, experiment, express alternative values, etc. is crucial for grassroots innovations (Seyfang and Smith 2007; Seyfang and Haxeltine 2012). This maintenance of a

protected space is seen as a key challenge for grassroots niches, which in turn links to practical challenges like funding. Protected space in this context then is not describing a policy framework that protects a niche innovation (e.g. novel technology) from market competition (Raven and Smith, 2012). The dominant regime is not strategically 'protecting' permaculture to sub-optimally perform experiments. Protected space in socially-orientated forms of innovation refers instead to a space (and sympathetic community) where niche projects promoting permaculture methods through distinctive values and social and environmental aims are nurtured. As Seyfang and Haxeltine (2012, p. 384) put it, '[t]he 'protected space' may be one of values and culture rather than market pressures…which makes translation of ideas more difficult due to the fundamental clash of values, ideas, and practices'. For the niche to successfully diffuse ideas in this context may require extra things to happen e.g. internal adaptation by the niche, or the regime adapting its functions (e.g. change in regulations) to incorporate niche ideas. Successful innovative socio-technical niches need to somehow combine 'radical' and 'reforming' characteristics (Smith 2006; cf. Raven and Smith, 2012), which in practice 'implies that there must be niche elements that can be appropriated easily by the mainstream, leading towards mildly more sustainable reforms' (Morris *et al.* 2014: 193).

Seyfang and Haxeltine's (2012) review of SNM and their study of the UK's Transition Towns movement provide fruitful insights for analysis of the permaculture network in England. Their work also draws attention to the need to appreciate *internal niche processes versus external processes* by understanding the role of identity and group formation. This element of SNM is very important but under-researched. It is examined and extended here by combining insights from COP, particularly in relation to boundary processes (Wenger 2000; Swan et al 2002; Oreszczyn et al 2010; Tisenkopfs *et al.* 2015). We know from this work that forms of knowledge, learning and practice are associated with specific groups or communities with social bonds strengthened through a process of sharing the same knowledge, values, practices and repertoires (Ingram and Maye 2016). Boundaries can be maintained by such groups to protect critical competences but such communities or groups may also construct and defend themselves to such an extent that they may become insular and orientated only to their own communities of practice/interest. Boundaries may be a source of separation and misunderstanding (Wenger 2000). For niches to develop effectively they need to communicate effectively with wider audiences beyond their community of practice (Smith 2006). Research on knowledge in organisations shows how knowledge boundaries appear when you have interaction between specialised domains. Knowledge in this moment becomes a 'curse' because you need to abandon past knowledge at a boundary when a novelty appears (Carlile 2004, p. 557). If you want effective exchange finding common knowledge is therefore critical (Ingram and Maye 2016).

Boundaries can also become what Wenger (2000) describes as 'spaces of unusual learning'. To enable niche-regime interactions the role of people who are able to provide connections across boundaries and introduce elements of one practice into another is very important. These 'boundary spanning processes' (*ibid.*) can be one-way or two-way connections that involve different types of boundary agent, including (Oreszczyn *et al.* 2010, p. 406): 'brokers' (caring for one boundary), 'roamers' (move around several boundaries), 'outposts' (explore new territories and bring back new ideas) and 'pairs' (brokering via relationships between two people of different communities). Boundary agent roles may be formal or informal. COP

theory and boundary spanning/knowledge brokerage in combination with SNM can therefore inform analysis of bottom up innovation processes by better understanding *social relations and interactions* between emerging sustainability transitions and mainstream AKS actors. SNM is useful to assess the methods employed to diffuse and translate their socio-technical practices. By combining SNM with COP theory the role of internal niche processes and boundary spanning activities as enablers for niche-regime interactions can also be examined. These conceptual elements (managing expectations, social learning, networking, diffusion processes and boundary activities) therefore provide useful criteria to assess permaculture in England as a grassroots social innovation and 'radical novelty' that forms at the micro-level of niches (Geels and Schot 2007, p. 400; Ingram *et al.* 2014b).

Methodology and research methods

The analysis of the permaculture network is underpinned by a transdiciplinary approach (Home and Rump, 2015) – i.e. it was a co-produced epistemology and data collection process, which involved stakeholders and research participants from the start, actively informing and co-constructing research design as well as outputs/findings. This approach was structured around five participatory workshops, which were conducted over a four year period (for details see: Ingram *et al.* 2013). Between 15-20 participants took part in each workshop and were recruited to represent the diverse community of actors who participate and engage with permaculture, which included representatives from the Permaculture Association (hereafter PA), permaculture practitioners and others not directly involved but interested in the permaculture movement or connected to an organisation in the mainstream agri-food regime. In addition, 20 face-to-face interviews were conducted with individuals from the permaculture community, as well as observation and participation at three meetings and two telephone conferences of the Permaculture Association Research Advisory Board.

