Shifting from farming to tending the earth: A discussion paper

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Abstract

'Regenerative agriculture' captures a diverse range of land management and agricultural techniques and practices, which have in common a principled and ethical commitment to caring for the land to support its health and vitality. Regenerative agriculture (more commonly known as agroecology outside Australia) is not new. There are scholars around the world looking at indigenous ways of managing land, showing that developing a reciprocal relationship with the land is an ancient practice. It is a practice that has been neglected with the recent development of industrialised agriculture, which derives from what Australian farmer-scholar Charles Massy, and others before him, call a 'mechanistic worldview', using the ideas and value commitments of rationalism, capitalism and imperialism. Regenerative agriculture is making a comeback now as farmers and those who care for the land are realising that exploitative land management and agricultural practices degrade their social, economic and agricultural capital. This paper argues that there is an urgent need to transition from the destructive practices of industrial agriculture, based in a mechanistic worldview, to the holistic practices of regenerative agriculture and agroecology, which are grounded in a more ecological worldview. This paper does not present primary experimental outcomes but references over 52 interviews carried out by the lead author, together with several case studies published by Charles Massy. The purpose is to illustrate the potential of regenerative agriculture and critique the current practice of regenerative agriculture as missing a central aspect of shifting to working in the ecological worldview. This paper argues for a shift from the concept of farming, back to the concept of tending the land, or custodianship, with the outcome being to produce nourishment and contribution to a thriving socio-ecological system.

Keywords: Regenerative development, regenerative agriculture, agroecology, organic agriculture, custodianship, soil health

Introduction

Regenerative agriculture, also known as agroecology – the science and practice of sustainable food systems (Frison & IPES-Food, 2016) - is not new. The work of Pascoe (2014), Gammage (2011) and others in recovering the knowledge of indigenous ways of managing land, shows that developing a reciprocal relationship with the land is an ancient practice. Indeed, when one reflects on the fact that 600 Aboriginal nations continuously occupied the continent we now call Australia for 80,000 years or more, indigenous custodianship of the land and its lifeforms is the very essence of 'sustainability' (Pascoe, 2014). Indigenous custodianship and intimate relations with 'country' was violently severed in post-1788 Australia, with the arrival of modern, and subsequently

industrialised, agriculture, driven by the expansionary logic and imperatives of capitalism, colonialism and imperialism (Mayes, 2018). Yet the concept and practice of a custodial, stewardship relationship with the land is now returning as farmers and those who care for the land realise that agriculture based on fundamentally exploitative and extractive techniques is degrading their social, economic and agricultural capital.

This paper outlines some of the principal concerns about current mainstream agricultural practice, and, drawing on the work of Australian regenerative farmer and scholar, Charles Massy, relates these concerns to the prevailing dominant worldview. We explore the argument developed by Massy (2017) and others (Frison et al., 2016) that what is required now is a paradigm shift in both agriculture and society more broadly, from a worldview variously described as 'mechanical', 'industrial' and 'extractive', to an 'ecological' worldview that acknowledges humanity's basic interdependence with the ecosystems of which we form part. The concept of 'regenerative development' is presented as a way to integrate this 'new' worldview. Looking at the current practice of regenerative agriculture and comparing it with the process of regenerative development, we explore the potential for the further evolution of regenerative agriculture

Methods

The present research began with a literature review of both scholarly and practice-based publications of organic, regenerative, holistic and permaculture practices in agriculture and regenerative development initiatives. The following section presents a summary of the key aspects that were revealed from the literature review. This literature was coded inductively (Thomas, 2006). This is an approach to qualitatively analysing data through the expertise of the person working through the data, that is "The researcher begins with an area of study and allows the theory to emerge from the data" (Strauss & Corbin, 1998, p.12). Following this method, the analysis identified themes and insights into how the current practice of regenerative development, which is primarily focused on the built environment, and those apparently similar practices in regenerative agriculture, complemented or differed from each other. The main aim was to investigate the widely held sense of frustration amongst sustainable food system advocates and practitioners that the agricultural practices that are leading to improvement in soil, ecosystem and social system thriving are still viewed as 'niche'; and therefore of limited relevance to the majority of farmers as well as to agricultural policy makers.

Inductive coding allowed for the conversion of papers, case studies, manuals, online content and books into keywords, approaches and concepts that suggested synergy between the two approaches. Inductive coding supported the research process, with continual revisiting of the codes allowing an unfolding or revealing of what could be learnt through the data. Though Thomas (2006) outlines how inductive coding is an alternative to grounded theory, 'discursive grounded theory' was used to bring the codes and themes together to craft the discussion below. Grounded theory is a systematic methodology in the social sciences involving the construction of theory through the gathering and analysis of data (Martin & Turner, 1986; Strauss & Corbin, 1994). Grounded theory is a research methodology which also operates inductively hence working well with this pragmatic coding approach.

Critical to guiding the coding, the themes and how they build an argument is the key question, which based on the aim above is: 'what insights can regenerative development

practice, as outlined by Plaut et al. (2016), and Mang & Haggard (2016), bring to agricultural practice which increases the capacity of land/soil, ecological and social systems?'. Inductive coding and discursive grounded theory require that the researcher is well grounded in the field in question. Hes has written and practiced in sustainable and regenerative development for 25 years. Rose has written, researched, taught and practiced in the fields of international development, human rights and sustainable food systems since 2001. This article draws on this extensive experience, as well as the authors' shared goal which is to generate and support alternative narratives for the thriving of humanity, based on a fundamental shift from exploitative and extractive human-nature relations, to relations of interdependence and mutual symbiosis (Leung & Poulin, 2008). This comes from a deep ecological understanding that a system will only thrive if it is contributed to, whereas taking from a system constantly leads to collapse.

