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Food Sovereignty, Agroecology and Resilience: Competing or Complementary Frames?

Rachel Bezner Kerr, Hanson Nyantakyi-Frimpong, Esther Lupafya and Laifolo Dakishoni and the SFHC organization[1]

Abstract

Food sovereignty, a concept broadly defined as the peoples' right to define their own food and agricultural systems, is often used as a rallying cry against large-scale political and economic factors that influence farmers' potential to produce food themselves, such as land grabs, climate change or international trade agreements. There is limited empirical research on linkages between food sovereignty approaches and outcomes for smallholder households' livelihood, health and wellbeing. Agroecology is a set of agricultural practices embedded in ecological principles such as recycling of organic material, mulching and minimizing toxic inputs. At the same time, agroecology is also a social movement(s) of like-minded organizations, which is increasingly being linked to food sovereignty in international events, development practice and in scholarship. Resilience, a concept borrowed from ecological theory, is defined as the ability to cope with, adapt and live with changes and uncertainty. There has been a surge in resilience-related development activities and scholarship in recent years, with increased focus by governments, development organizations and scientists on ways to build resilient communities in the Global South. In this paper these three concepts will be interrogated in light of an ongoing participatory action research project in Malawi with agrarian communities. We draw on over a decade of experience of smallholder farmers' efforts to use agroecological methods to improve food security, nutrition and land quality, using farmer-to-farmer educational methods. Using case studies from our long-term work, we will examine multiple perspectives on agroecology, food sovereignty and resilience, with data from surveys, interview, focus groups, observations and farmer-led experiments.

[1] This paper draws on the long-term work of the Soils, Food and Healthy Communities organization (www.soilsandfood.org) and while not all SFHC farmers are listed as authors, we acknowledge their contributions to this paper. Funding from the Government of Canada (Global Affairs Canada), International Development Research Centre, Canadian Foodgrains Bank, Presbyterian World Service and Development, and Cornell University is gratefully acknowledged.

Introduction

In this paper three concepts, resilience, agroecology and food sovereignty, will be interrogated in light of an ongoing participatory action research project in Malawi with agrarian communities. We draw on over 15 years of experience with smallholder farmers' efforts to use agroecological methods to improve food security, nutrition, equity and soils, using farmer-to-farmer educational methods. Empirical findings from this participatory action research are then brought into conversation with the literature on resilience, agroecology and food sovereignty (Altieri et al, 2015; Berkes et al., 2003; Folke, 2006; Garrity et al., 2010; Wittman et al. 2010; Alteiri, Funes-Monzote, & Petersen, 2012; Chappell et al., 2013).

In Africa, much of the concern surrounding climate change stems from potential negative effects on smallholder agriculture (Dumenu and Obeng, 2016; Müller et al., 2011), food security (Olsson et al., 2014; Porter et al., 2014), dietary quality (Tirado et al., 2015). Recent scientific assessments indicate that agriculture in Africa will be highly affected by climate change, in the next fifty years, including truncated growing seasons, increased occurrence of erratic rainfall, droughts and floods (Niang et al., 2014; Li et al. 2009). There is a broader consensus that climate change will have adverse consequences for Africa as a whole, despite regional variability, including food security, nutrition, and health (Müller et al., 2011; Olsson et al., 2014; Porter et al., 2014; Tirado et al., 2015). There is an emerging body of scholarship examining how to build climate change resilience by harnessing indigenous adaptation practices and farming innovations (Jiri et al., 2015; Mapfumo et al., 2015; Mortimore and Adams, 2001; Nyong et al., 2007).

Resilience is a term which has gained in currency within academic and policy discussions about climate change adaptation. Defined as a system's ability to retain the same structure and function in response to changing contexts, in response or recovery following a socio-ecological stress, without external help. A resilient system also has the ability to learn and adapt, that is, to draw lessons from past experiences, and put this knowledge into practice without repeating past mistakes. In some of the literature, resilience also emphasizes building individual or community capacity to learn and adapt through formal and indigenous knowledge. There is an immense literature that has examined some of the inherent weaknesses of resilience and its application in practical contexts (Folke, 2006; Lebel et al., 2006; Berkes et al., 2003). A number of studies have examined different agricultural strategies used to address resilience in Sub-Saharan Africa, such as agroforestry, crop-livestock integration, and polycultures (Garrity et al., 2010; Mbow et al., 2014).

Many of these practices could be deemed agroecological, meaning they mimic natural systems, by trying to have a more closed-loop system of organic material, water and energy, increased agrobiodiversity and close attention to the interacations of crops, insects and disease ecologies at the farm and landscape level (Gliessman 2015; Snapp 2008). Both a set of farming practices as well as a broader social movement (Wezel et al. 2009), agroecological approaches include attention to social, economic and political dynamics that shape food production, local knowledge and building farmer capacity to innovate as well as specific technical practices that draw on ecological principles. Recent policy advocates draw on this evidence to call for more agroecological approaches to climate change adaptation, as witnessed by the Food and Agricultural Organization's recent international symposium on Agroecology, Food Security and Nutrition. While there is increasing empirical studies as well as political mobilization related to agroecology, particularly in Latin America, there are few studies on the implications of agroecological approaches in relation to resilience for smallholder farmers in the Sub-Saharan African context (Tomich et al. 2011).