The workshops, interviews and observational work focused on the permaculture's learning and innovation networks and aimed to address the three research questions introduced at the start of the paper. Some more specific research questions were also co-developed which sought: to understand how learning networks emerge and operate in the permaculture community; to understand the nature, extent and development of the permaculture innovation; to evaluate specific strategies to disseminate permaculture practice, including a project called Learning and Network Dissemination (hereafter LAND) and a related project called FarmLAND; and to examine the constraints and opportunities for linking the permaculture community to the AKS[ii] and other elements of mainstream agriculture. For example, the first workshop examined the evolution of the permaculture community in England. In discussion with participants from the PA and at the first workshop, the LAND and FarmLAND projects were identified as key strategic developments for the group and something that warranted further analysis. The PA were awarded the LAND project in 2009. The grant of £273,000 was awarded through the Big Lottery's Local Food programme and it aimed to broaden the scope of the network and to promote and disseminate permaculture good practice to interested publics. The FarmLAND project aimed to promote permaculture design at the farm scale by working with farmers and partners/training organisations in the mainstream agricultural knowledge system. Two subsequent workshops examined these particular initiatives in detail, as well as interviews and analysis of other sources. The final two workshops examined links with other agro-ecology approaches and links and interactions

with mainstream agriculture/the AKS respectively, as well as providing space for general reflexive analysis.

Drawing on material from the workshops and interviews the analysis below is framed to: firstly, examine the internal composition of permaculture as a 'radical novelty' (i.e. to reveal identity and social formation within the permaculture community); and secondly, to look at strategies and processes of diffusion, linking the analysis to SNM diffusion ideas (replication, scaling up and translation) and to COP work on boundaries (brokers, objects and interactions). The second part of the analysis forms the main empirical focus for the paper.

The permaculture community of practice

This paper examines attempts by the permaculture community in England to interact with the agri-food regime and to influence understandings of agri-food sustainability. Understanding internal niche processes is important to analyse interaction processes, as identity and social formation influence the diffusion of innovations. This section examines learning processes among permaculture practitioners in England (see also Ingram *et al.* 2014a), utilising ideas from COP (Wenger, 2000) and themes within SNM, specifically expectation management, networking and learning.

The permaculture approach and transformative ambitions

Permaculture is often described as a design system for creating sustainable human environments. Definitions are broad ranging but all encompass a social and community dimension and some reveal a political ideology. Take this quote, for example, which appears on the inside cover of every edition of *Permaculture Activist* magazine:

> 'Permaculture is a holistic system of DESIGN, based on direct observation of nature, learning from traditional knowledge and the findings of modern science. Embodying a philosophy of positive action and grassroots education, Permaculture aims to restructure society by returning control of resources for living: food, water, shelter and the means of livelihood, to ordinary people in their communities, as the only antidote to centralized power' (Permaculture Activist 2004, p. 3; quoted in Veteto and Lockyer 2008, p. 48).

Veteto and Lockyer (2008, p. 49) capture the essence of permaculture neatly when they describe it as 'a holistic and common-sense approach that recognises humans as an integrated part of ecosystems'. It represents an alternative approach to food production and operates under a distinct set of ethical and design principles.[iii] Community and agricultural systems are designed according to the principles that mimic ecological systems (Mollinson and Holmgren 1978; Mollison 1988; Holmgrem 2002).

A key feature of the permaculture approach is achieving maximum gain for minimal energy expenditure (in contrast to the energy intensive mainstream agri-food regime). Permaculture is modelled on relationships in natural systems. It is not a production system but a land use and community planning philosophy. It does not prescribe a specific practice of food production. A central concept is the design of *ecological landscapes* that produce food. Given

the emphasis on ethics, philosophy and design principles, permaculture is not limited to a specific method of production (like organic, for example); it's a design system and does not have a rigid set of rules (Veteto and Lockyer 2008; see also Pickerill 2010). Nevertheless, it is often described as 'agro-ecological production' and is commonly associated with perennial plants, agroforestry, organic systems, forest gardening and polyculture, with community at the centre of the model (Ingram and Maye 2016).

Permaculture then is a radical second order novelty that is developing in the wider value space of agro-ecology. In terms of expectation management, the permaculture community has high level ambitions (Ingram *et al.* 2014a). The approach questions the operation and logic of the mainstream agricultural regime and advocates a radical shift in the way the food regime is run towards agro-ecological principles. Its goals are transformative – it aims to transform the food production system and its organisation.

The permaculture network in England and social learning

Individuals and communities practising permaculture in England are diffuse and distributed across a range of sites, including home gardens, community gardens/farms, public spaces, allotments and smallholdings. The permaculture community in England is focused around the PA. This is a membership organisation that involves over 1200 individuals, 67 groups and 18 businesses (Permaculture Association 2011; Ingram *et al.* 2014a). It also has its own staff, a board of trustees and a research advisory board. The PA has developed a set of tools and information that the community can use. As well as providing access to advice and information it also aims to promote the theory and practice of permaculture to the general public and coordinates the LAND and FarmLAND initiatives.