The data for this paper are drawn from the literature cited, 52 interviews carried out with leading built environment academics and practitioners carried out between 2001-2014 and related in the book *Designing for Hope* by Hes & du Plessis (2014a), their analytic paper (2014b), and the work of Massy (2017).

Results and discussion

The results of bringing together the regenerative development work and those of food growing practice with a whole of systems approach is presented in two themes. The first is that the current approach to development and agriculture is failing, arguing for the need to change the worldview and paradigm under which we do our work. The second theme is how to work in this new worldview and its socio-ecological framework, and then moving onto a reflection on what is regenerative development practice and how can this inform organic and whole system-based agriculture.

Theme 1 – The current approach to agriculture and development is failing

For several decades, there have been growing calls from many areas of research and practice for a radically different understanding of, and approach to, what is termed 'sustainable development' (Peet & Hartwick, 2015). The clamour for change is increasing because many of the social and ecological indicators that underpin not only our civilisation, but also our biosphere and therefore the basic conditions of our existence, are being eroded and threatened (see for example the planetary boundary work of Rockström et al (2009) and *The Limits to Growth* (Meadows et al., 1972) and Meadows et al. (2006). In other words, we are generally failing at our current approach to sustainability, insofar as that concept implies the establishment and maintenance of conditions that will allow human and non-human life to not only survive, but flourish into the foreseeable future (Robert et al., 2005). Authors including Lyle (1994), McDonough & Braungart (2002), Birkeland (2008), Cole (2012), Mang & Reed (2012), Raworth (2017) and du Plessis (2009), call for approaches that facilitate development outcomes that move beyond marginal improvements and shift our focus towards creating vitality and net benefit. This would be a form and practice of development that begins to heal the damage done in the past and creates vital relationships that lead to resilience.

This call is mirrored in the agricultural sector, with authors and researchers writing about the decline of social, ecological, and economic indicators (see for example Soils for Life, 2012; Koohafkana, Altieri & Holt-Gimenez, 2012; Holt-Gimenez & Patel, 2009; McIntyre et al., 2009; Rhodes, 2017) and increased vulnerability to climate change (Rosenzweig &

Hillel, 2008). When we examine the global food and agricultural system and its impacts, what confronts us appears to be a bewildering and proliferating array of problems and 'crises' (Rosset, 2011; Campbell et al, 2013). We see, for example, persistent malnutrition and the so-called 'obesity pandemic' affecting, cumulatively, in the region of 1.5 billion individuals (Patel, 2007; Swinburn, 2011). At the social level, we see a generalised rural crisis, said to be the result of the widespread dispossession of large numbers of small and peasant farmers, in the wake of the expansion of large-scale, industrialised capitalist agriculture, and liberalised commodity trade, in many countries (Holt-Gimenez & Patel, 2009), resulting in what is widely seen as 'accumulation via dispossession' via an ongoing neo-colonial 'global land grab' (Hall ,2013). Economically, this globalising food system is characterised in many of its sectors by concentrations of power and resources into a small coterie of transnational corporations (IPES-Food, 2017). Commentators describe the system as oligopolistic (Wilkinson, 2010; Howard, 2016).

Politically, critics argue that the expansion of the system has been substantially predicated on the dismantling of domestic agricultural sectors in many countries of the Global South, often achieved through the imposition of conditionalities attached to the so-called 'structural adjustment' and 'stabilisation' loans overseen by the World Bank and the International Monetary Fund (Bello, 2009). Critics say that this loss of domestic productive capacity is a fundamental reason why many poor populations in the Global South have been exposed to steep rises in the prices of basic grains in recent years (Patnaik ,2010).

Since the advent of the 'Green Revolution' (Borlaug, 2009; Shiva, 1991), capitalist agriculture has turned increasingly in the direction of monoculture cropping, which at times can reach very large scales; and which is generally dependent on irrigation and the regular addition to the soil of agri-chemicals (McMichael, 2010). Paraguay, for example, has seen a 300% increase in the acreage devoted to the growing of soybeans for export as animal feed, to 6.5 million acres by 2008 (Howard, 2010; Correia, 2019). The soy monoculture in Paraguay forms part of the so-called 'Republic of Soy' that spans tens of millions of acres across Argentina, Paraguay and Brazil, and is associated with numerous forms of violence and dispossession (Howard, 2010; Correia, 2019). Meta-analyses, by the United Nations-sponsored Millennium Ecosystems Assessment (UN, 2005), and more recently the Global Assessment on Biodiversity and Ecosystem Services (IPBES, 2019), have documented how such practices frequently entail major changes in landscapes and waterways, such as de-forestation and increasing soil salinity, thus compromising the integrity of eco-systems.