Situated learning involves a process of engagement in a 'community of practice' and is based on the notion that learning is social and comes largely from our experience of participating in daily life (Lave and Wenger 1991). This view of learning as a social process underpins the permaculture approach. The community has emerged through processes of social learning and knowledge sharing amongst individuals and groups of practitioners who share a common interest in, and enthusiasm for, the approach. As was explained in the workshops and individual interviews and site visits, practitioners learn experientially on their own sites. A significant level of individual, context-specific knowledge is built up, with an acceptance that people have different knowledges (Ingram and Maye 2016). Social and experimental knowledge generate tacit forms of knowledge. In the first workshop participants were asked to explain what was unique about the permaculture approach. The capacity to share knowledge about permaculture practice with no suggestion of personal gain emerged as a defining characteristic. Sharing was enabled by people having the same 'ethical mindset'. Participants explained that permaculture is difficult to define, with different interpretations according to local circumstances. The 'spirit' of permaculture cannot be put down on paper – it 'rubs off' from being and working with others. As one participant put it, '[t]here is no such thing as wrong as long as you learn' (Permaculture workshop, Bristol, 19th March 2012).

Despite the emphasis on social and experiential learning, there are reified forms of knowledge that individuals refer to, such as Mollison's (1998) *Permaculture – A Designer's Manual*, as well as other inspirational individuals who act as advocates for permaculture. Experiential

learning is also supported by the Permaculture Design Course and the Diploma in Applied Permaculture Design. These courses are run by the PA and, although formalised, the training style emphasises co-learning and an ethos of sharing, unlike more mainstream learning systems. Competence in practising permaculture is enhanced by undertaking these courses, which can be regarded as part of a 'regime of accountability', a set of reified forms (rules, standards, policies, goals) that the PA has developed over time to develop a sense of joint enterprise (Wenger 2000; Swan et al 2002).

Interviewees and workshop participants explained also how they source information and advice from beyond the PA through extensive networking. These were invariably sources in the 'alternative social learning system' compared to the formal agricultural knowledge system, including, for example, the Agroforestry Trust, the Soil Association, the Centre for Alternative Technology and Transition groups. In discussions about knowledge sources and networks participants opted for sources which they felt reflected their belief in self-sufficiency, distinct from the farming community and formal knowledge system sources which signified a very different, subsidy-orientated view, of food production.

Diffusion processes

SNM theory suggests learning and networking are crucial facets of successful socio-technical niche development. Two aspects of these were identified as critical: first, a need to encourage second-order learning; and second, a need to network with actors beyond the niche scale. The analysis above shows how the permaculture community in England has developed a distinct knowledge system, characterised by a community of individuals and groups who learn experientially and share and validate their knowledge through social networks and events, supported by formal structures and activities run mostly by the PA. The analysis reveals a high degree of internal coherence and a group whose social identity is formed around the practice of doing permaculture. The permaculture concept is also a focus of discussion, with contestation about how permaculture is interpreted and operationalised. The potential for permaculture to develop as a radical innovation is arguably constrained by internal processes and the nature of group formation. The insularity of the permaculture community of practice nurtures internal processes but restricts external communication and therefore constrains diffusion. However, there are attempts to disseminate the permaculture concept beyond its community of practice, as examined in this section, organised in relation to SNM diffusion processes. As will be shown from this analysis, understanding the ability of a group to balance internal processes and external communication provides an important new lens to the analysis of diffusion processes for niche-level innovations.

Demonstration and replication

Grassroots innovations may face more challenges than market-based innovations because they are 'protected spaces' that are values driven (Seyfang and Haxeltine 2012). External interventions, such as grant funding, are crucial to network survival but may also create internal tensions. The LAND grant, for example, funded 3 new and 4 existing part-time staff members, including the PA's CEO as LAND Co-ordinator, a Learning co-ordinator and a Network co-ordinator. The project aimed to develop a national permaculture demonstration network in England, including home gardens, community gardens, public spaces and farms.

During workshop discussions and interviews with practitioners and PA employees it was recognised that there were strong network ties between the PA and its members but weak ties between members, with very little regional clustering (of activities). One aim of the LAND project was to strengthen weak ties within the network, but it was designed also to encourage boundary interaction with interested publics.

A key device/object was through the establishment of LAND Centres, which represent what Wenger (2000, p. 236) terms 'boundary encounters' – which, through the form of visits and discussions – provide direct exposure to, in this case, permaculture practice. There are around 60 LAND Centres linked to the project and distributed across parts of England, with an aim to eventually reach 80 LAND Centres. The Centres provide learning and networking support (via design tutorials), events (regional skill sharing, specific training, education working group) and host Group Visits (where groups of interested practitioners or members of the general public could visit an accredited site). To be recognised as a LAND Centre sites must meet eligibility criteria.[iv] The criteria were created by PA to allow them to promote projects to the general public with the knowledge that the projects are well run and demonstrate permaculture ethics and principles. There is also a wider network of 15-20 'LAND Learners' – these are sites progressing towards meeting the eligibility criteria for a LAND Centre. In this sense the LAND project is attempting to create some standardisation and homogeneity, as LAND Centres must meet the eligibility criteria and must be considered a good example of what permaculture is (in practice).

Participants at workshops were encouraged to reflect on LAND and its aims. One participant, who is based in London but visited sites in Devon and Cornwall, all of which were about permaculture generally rather than just food growing (building, growing, waste management, cultivation), valued the experience:

> 'I was on a trip recently and the places I visited were all a result of them being on the LAND demonstration website. There was about 11 of them and through the visits I learned a lot more about food growing and land management and stuff like that, so in that respect I think it is very close to fulfilling its aims and objectives because all the information is there and you can access it and you can get in touch with all the sites and they are welcoming' (Permaculture workshop, Bristol, 19th March 2012).

Some permaculture practitioners have therefore used the network to expand their learning by visiting a number of sites. LAND Centre representatives at the workshop commented that they appreciated the recognition LAND gave them and the structure it gave them in terms of dissemination, including the provision of laminated visual aids to explain practices on sites. These fairly simple aids acted as 'boundary objects' (Wenger 2000) in the sense that they helped to connect visitors to the practice and support connections between practices. LAND data regarding visitors to the LAND centres showed that the project had fairly limited success in demonstrating permaculture practice to the general public when assessed in terms of visitor numbers and activities (in 2010, for example, LAND learning centres had about 100 visitors per centre). Some visitors were already engaged permaculture practitioners and the visits were an opportunity to learn more about permaculture. Demonstration and diffusion to visitors unfamiliar with permaculture practice (i.e., expanding the niche to wider audiences) was less evident in some cases. The emphasis on visitor numbers and activities

does not consider the quality of knowledge exchange, teaching and learning experiences of those taking part. During the workshop and interview discussions participants noted that permaculture (as a concept) is misunderstood by the public and that visitors (the general public) do not fully understand permaculture in a 2-3 hour visit (despite the provision of signs, etc.). The objective to reach the general public has therefore been challenging for the LAND project. Boundary encounters (in terms of LAND site visits, etc.) tended to be 'insiders' rather than the uninitiated, unaffiliated general public. LAND Centre 'hosts' also explained that they found it hard to explain the permaculture concept to visitors in a short visit. Achieving second order learning in this context takes time and immersion in the practice.

Scaling up and social network relations

Despite critical comments above about demonstration as diffusion, the LAND project has had some success in enabling a number of sites to be accredited across the country, and growing the LAND network and also the permaculture community more generally by attracting more interest, even if not always new participants. The LAND initiative and grant therefore provided a significant financial boost to permaculture as a radical novelty, enabling it to grow in scale. Participants questioned however the ability of LAND at helping them to network. As one participant commented, 'there is just not enough local connectivity' (Permaculture participatory workshop, Bristol, 19th March 2012).

The PA FarmLAND initiative is another device to enable boundary interaction. The ambitions of the initiative are to 'scale up' permaculture to larger-scale farms to show that it can be done at that scale (demonstrating in turn how permaculture may become more extensive or even replace the current agricultural regime). To date, the initiative has mainly attracted smallholders who have an interest in permaculture, although a small number of larger scale farmers attracted either by the permaculture approach or, more often, specific approaches which can be implemented on conventional farms, including, for example, holistic grazing and mob grazing.[v] PA interviewees explained that there are some mainstream concepts which resonate with permaculture (e.g. sustainable intensification) but such concepts are reframed through a permaculture lens and boundary interactions are often at an individual rather than organisational level. In fact the PA has faced resistance from mainstream farming bodies, such as the National Farmers' Union (NFU), which represents farming interests in England and Wales, despite attempts to engage them. Communication between permaculture practitioners and farmers was also a problem, partly because permaculture is a difficult concept to explain. One farmer who was applying permaculture principals on his farm described, for example, how 'even to the closest farmers that we work with, if you said do you know what permaculture means, if they do, it will be nothing to do with us. They know that we're organic, and they know that we're grass-fed' (Organic farmer). Some permaculture practitioners therefore reported having good social networks with local farmers but they did not share knowledge.

Despite these difficulties, members of the PA in particular (especially the CEO) have played brokering roles (Wenger, 2000), in the sense that they are networking with other individuals and organisations outside the permaculture community. In the case of permaculture, brokering is evident in terms of attempts to initiate conversations with farmers and farmer unions, for example, as well as the academic community, through attempts to develop a

research strategy for PA and to develop evidence that shows permaculture works and is credible. This brokering is not impartial, of course, but shows attempts to further develop permaculture as a radical novelty innovation. This also includes building partnerships with other organisations who promote agro-ecological approaches, including the Campaign for Real Farming, Organic Growers Alliance and Biodynamic farming network.