This eco-system degradation takes multiple forms, including a loss of biodiversity brought about through the homogenisation of ecosystems and an anthropogenic acceleration in the rate of species extinction "by as much as 1,000 times over background rates typical over the planet's history" (UN, 2005; IPBES, 2019). Industrialised monoculture agriculture has made possible the rapid expansion in the past fifty years of 'concentrated animal feed-lot operations', CAFOs, also known as 'factory farms'. The negative social and environmental impacts of such operations are well documented and they are compounded by the lax regulatory regimes under which such facilities typically operate (Safran Foer, 2009; Guthman, 2011; Emil & Neo, 2011).

It seems then this system ripples with tensions and crises at every level. La Via Campesina, the global farmer movement and a principal protagonist of food sovereignty, speaks of 'multiple, converging crises':

> *In the current global context we are confronting the convergence of the food crisis, the climate crisis, the energy crisis and the financial crisis. These crises have common origins in the capitalist system and more recently in the unrestrained de-regulation in various spheres of economic activity, as part of the neo-liberal model, which gives priority to business and profit* (La Via Campesina, 2008, paragraph 13).

This addresses what Homer-Dixon and his colleagues describe as 'synchronous failure': that is, "an emerging pattern or architecture of causation that will increasingly characterize the birth and progress of crises in the future", which they conceptualise by reference to its "deep causes, intermediate processes, and ultimate outcomes" (Homer-Dixon et al, 2016, p.6).

There is a growing realisation that the worldview that has led to the current level of development is no longer able to underpin the needs of the future (Massy 2017). Those seeking a new worldview are looking for holistic approaches and frameworks to inform and guide decision–making and practice. As regards agriculture and food growing, various philosophies and methodologies have emerged that seek to transcend the destructive impacts of industrial agriculture, including holistic agriculture (Widdowson, 1987), permaculture (Mollison & Holmgren, 1978; Holmgren, 2002), regenerative agriculture (Rodale, 1983), organic agriculture (Northbourne, 1940) and biodynamic farming (Pfeiffer, 1938). To a greater or lesser extent, some of these are informed by First Nations cultures that were based in an integrated and symbiotic relationship with the land. An early pioneer in this thinking was Rudolf Steiner and the Experimental Circle founded in 1924 as written about in Paull's paper on Edith Ileen Macpherson (2017). Steiner challenged the circle to consider the farm as an organism, a living system, not a factory. As Paull (2017, p.31) writes, Steiner regarded "… it [the farm] as a biological enterprise rather than an industrial one", referencing Paull (2011) and Steiner (1924). Recently, Massy in his 2017 book *Call of the Reed Warbler: A New Agriculture, A New Earth* calls for the engendering of a neo-organic mindset where we view ourselves as a part of nature and its cycles, not separate from it. Massy engagingly illustrates why there is a need for a worldview shift from a 'mechanical mindset', where the earth is seen as a resource from which to extract profit, to an 'ecological mindset', where humans are part of nature, and can contribute to its thriving.

Massy's use of 'mechanical' to depict the prevailing practice of philosophy of industrial agriculture is not new. The 'mechanistic' worldview has been described as such by many (e.g. Steiner as mentioned above) and researchers (see summary in Kambo, Drogemuller & Yarlagadda, 2016).While it has arguably served humanity well over the past 200 years or so, its limitations are now clearly apparent given the scale, complexity and urgency of the major challenges we are facing.

The mechanistic worldview is underpinned by:

1. ***rationalism***: the idea that we are able to understand things if we only spend enough resources investigating them;

2. ***imperialism*:** the assumption that if we can understand everything we can manage and control it;

3. ***linear reductionist thinking***: we can solve all problems by breaking them down and understanding their constituent parts; and,

4. ***alienation and domination***: the religious and philosophical perspective that we are separate from nature but are entitled to dominate it.

There are elements in the mechanistic worldview that are worth retaining. Yes, understanding is a 'good thing'; yes, understanding the parts and becoming specialists has value; and yes, taking responsibility for our actions as intuitive, intelligent people is a good thing. But it is not just that this worldview and its underpinning aspects are incomplete. It is understanding with the acceptance of not knowing and uncertainty; therefore being cautious, starting slow and using the precautionary principle; it is co-creating solutions through multidisciplinary specialist input but within a bigger narrative of contributing to the health and vitality of the whole; it is seeing ourselves as being a part of nature but with unique potential to contribute to it. Kuhn (2009) was one of the first to discuss this shifting in worldviews, that when one can no longer describe the complexity of the world through a current mindset and therefore developing a more complete one, is part of the evolution and development of the human.

This more complete worldview is currently emerging. Some call it the whole systems worldview, others the holistic worldview, yet others, the ecological worldview (du Plessis & Brandon, 2014; Benne & Mang, 2015; Dias, 2015; du Plessis, 2009). Each of these has aspects in common. For the purposes of this paper, the 'ecological worldview' is taken as the lens through which agriculture and food systems are discussed. The ecological worldview sees nature as a partner (McHarg & Mumford, 1969) and teacher (Benyus, 1998), it works holistically (du Plessis & Brandon, 2014) and at a systems level, that is not as a linear process but as a cyclical open ended relational one (Hes & du Plessis, 2015, du Plessis & Brandon, 2014, Meadows et al., 2005; Meadows, 2008; Lyle, 1994, McDonough & Braungart, 2009). According to this worldview, change is inevitable and concepts of adaptation and resilience are critical and we need to adhere to living systems principles (du Plessis & Brandon, 2014; Benne & Mang, 2015; Cole, 2012; Cole et al., 2012). The ecological worldview is based on a socio-ecological system, which means that the critical aspect for the system is to support ecosystem vitality and viability using social, human, wisdom and the capacity to contribute to the system.

Socio-ecological systems have four fundamental aspects. First, they are formed from biophysical flows (the stuff, the technology, hardware, resources, nutrients, soil, water, etc.); secondly, they are also formed from mental flows (the way people think, how they make sense of the world, how they relate, education, innovation, often called the software); thirdly, the complex elements of the system are nested (in a house, in a suburb, in a city, in a state, in a country); and finally, they are interrelated (everything has an impact, ripples that can affect each other, for example decisions at a national level can have an impact on an individual's personal income). This perspective is very different for the mechanistic worldview, which sees the world as a socio-technical system – a system ruled by people (socio) through their ability to be rational, through their ingenuity (technology) and through a right to rule over nature.

Theme 2 – How to work in the socio-ecological worldview: Regenerative development, regenerative agriculture, and agroecology

Regenerative development

Regenerative development is one of the critical pathways or processes in a socio-ecological system and a farming outcome that is in synergy with the natural environment. The process aims to produce outcomes that restore and support environmental, social and economic flows from a systems perspective. Working holistically and collaboratively to develop potential is the reason it is seen as a process suited to the emerging ecological worldview. Though applied to the built environment for the past three decades, it is re-emerging in agricultural practices.

Regenerative development for this paper is understood through the work of Mang & Haggard (2016), Mang & Reed (2012), Sanford (2017), Plaut et al. (2012) and Cole (2012). It is not restorative development, or activation or revitalisation. Its aim is to deliver a 'living environment': "a setting that is thriving, healthy, and resilient because its ecological, social, and economic systems are continually nourished" Plaut et al. (2016, p. 2). Regenerative development is the process to achieve this. Plaut et al. go on to define it as "the process of cultivating the capacity and capability in people, communities, and other natural systems to renew, sustain, and thrive" (p.2). Simplified, the approach to regenerative development is to:

1. Understand the flows through a system that bring it to life, that create a living system. Flows are the various resources, including 'intangibles' such as culture and social cohesion, that interact with the place. In the farming context that is an understanding of the soil, its characteristics, the hydrological systems, the water shed, the climate, the history of the site, and what creates a vital and viable ecosystem on that site, and so forth.

2. Design relationships on the farm, relationships between the ecosystems and the crops, relationships that create mutually beneficial outcomes between flows, the question shifts from, 'how do I produce the most per hectare?' – to, 'how do I support the existing systems to thrive and not only create food but also improve the soil, sequester carbon, provide habitat, etc.?'

3. Operate within the context of the place to ensure its relevance, resilience, and ability to adapt. Within the farming context, how do you create a viable food producing system that can adapt to changing circumstances, be they economic, climate, labour, pests, etc.?

Regenerative development draws on the fields of knowledge required to better understand the "unique social, cultural and ecological opportunities and constraints of place" (Cole, 2012, p.48), including history and Nature's wisdom (Benyus, 1997), and provides alternative ways to look at development. Regenerative development focuses on symbiosis with nature, in contrast to most other forms of development which can focus on other aspects. Critically, regenerative development aims to work within a system to enable the potential of the system to emerge, to co-evolve the aspects of the system so that it can constructively adapt to change and evolve towards increasing states of health

and abundance. This typically involves a shift in mindset that puts thinking about the potential before problem-solving (Mang & Reed, 2012).

There is an illustrative adaptation to an ancient maxim cited by regenerative development pioneers Mang & Haggard (2016): 'give a man a fish and he will eat for a day, teach him how to fish and he will eat for a life time'. This is the mechanistic worldview; the ecological worldview would add a line to this saying, something like 'teach a person to love the ocean and they will both thrive'. This is the change that regenerative development has the potential to contribute: the idea of investing 'heart and head' into the relationship with the earth.

Regenerative agriculture

The US-based Rodale Institute (2015) claims that the term regenerative agriculture has been used since the late 1980s, when Robert Rodale, son of organic agriculture pioneer J. I. Rodale, used the word 'regenerative' in relation to the use of land: "where what we are really doing with the American Land is not only producing our food but regenerating, improving, reforming to a higher level the American landscape and the American Spirit" (p.18). The term was used to describe the continuing organic renewal of the complex living system, healthy soil, and therefore food and healthy people. Five regenerative landscape functions forming an indivisible dynamic whole are identified as: solar energy, the water cycle, the soil-mineral cycle, dynamic ecosystem and the human-social aspect

Regenerative agriculture is a holistic land management practice that looks at the flows of sunlight, water, nutrients and photosynthesis in plants to contribute to the health and vitality of the land. Not just to close the carbon cycle, and build soil health, crop resilience and nutrient density, the biophysical 'stuff' but also to build social capital on farms, developing the vitality of people, their capacity to adapt, and be resilient, contributing to families, communities and so forth:

> *Regenerative agriculture improves soil health, primarily through the practices that increase soil organic matter. This not only aids in increasing soil biota diversity and health, but increases biodiversity both above and below the soil surface, while increasing both water holding capacity and sequestering carbon at greater depths, thus drawing down climate-damaging levels of atmospheric CO2, and improving soil structure to reverse civilization-threatening human-caused soil loss (CSU Chico 2017, paragraph 2).*