Translation

The translation of core ideas underpinning the niche into mainstream thinking is a key process of diffusion and successful SNM (Seyfang and Haxeltine 2012). There is limited evidence of translation of ideas between the permaculture community and the regime. Translation is largely through links with other or connected agro-ecology approaches. For example, interest in systems such as holistic grazing and agroforestry is growing within mainstream agriculture. Whilst not exclusive to permaculture, these systems are part of the overall permaculture design package. The wider Transitions Movement and new initiatives like Regenerative Agriculture also do not use the permaculture brand but have strong links and owe some of their thinking to permaculture ideas. There is an argument too, however, that the best most appropriate elements of permaculture are selectively taken by other interests but the wider approach/philosophy is not. Analysis of the partnerships built by PA staff supports this point, with interaction typically with those in the same social learning system (e.g. Biodynamic farming network or the Campaign for Real Farming). Connections are made with some mainstream AKS actors but interviewed PA participants described them more as dissemination rather than learning and translation opportunities. Boundary connections are also at an informal level and most boundary interaction is done at the individual level rather than a more formalised organisational level. A second, arguably more significant, form of translation is through an educational rather than agricultural route. Some courses and modules (e.g. level one mulching module) have been accredited by the Open College Network (Ingram and Maye 2016), which offers and awards vocational credit-based courses and qualifications through its 2,500 centres in the UK. This offers another way to make permaculture ideas accessible and open to a wider audience. Traditionally training was done via the Permaculture Design Course and the Diploma in Applied Permaculture Design. Utilising the Open College Network provides a common fora for knowledge sharing and the potential for boundary crossing, even if not via conventional AKS educational pathways.

A third form of translation is through participatory research methods that the PA are using to translate ideas to the scientific community in an attempt to provide credible evidence to actors in the agri-food regime that permaculture 'works'. In interviews and discussions this development was something the PA CEO was keen to stress, seeing it as an important means to provide intellectual rigour and credence to permaculture practices and thus to enable translation of permaculture practices and ideas to AKS actors in the future. The PA has implemented a research strategy and Research Advisory Board (including interested academics), with the PA community of practitioners acting as a research resource (described as a Practitioner Research Network) who can help to carry out small-scale research into a range of topics, with the aim to bring together the data available from a number of plots to produce a published research evidence base. A member of the Research Advisory Board explained the rationale behind this research strategy further:

> '[A] few years down the line we will put out a paper to prove that permaculture works and draw on evidence of applying principles to a plot from all continents, we will have 10-20 examples from the main ecosystems on the planet…We can offer evidence that permaculture design works, the approach is working".

This research work was in early stages of development at the time of data collection (2011-2013) but it reveals attempts and a need by PA to seek credibility with AKS actors and to demonstrate and report that credibility through peer reviewed publications (as a common knowledge and language), although translation may still be challenged in future interactions because of the non-conventional approach adopted to collect data (e.g. small-scale participatory trials of wheat and poly vegetable production).

Conclusion

This paper has provided an analysis of the permaculture community in England and has situated it within the sustainability transition literature, looking specifically at the place of niche innovations in the transition debate, particularly the challenge of understanding regime and niche interactions to understand transition. Ideas from SNM and COP have been drawn upon to examine the evolution of permaculture in England as a radical grassroots innovation. Seyfang and Haxeltine's (2012) framework provides a useful means to examine grassroots niches. When judged according to their criteria of managing expectations, social learning and networking, permaculture remains as a novelty project in the process of establishment. Evidence of second order learning and networking with stakeholders outside the community of practice is limited, with any interaction done via individual networking and boundary spanning, and the network is arguably over ambitious in its aim to transform the agri-food regime. As Seyfang and Haxeltine (2012, p. 384) reflect, 'expectations should be widely shared, specific, realistic and achievable'. The permaculture community is innovative in their approach, positioning food as part of a wider land use and community based philosophy, with distinct messages about system design and energy uses. The way elements of permaculture practice are finding their way into mainstream farming and wider arguably now more established niche innovations, notably Transition Towns, shows some influence and evolutionary progress. However, there is limited evidence to suggest permaculture has impacted mainstream agriculture. PA has attempted to replicate and, to a lesser extent, scale up permaculture. However, the translation of permaculture into the mainstream agri-food regime has been very challenging, in large part because it is a difficult concept to describe. Projects like LAND and FarmLAND have only had limited success in translating permaculture ideas into conventional agriculture, where links are weak, and the PA is not well-known to actors in the mainstream AKS.

The value and need to appreciate internal niche processes and identity practices as well as external communication mechanisms when conducting innovation diffusion analysis is evident, particularly when examining social and grassroots innovation development pathways. Wenger's (2000) work on boundary interactions has been utilised here to explore interrelations with, and diffusion into, the mainstream agri-food regime. In the case of permaculture we can see a clear tension between internal activities that tend to reinforce a boundary between the permaculture knowledge system and the wider AKS. So far there has been limited translation into mainstream thinking and practice. However, some external

activities designed to cross these boundaries are noted. Dynamics create opportunity for niches and transition. In this regard, tensions between the permaculture knowledge system and the formal AKS are creating opportunities as well as challenges (Ingram and Maye 2016). At a practice level, the multiple ways that permaculture is interpreted and the multiple and overlapping networks that permaculture practitioners and PA staff enrol into create learning opportunities that cross AKS boundaries. Tensions within the agri-food regime itself are also creating opportunities for boundary crossing. Within the mainstream agri-food regime, for example, there is recognition for the need for an integrated approach to tackle complex food system problems and this may provide opportunities for permaculture in the future, given the systems approach that it advocates.

The analysis also reveals the heterogeneous configuration of elements from an MLP perspective (Geels and Schot 2007) and the need to critique what we mean by 'niche' innovations and how we examine them from the perspective of social and grassroots innovations. In terms of understanding niche-regime interactions, there is a need for a much less hierarchical representation of niches and regimes. For example, the mainstream agri-food regime is not homogenous (Darnhofer 2015). Although limited to date there are instances where some elements of the regime/regime actors have connected with permaculture, albeit very selectively and usually in individual capacities. It is important to pay attention to niche-regime interactions at a case level, as it reveals strategies employed by novelty innovations to consolidate ideas. Particularly important in this regard is 'lateral anchoring' (Elzen et al 2012) or 'lateral linkage' (Ingram 2015) to enhance capacity through interaction with multiple sub-regimes and, in the case of permaculture, the important role and influence of key individuals as boundary spanners.

Examining the evolution of radical niche innovations such as permaculture is therefore valuable, revealing the way that beliefs, values and epistemologies make the process of sustainability transition challenging and complex, particularly when different knowledge systems clash with one another. It reiterates too the challenge faced by eco-economy advocates to transform the mainstream agri-food regime (Goodman *et al.* 2012). Socio-technical forms of ecological modernisation that modify but do not significantly reform the productivist model of food provisioning continue to dominate agri-food policy discourse. Permaculture has the potential to provide discursive and dialectical resources to challenge this mantra, as well as practical examples and a dedicated knowledge system to support learning. Future work is needed that not only examines the internal and external dynamics of niche innovations but explores boundary work and processes of interaction between knowledge systems. This is necessary to understand the dynamics and shape of new constellations of actors which are forming in the context of sustainable food transitions, including how they may be better supported. It also provides an opportunity for agri-food scholars to take a lead in developing more reflexive forms of food system governance (Hinrichs 2014) by fostering and nurturing the intersectional spaces between knowledge systems so that sustainable food system niches and mainstream regimes can develop more generative pathways of change.

References

Adams, D. and M. Hess (2008) Social innovation as a new administration strategy. *Proceedings of the 12th annual conference of the International Research Society for Public Management*, Brisbane, 26-28 March, pp. 1–8. Accessed 02.08.2015. Available online at http://www.irspm2008.bus.qut.edu.au/papers/documents/pdf/Hess%2020&%2020Adams%2020%2020Social%2020innovation%2020as%2020a%2020new%2020Public%2020Administration%2020Strategy%2020-%2020IRSPM%202008.pdf

Bock, B. (2012) Social innovation and sustainability: How to disentangle the buzzword and its application in the field of agriculture and rural development. *Studies in Agricultural Economics* 114 pp. 57-63

Brunori, G., D. Barjolle, A. Dockes *et al.* (2013) CAP Reform and innovation: the role of learning and innovation networks. *Eurochoices* 12 (2) pp. 27–33

Carlile, P. R. (2004) Transferring, translating, and transforming: an integrative framework for managing knowledge across boundaries. *Organization Science* 15 (5) pp. 555-568

Curry, N., J. Ingram, J. Kirwan *et al.* (2012) Knowledge networks for sustainable agriculture in England. *Outlook on Agriculture* 41 (4) pp. 243–248

Darnhofer, I. (2015) Socio-technical transitions in farming: key concepts. Pp. 17-31 in L.-A. Sutherland, I. Darnhofer, G. Wilson *et al.* eds, *Transition pathways towards sustainability in agriculture. Case studies from Europe* (Wallingford, CABI)

Elzen, B., B. van Mierlo and C. Leeuwis (2012) Anchoring of innovations: assessing Dutch efforts to harvest energy from glasshouses. *Environmental Innovation and Societal Transitions* 5 pp. 1–18

Esparcia, J. (2014) Innovation and networks in rural areas. An analysis from European innovative projects. *Journal of Rural Studies* 34 pp. 1-14

Feola, G. and R. Nunes (2014) Success and failure of grassroots innovations for addressing climate change: the case of the Transition Movement. *Global Environmental Change* 24 pp. 232-250

Geels, F. (2004) From sectoral systems of innovation to socio-technical systems: insights about dynamics and change from sociology and institutional theory. *Research Policy* 33 pp. 897–920

Geels, F. and J. Schot (2007) Typology of sociotechnical transition pathways. *Research Policy* 36, pp. 399-417

Goodman, D., E. DuPuis, and M. Goodman (2012) *Alternative food networks: knowledge, practice, and politics* (Abingdon, Routledge)