The above description by the Regenerative Agriculture Initiative, California State University, Chico and The Carbon Underground is still limited to contributing to the physical flows. For example they outline how regenerative agriculture will:

> *(i) contribute to generating/building soils and soil fertility and health; (ii) increase water percolation, water retention, and clean and safe water runoff; (iii) increase biodiversity and ecosystem health and resiliency; and (iv) invert the carbon emissions of our current agriculture to one of remarkably significant carbon sequestration thereby cleansing the atmosphere of legacy levels of CO2 (CSU Chico 2017, paragraph 3).*

Yet, from the regenerative development perspective, the power of integrating the ecological worldview is the engagement of the mental/social aspects of the people working the land. This is the shift from mechanistic thinking to ecological thinking. All of

the case studies that are available where people on the land have taken holistic, ecological approaches to tending their farms talk about the social gains for their families, themselves and their communities. This is working at the 'human-social aspect', yet the argument from the regenerative development approach is that this should be the overarching approach. That is, if we can get the narrative right, engaging and inspiring, it creates the will to implement the systems change to create mutually beneficial relationships between other aspects: solar energy, the water cycle the soil-mineral cycle and the dynamic ecosystem.

Agroecology

We suggest, that there is a need and an opportunity for a cross-cultural and intercontinental dialogue and encounter between practitioners and advocates of regenerative agriculture, with practitioners, advocates and scholars in the field of agroecology, conceived as a science, a farming system and a social movement (Altieri, 2018). Agroecology is described as "the application of ecological concepts and principles to the design and management of sustainable agro-ecosystems"; it is a method of agricultural practice that eschews the uncritical embrace of corporate-led 'high' technology and large-scale mechanisation, in favour of a reliance on building and sustaining local human capacity and peer-based exchanges of knowledge (Altieri, 2010). Agroecology captures a range of production and design methodologies, such as nutrient and energy recycling, integration of crops and livestock, species diversification, and taking a 'whole-of-system' approach rather than a reductionist focus on a single species (United Nations, 2011; IPES-Food, 2016).

Agroecology is aimed at developing "agricultural systems in which ecological interactions and synergisms between biological components provide the mechanisms for a system to sponsor its own soil fertility, productivity and crop protection" (Altieri 2010, p. 6). Farming systems operated according to agroecological principles increasingly become self-sustaining, thereby reducing farmers' dependence on synthetic inputs, whilst diversifying their production and raising yields (IPES-Food, 2016). These practices represent what Pretty (2010) terms "sustainable intensification"; that is, "making better use of existing resources and technologies" in order to increase agricultural production.

Farmer autonomy and self-determination lie at the centre of agroecology. This methodology of production is explicitly intended to reduce farmer dependence on purchased external inputs such as seed, agri-chemicals and fossil fuels, because its aim is to build "agricultural systems in which ecological interactions and synergisms between biological components provide the mechanisms for the system to sponsor its own soil fertility, productivity and crop protection" (Altieri 2010). It poses a direct challenge to the further consolidation and expansion of the globalising capitalist food system, which is premised on what rural sociologists have termed the decades-long tendency towards 'appropriationism', that is, "the process by which corporate agribusiness reduces the importance of nature in farm production" and thereby generates multiple opportunities for capital accumulation and profit (Goodman et al., 1988). Appropriationism is an expression of how the capitalist food system patterns configurations of scarcity to the benefit of agribusiness; agroecology disrupts such configurations by (re-)connecting farmers with a natural economy of abundance (IPES-Food, 2016).

The success of agroecological methods is fundamental, not just to the claims about climate change, but to the underlying question of whether small-scale farmers can feed the planet (IPES-Food, 2016; Godfray et al., 2010).

The agroecological revolution in Latin America

Altieri & Toledo (2011) trace the development of what they term the "agroecological revolution" across Cuba, Brazil, Mexico, Central America and the Andean region over the past few decades. The capacity to combine high levels of production, whilst progressively reducing the ecologically destructive impacts of agriculture, is what gives agroecology its potentially 'revolutionary' character, according to Altieri & Toledo. They identify and describe the "cognitive, technological and social" dimensions of this revolution, which interact in a mutually supportive dynamic to sustain and strengthen its growth and impact.

As a "highly knowledge-intensive" set of methodologies that have their roots in ancestral indigenous cultures, agroecology is expressive of a "peasant epistemology" because it is "developed on the basis of farmers' knowledge and experimentation" (Alteri & Toledo, 2011, p. 588). According to these authors, the knowledge and innovations associated with agroecological techniques have spread principally through peer-based farmer-to-farmer networks; and these networks in turn are being supported by continent-wide academic and NGO collaborations. Amongst a number of 'epistemological innovations' associated with agroecology, Altieri & Toledo (2011, p.598) mention its transdisciplinary and holistic character ("joining political ecology, ecological economics and ethnoecology"); its abandonment of value-neutrality and its "self-reflexive" character; its embrace of a "long-term vision"; and its dialogic and participatory character, valuing "local wisdom and traditions" in order to "constant[ly] create new knowledge". These horizontal and de-centralised forms of knowledge-sharing epitomise the connectedness of this methodology, which contrasts with the dis-empowering and atomising effects of proprietary-based knowledge systems that form the basis of contemporary capitalist agriculture.