747 Halfacree, K. (2007a) Back-to-the-land in the twenty-first century – making connections with
748 rurality. *Tijdschrift voor Ecocomische en Sociale Geografie* 98 (1) pp. 3-8
749
750 Halfacree, K. (2007b) Trial by space for a 'radical rural': introducing alternative localities,
751 representations and lives. *Journal of Rural Studies* 23 (2) pp. 125-141
752
753 Hargreaves, T., N. Longhurst, and G. Seyfang (2013) Up, down, round and round: Connecting
754 regimes and practices in innovation for sustainability. *Environment and Planning A* 45 pp. 402-
755 420
756
757 Hinrichs, C. C. (2014) Transitions to sustainability: a change in thinking about food systems
758 change? *Agriculture and Human Values* 31 pp. 143-155
759
760 Holmgren, D. (2002) *Permaculture: principles and pathways beyond sustainability* (Hepburn,
761 Victoria, Holmgren Design Services)
762
763 Home, R. and N. Rump (2015) Evaluation of a multi-case participatory action research
764 project: the case of SOLINSA. *Journal of Agricultural Education and Extension* 21 (1) pp. 73-
765 89.
766
767 Ingram, J. (2015) Framing niche-regime linkages as adaptation: an analysis of learning and
768 innovation networks for sustainable agriculture across Europe. *Journal of Rural Studies* 40 pp.
769 59-75
770
771 Ingram, J., N. Curry, J. Kirwan *et al.* (2013) WP4 Synthesis Report. SOLINSA project
772 Deliverable 4.2a. October 2013. Available at www.solinsa.net
773
774 Ingram, J., D. Maye, N. Curry, J *et al.* (2014a) Learning in the permaculture community of
775 practice in England: an analysis of the relationship between core practices and boundary
776 processes. *Journal of Agricultural Education and Extension* 20 (3) pp. 1-16
777
778 Ingram, J., D. Maye, N. Curry, J *et al.* (2014b) Interactions between niche and regime: an
779 analysis of learning and innovation networks for sustainable agriculture across Europe.
780 *Journal of Agricultural Education and Extension* 21 (1) pp. 55-71
781
782 Ingram, J. and D. Maye (2016 – in press). Niche knowledge systems – challenging or
783 invigorating the AKS. In press in B. Elzen, A. Augustyn, M. Barbier, and B. van Mierlo eds,
784 *Agroecological transitions: changes and breakthroughs in the making* (Wageningen:
785 Wageningen University)
786
787 Kemp, R., J. Schot, and R. Hoogma (1998) Regime shifts to sustainability through processes of
788 niche formation: the approach of Strategic Niche Management. *Technology Analysis and*
789 *Strategic Management* 10 (2) pp. 175–195
790
791 Kirwan, J., B. Ilbery, D. Maye *et al*. (2013) Grassroots social innovations and food localisation:
792 an investigation of the Local Food programme in England. *Global Environmental Change* 23
793 pp. 830–837

Lachman, D. A. (2013) A survey and review of approaches to study transitions. *Energy Policy* 58 pp. 269-276

Lave, J. and E. Wenger (1991) *Situated learning: legitimate peripheral participation (learning in doing: social, cognitive and computational perspectives)* (Cambridge: Cambridge University Press)

Lawhon, M. and J.T. Murphy (2011) Socio-technical regimes and sustainability transitions: insights from political ecology. *Progress in Human Geography* 36 (3) pp. 354–378

Leach, M., J. Rockström, P. Raskin *et al*. (2012) Transforming innovation for sustainability. *Ecology and Society* 17 (2) p. 11.

Marsden, T. (2013) From post-productionism to reflexive governance: contested transitions in securing more sustainable food futures. *Journal of Rural Studies* 29 pp. 123-134

Maye, D. and J. Kirwan (2013) Food security: a fractured consensus. *Journal of Rural Studies* 29 pp. 1-6.

Mollison, B. (1988) *Permaculture – A Designer's Manual* (Tyalgum, New South Wales: Tagari Publications)

Mollison, B. and Holmgren, D (1978) *Permaculture One. A Perennial Agriculture for Human Settlements* (Melbourne: Trasworld)

Morris, C., J. Kirwan, and R. Lally (2014) Less Meat Initiatives: an initial exploration of a diet-focused social innovation in transitions to a more sustainable regime of meat provisioning. *International Journal of Sociology of Agriculture and Food* 21 (2) pp. 189-208

Neumeier, S. (2012) Why do social innovations in rural development matter and should they be considered more seriously in rural development research? – Proposal for a stronger focus on social innovations in rural development research. *Sociologia Ruralis* 52 pp. 48-69

Oreszcyn, S., Lane, A. and Carr, S (2010) The role of networks of practice and webs of influence on farmers' engagement with and learning about agricultural innovations. *Journal of Rural Studies* 26 pp. 404-417

Permaculture Activist (2004) What is Permaculture? *Permaculture Activist* 53 (Autumn): p. 3

Permaculture Association (2011) *Permaculture Association Britain Research Strategy 2010 – 2014* (Leeds: Permaculture Association)

Pickerill, J. (2010) Permaculture in practice: Low Impact Development in Britain. Pp. 180-194 in J. Lockyer and J. Veteto eds, *Localizing Environmental Anthropology: Bioregionalism, Permaculture, and Ecovillage Design for a Sustainable Future* (Oxford: Berghahn Books)

Renting, H., M. Schermer, and A. Rossi (2012) Building food democracy: Exploring civic food networks and newly emerging forms of food citizenship. *International Journal of Sociology of Agriculture and Food* 19 (3) pp. 289–307

Rotmans, J., R. Kemp, and M. van Asselt (2001) More evolution than revolution: transition management in public policy. *Foresight* 3 (1) (February 1) pp. 15–31

Seyfang, G., and T. Haxeltine (2012) Growing grassroots innovations: exploring the role of community-based initiatives in governing sustainable energy transitions. *Environment and Planning C: Government and Policy* 30 pp. 381-400

Seyfang, G., and A. Smith (2007) Grassroots innovations for sustainable development: Towards a new research and policy agenda. *Environmental Politics* 16 pp. 584 – 603

Smith, A. (2006) Green niches in sustainable development: the case of organic food in the United Kingdom. *Environment and Planning C: Government and Policy* 24 pp. 439-458

Smith, A. and R. Raven (2012) What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy* 41 pp. 1025-1036

Swan, J., H. Scarbrough and M. Robertson (2002) The Construction of Communities of Practice in the Management of Innovation. *Management Learning* 33 pp. 476-496

Tisenkopfs, T., I. Kunda, S. Sūmane, *et al.* (2015) Learning and innovation in agriculture and rural development: the use of the concepts of boundary work and boundary objects. *The Journal of Agricultural Education and Extension* 21 (1) pp. 13-33

Veteto, J. R., and J. Lockyer (2008) Environmental anthropology engaging permaculture: Moving theory and practice toward sustainability. *Culture and Agriculture* 30 pp. 47–58

Wenger, E. (2000) Communities of practice and social learning systems. *Organization* 7 (2) pp. 225–246

Wiskerke, J. (2003) On promising niches and constraining sociotechnical regimes: The case of dutch wheat and bread. *Environment and Planning A* 35 pp. 429-448

Notes

[i] The research on which this paper is based was carried out under the SOLINSA (Support of Learning and Innovation Networks in Sustainable Agriculture) project, which was funded under the Seventh Research Programme of the European Union (Project number 266306). I am very grateful to two reviewers, the editor, Bettina Bock, and my colleagues Julie Ingram and James Kirwan, for their very constructive comments on earlier drafts of this paper. I would also like to thank the Permaculture Association for all their help and input during the research phase.

[ii] AKS refers to the formal institutes/actors responsible for enabling innovation, as well as the actor networks that support agricultural innovation and learning (Ingram 2015: 61). Within mainstream agriculture actor networks include, for example, agricultural scientists and extension officers, as well as private industry suppliers.

[iii] Permaculture has three underpinning ethics: 1) care for the earth, 2) care for people, and 3) set limits to consumption and reproduction and redistribute surplus. Different sets of principles have been proposed building on those first proposed by Mollison (1985). The Permaculture Association uses the 12 design principles set out by Holmgren (2002): 1) observe and interact, 2) catch and store energy, 3) obtain a yield, 4) apply self-regulation and accept feedback, use and value renewable resources and sources, 6) produce no waste, 7) design from patterns to details, 8) integrate rather than segregate, 9) use small and slow solutions, 10) use and value diversity, 11) use edges and value the marginal, 12) creatively use and respond to change. A set of design tools are also available.

[iv] There are 10 criteria that LAND Centres must meet (https://www.permaculture.org.uk/people-projects-places/land-criteria; accessed 25.03.2016): 1. have a design that uses the ethics, principles and methods of permaculture; 2. be committed to their project development in the medium and long term; 3. have at least one key project member with a Permaculture Design Course certificate; 4. be willing to share skills and relevant information with other permaculture projects, volunteers and visitors via the Permaculture Association website; 5. maintain Permaculture Association membership; 6. be willing to explain to visitors and volunteers how permaculture is put into practice on their site, in person and through interpretative signage; 7. be available to welcome and receive volunteers and visitors on at least 15 occasions a year (minimum numbers and a charge can be set by the Centre); 8. have appropriate insurance policies, health and safety procedures and risk assessments; 9. display membership of (and a weblink for) the LAND project on project websites and on the actual site; and 10. receive feedback, including a biennial check.

[v] Holistic grazing is a land management system that mimics nature. It was developed in the 1970s by Allan Savory to improve biodiversity on rangeland environments. Wild grazing animals concentrate in small areas to graze but move on quickly to avoid predators. Holistic grazing and mob grazing copy this behaviour profile, with animals clustered into small areas but moved on quickly to avoid over-grazing (https://www.permaculture.org.uk/education/course/holistic-management-farming-and-grazing-course-3-day-introductory-course-2014-10-06; accessed 14.06.2016).