The techniques associated with agroecology are an expression of what Schumacher (1972) calls "intermediate" or "appropriate, people-centred", and locally-controlled, technology. As a labour and knowledge-intensive, rather than capital intensive, mode of production, agroecology encourages the development of "autochthonous technologies" based on "diversity, synergy, recycling and integration", as well as locally-available energy resources (Altieri & Toledo, 2011, p. 588, p 607). This leads these authors to argue that not only does agroecology support the achievement of food sovereignty, but also "technological sovereignty" and "energy sovereignty", with the former described as the exploitation of "environmental services derived from biodiverse agroecosystems [using] locally available resources [that] farmers are able to produce without external inputs" and the latter as "the right for people inhabiting farms, cooperatives or rural communities to have access to sufficient energy within ecological limits from local and sustainable sources, such as plant biomass produced on farm, without sacrificing food crops" (p. 607).

One example of this technology is the elaborate system of terraced cultivation developed by the pre-Columbian and pre-historic Andean cultures of Peru, which "provided tillable land, controlled [soil] erosion, and protected crops during freezing nights" (Altieri & Toledo, 2011, p.603). Another example, in the Australian context, is the recent emergence

of ‘pasture cropping’ amongst cereal and livestock farmers; in this innovation, born out of the necessity of adapting to harsh drought conditions, cereal crops are sown directly into pastures, thereby eliminating the need for tillage, substantially reducing inputs, restoring soil fertility, maintaining yields, and helping to secure financial viability for farmers.

The social and political dimensions of agroecology flow from the collaborative, co-operative and communal character of its epistemology and technologies, its connectedness. Practices that are rooted in local customs and traditions, which require for their development and “diffusion constant farmer participation” and interaction, and which have a sound economic rationale in the form of reduced reliance on external inputs, are likely to be conducive to social movement mobilisation and organisation, as has in fact occurred in many countries in Latin America, Brazil especially (Altieri & Toledo, 2011, 599). The collaborative construction and sharing of knowledge and practices constitutes a concrete manifestation of the ‘“circulation of the commons” (de Peuter & Witherford, 2010); and its linkage to social movement formation demonstrates the inherent synergies between forms of economic democracy and effective political praxis (Panayotakis, 2011).

Agroecology and regenerative agriculture

What further strengthens the normative appeal of agroecology for progressive and radical agrarian movements is its ecologically benign and regenerative nature. In contrast, capitalist agriculture and food systems are principal contributors to anthropogenic climate change, contributing up to 30% of all greenhouse gas emissions or more (IPES-Food, 2016). Such a claim, if it can be substantiated, is politically significant for at least three reasons.

In the first instance, it serves as a powerful critique of the irrationality and sheer wastefulness of the globalising capitalist food system, when contrasted with an existing and viable alternative, thus undermining the common sense on which the system is based (Vandermeer, et al., 2009). Understood holistically, the waste this system generates includes not only multiple direct and indirect forms of pollution and contamination, but also the waste of solar and animal energy, as well as human energy, knowledge and capacities. In the industrialisation of agriculture, there is a paradoxical and ultimately self-defeating transformation, expressive of the ecological rift:

> *... farming, which is inherently cyclic, capable of regenerating and reproducing itself indefinitely, becomes ... destructive and self-exhausting when transformed into an industry* (Berry, 2009, pp.63-4).

Secondly, the ecological benefits of agroecology constitute a powerful defence of peasant agriculture, strengthening the claims of food sovereignty to embody the new “good sense”, and providing justification for claims that such agriculture should be recognised and supported by governments and international institutions (Martinez-Alier. 2011, p. 149; IPES-Food. 2016). Implicitly drawing on the traditions of “agricultural energetics” dating back to the 1880s, La Via Campesina makes the justifiable claim that the capitalist industrialisation of agriculture has transformed it from being a net producer of energy to being a net consumer (Martinez-Alier, 2011, p. 152). Conversely, agroecological production, and regenerative agriculture, that does not involve large-scale deforestation and land-clearing, and which does not rely on heavy machinery and large amounts of synthetic inputs, not only consumes far less fossil fuels, but also, through the increase of

organic matter in soils, increases their carbon capture potential (Vandermeer, et al., 2009; Aguilera, et al., 2013; Massy, 2017). Further, not only does agroecology appear to mitigate the severity of climate change through emissions reductions, its practices and techniques have demonstrated a far higher level of resilience to extreme weather events in recent years (Altieri & Toledo, 2011).

The lesser reliance on fossil fuels points to a third reason for the political significance of agro-ecology: its capacity to function productively within the emerging resource constraints which capitalist agriculture is encountering in the form of “biophysical contradictions” (Weis, 2010). Forms of agriculture that can reliably produce diverse crops in the midst of a resource-constrained and climatically-changing world, and which can restore fertility to soils degraded by the practices of capitalist agriculture over decades, should be highly prized and supported by governments cognisant of their obligations to ensure the universal right to food to all their citizens (IPES-Food, 2016).

Agroecology, regenerative agriculture and regenerative development

Let us now examine each of the regenerative development processes starting with flows. The first step is to create an understanding of the ‘flows’ that bring a system to life, so that we can use our ingenuity to design ways to take the second step which is to create mutually reciprocal ‘relationships’ to create the final step: vital, viable, responsive and adaptable farms.

Given the literature in the fields of regenerative agriculture and agroecology, what are examples of the flows, relationships and living outcomes? Critical biophysical flows that bring a piece of land, country, to life are sun, water and nutrients/soil. The relationship then is the ability for plants to take these flows and through photosynthesis create organic matter. Look after the quality of the water, nutrients/soil and ability to connect to the sun and there is a good foundation for creating thriving relationships. Yet, as mentioned previously, these are only the biophysical aspects, and there are many other flows that may be pertinent to understanding how to contribute to the thriving of the land. These flows and how they affected the land can often be investigated by looking back in time. Examples of the biophysical flows could be, innovation in seed, pest control, labour, money, surrounding ecosystems, geological and hydrological systems, technology, and so forth. The insights from the decades of practice and scholarship in agroecology, as discussed above, reveal many examples of such innovations. There are then also the non-biophysical flows. Research is a key conceptual flow, as are innovations in practices and education, which cumulatively constitute the mental framework farmers have of the land. To illustrate the power of this non-physical flow is to appreciate the difference between the worldviews of indigenous Australians as opposed to the mindset of occupation, ownership and control that colonial people brought to seeing and managing/ interacting on the land (Mayes, 2019).

Once these flows are mapped out and understood, then the farmer can design a farming process to bring increased viability and vitality to the flows by creating mutually reciprocal relationships. This is something that is very well explored in permaculture literature, though still mostly based on engaging with the biophysical. The real potential of the regenerative development process to is to engage with the mental flows, which create the

will and capacity in people as well as the land. Massy states that “the socio-ecological element is a key aspect of regenerative agriculture” (2017, p. 43), yet the work of Altieri & Toledo (2011) in documenting the agroecological revolution in Latin America shows that the social and human dimensions of this process are further advanced there.

It is through engaging at this higher level of will, recognising the inevitability of change, understanding the past flows of the land and how they impacted its ability to thrive that the real difference in regenerative development emerges. The process allows a farmer to create a narrative for their land, a contributive, irresistible narrative of how the land and its people can thrive together. Through this deep understanding of the land that the potential emerges that the farmer’s design can support further evolutionary processes. It gives a sense of purpose beyond making money, which is also an important flow, but not if it is degrading the system.

Table 1. Summary of 3 case studies looking at the triggers which caused the change in approach by the land owners, the flows they worked with, the relationships they developed between flows and the key outcomes (Massy 2017).

Case study	Colin Seis	Bruce Maynard	Ian and Di Haggerty
Triggers	Decline of farm due to chemical agriculture, general costs rising, salinity increasing, reducing fertility and dying trees. Could no longer afford expensive chemical inputs and pasture seed. Fire in 1979 destroyed much of the farm. No money so decided to let the native pastures return to the farm and to manage the pastures using the principles of Holistic Management	1980s Draught, high interest rates and low commodity prices	Seeing the impact of man on land and its degradation Experimentation and learning Mentors
Flows	Grazing, Cropping, Soil, Water, Fire, Sun	Soil, Crops, Water, Sun, Natural nutrients	Soil, water, sun, microbes, sheep, worm juice
Relationships	Agricultural system (relationship) known as pasture cropping, in which an annual cereal crop such as oats or barley is sown into a perennial pasture without tilling the soil	Build a 100 year view strategic planning by understanding the physical flows. Retaining soil structure – no-kill cropping no tillage cropping Approach land with a local rather than European mindset	Understanding the interrelated nature of things. Microbes critical to soil health and development. Untillable land to productive farm
Outcomes	higher crop yields, high animal production from cropped land, increased fodder for livestock, high rates of carbon bio sequestration, improved water holding capacity in soil, improved biodiversity and importantly, happier farmers Seis “acknowledged that the biggest change was that he now though ecologically…This in turn set him on an open-ended journey. ‘I find myself addicted to learning’ he said” (p. 201)	“it is not about our soil, stock or grain prices or our rainfall.’ … ‘it’s about our management … about the human propensity to do things” (p. 204). Improved soils, increased biodiversity, improved carbon capture and production	Viability with half the yield because of low costs Support nature to do its thing ‘lazy farming’ working with the local systems reduces work and money needed releasing those flows for education, development, family, community

There are a few case studies that are beginning to explore this approach to tending the land, some are documented in Massy (2017): “regenerative agriculture therefore implies

more than just sustaining something, but rather an active rebuilding or regeneration of existing systems towards full health" (p.43). Such case studies illustrate both the changes this process has brought to the land, the farm's productivity, and the wellbeing of the people on and around the land. Each is briefly summarised to highlight some flows, relationships and outcomes. There are 19 more case studies which can be found in an Outcomes Australia report (Soils for Life, 2012), which focused on the biophysical flows of the farms; the ones below are chosen because from Massy (2017) as they begin to look at the mental/non-physical flows also (Table 1).

Concluding remarks – From farming to tending the land

The purpose of this paper is to illustrate the potential of regenerative agriculture while arguing that current practice of regenerative agriculture is missing a central aspect to support a shift to working in the ecological worldview. That is a shift from the mechanistic to the ecological worldview, from the reductive management of the parts of the system, to the holistic engagement with the entire system. The central aspect is the need to design for the heart, head and non-physical aspects of producing food. We have shown that the practices of agroecology, especially as presented in South America, show a transition to this ecological worldview through the use of ancient knowledge, the focus on collaboration, and the development of farmers' understanding of the land and its potential. This is a shift beyond 'fixing' the land, or restoring it. It is actively designing the physical and non-physical spaces on land to co-evolve, to support and nurture each other.

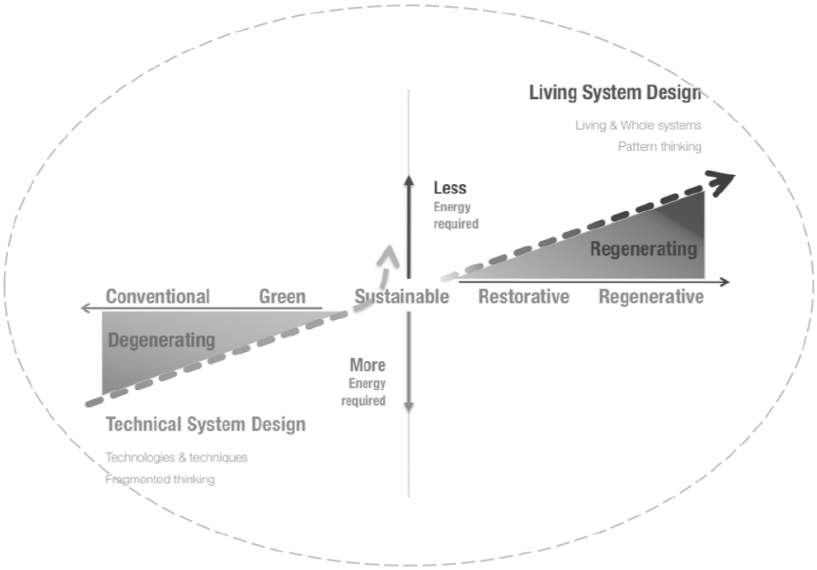

Figure 1. Original trajectory of built environment: conventional to regenerative (after Mang & Reed, 2012).

We propose that the approach to regenerative agriculture presented is more akin to restoration work, an important step, yet not yet leading to the full potential of the relationship between humans and the land. Figure 1 shows the trajectory of the last 50 years and the future of sustainable development. Adapted from a diagram by Reed & Mang (2012), it shows a journey from conventional practice, through aiming for higher performance for reduced impact, to sustainable practices, through restorative and onto regenerative. Regenerative agriculture is an important step in this trajectory; it is aiming

to fix the biophysical – soil, water, nutrients, microorganisms, money etc. – but not yet designing in the non-physical – creativity, history, collaboration, contribution, culture, etc..

This paper argues that the real power as outlined by Mang & Haggard (2015), Plaut et al. (2016), du Plessis (2016), and Cole (2012) is in the ability to integrate the 'heart and head', the mental, the non-physical flows in the design of our food production systems. It is not until then that the 'will' will be created to change, and that the understanding will exist to truly use our ingenuity to create greater vitality, viability and resilient outcomes. This is how the question posed is answered, 'how do we create momentum for the agriculture shift to a contribute, tending of the land?': it is through beginning from the human potential to create positive relationships with the biophysical aspect of our world (Fig. 2).

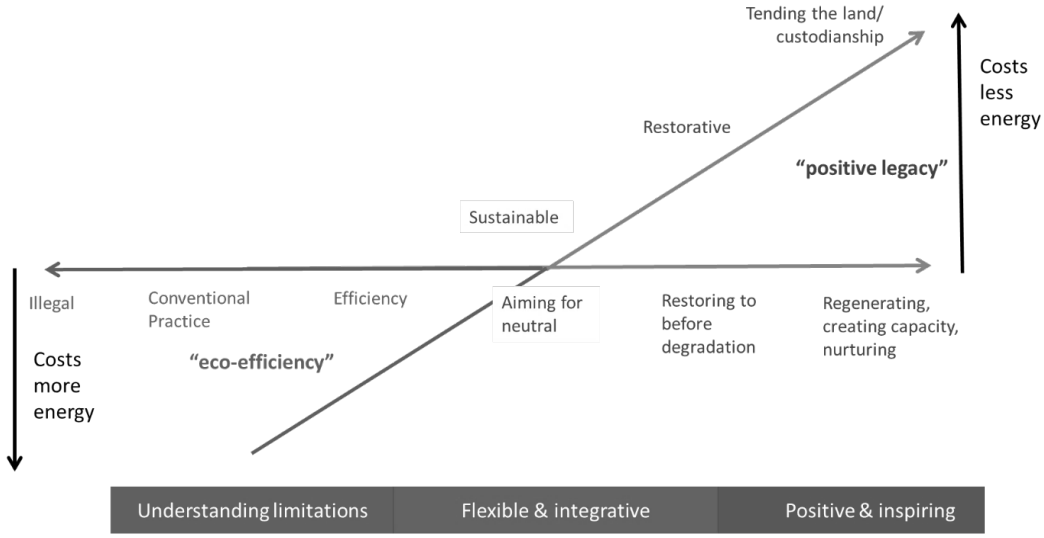

Figure 2. Trajectory of a shift from current agricultural practice to tending the land (adapted from Reed & Mang, 2012, and Beer, 2016).

This is something that many of the indigenous first peoples had with their land, the sense of responsibility, of care, of custodianship. It is a shift from using the land, to tending the land or 'caring for country'; to understanding that in the land's thriving lays our own thriving.

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