Food sovereignty is a much more politicized concept than the first two, having arisen out of the deep frustration and political alientation which smallholder farmers experienced throughout the world with increased neoliberal agendas being implemented through the World Trade Organization, international trade agreements such as NAFTA and structural adjustment policies (Wittman et al. 2010). Initially conceived and launched by La Via Campesina, an international peasants movement, food sovereignty has increasingly been interrogated, critiqued and re-conceptualized in scholarship, including several international conferences (Bernstein, 2014; Edelman et al., 2014; Li, 2015; Robbins, 2015).

The paper is organized as follows. We begin by situating the study within the broader literature on the concepts of agroecology, food sovereignty and resilience. We review past studies that have shown agroecological strategies used to build resilience, the links between food sovereignty and agroecology, and possible links between food sovereignty and resilience. We then discuss the ways in which the work of SFHC links to agroecology, food sovereignty and resilience. The theoretical implications of these findings are then discussed in light of these three different concepts.

Background Literature

Resilience

Stemming from the Latin word *resilire*, which means 'bouncing back,' 'rebounding,' or 'recoiling' (Alexander, 2013), resilience has its roots in complex systems theories, development psychology, and ecology (Berkes et al., 2003; Folke, 2006). While there have been many variations in the definition of resilience, there are certain crosscutting themes, including capacity, flexibility, adaptability, innovation, connectedness and feedback (Brown, 2013; Folke, 2006). Resilient systems can deal with shocks but maintain their essential structure and function, can learn and adapt to change, and can organize for change (Brown, 2013; Folke, 2006; Walker et al. 2006).

Resilience has been critiqued for failing to adequately take into account politics and power relations (Lebel et al., 2006), and reinforcing existing inequalities brought about by neoliberal governance (Welsh 2014). The concept as it has been applied has also been critiqued for ignoring or paying inadequate attention to social inequalities, gender, and power asymmetries within current systems (Nelson and Stathers, 2009). The focus has been almost entirely on exogenous natural disasters, rather than on the interplay and internal, social dynamics which can cause stress (Folke, 2006). Can a resilient system be a socially just one? Who decides what should be resilient, when to and to what purpose (Lebel et al., 2006). How much does encouraging resilience foster the status quo? The rise in the term 'Climate Smart Agriculture,' a concept launched by the FAO, highlights this real and present danger in the current political context (Lipper et al. 2014). What is 'climate smart' is currently under political contestation, with critics suggesting that there is a need to be attentive to ecological limits, social inequities and the specific practices associated with the term (Harvey et al. 2014; Neufeldt et al. 2013).

Agroecological Strategies to Address Resilience

Recent studies noted agroecological methods built resilience into food systems (Tomich et al. 2011; Ponisio et al. 2015). While Sub-Saharan Africa has natural inter- and intra-annual climate variability (Niang et al., 2014), several studies have shown how African smallholder strategies, such as polycultures and crop-livestock integration address resilience to these climatic changes (Garrity et al., 2010; Mbow et al., 2014). The integration of trees into farming systems in semi-arid parts of Africa ensure tighter nutrient recycling, while improving soil structural properties (Bayala, et al. 2008; Mbow et al., 2014; Lott et al., 2009). Different examples of agroforestry systems which build resilience have also been documented across Africa, including boundary plantings, perennial crops, hedgerow intercropping, live fences, and mixed strata agroforestry (Garrity et al., 2010; Mbow et al., 2014). Mixed crop livestock systems serve as insurance against droughts, provide income, enhance soil fertility and contribute to biodiversity in several regions in Africa (Ickowicz et al., 2012; Toutain et al., 2010). Increased agrobiodiversity is another important strategy in some regions, including intercropping maize with beans, cassava, cowpeas, groundnuts, pigeon peas, pumpkins, sorghum and sweet potatoes (Vincent et al., 2011).

Food Sovereignty and Repairing the Metabolic Rift

First developed by La Via Campesina, food sovereignty was a concept with a political message – that of people's right to control the food system – how to grow food, what kind of food to grow, and who gets access to that food (Patel 2009). Arising out of the interests of smallholder farmers, themselves a disparate and varied set of classes across cultures with a range of political views (Bernstein 2013), food sovereignty was conceptualized as a means to wrestle political control of the food system away from the concentrated agri-food industry back into both producers and eaters' hands (Patel 2009;

Wittman et al. 2010). Others have been skeptical of food sovereignty, arguing that by lumping all smallholder producers under the category of peasants, the concept fails to take into account the contradictory and competing class interests that advocate for food sovereignty, and ignore hard realities about the potential for peasants to viably produce enough food in the contemporary period (Bernstein 2014; Li 2014).

Several scholars have argued that agroecological approaches are fundamental to food sovereignty, because they repair the metabolic rift brought about by the commodification of land and labor through capitalism (Wittman 2009; Schneider and McMichael 2010; Altieri et al. 2012). Marx's original depiction of the metabolic rift was one in which nutrient cycles were disrupted through the alienation of labor, the establishment of hierarchies between town and country, and the internationalization of trade, which came about with the development of capitalism (Schneider and McMichael 2010; Friedmann 2010; Moore 2003). Here I build on earlier work by Moore (2003) and Schneider and McMichael (2010) in which they argue that the metabolic rift is a set of relational ecological and social processes, disrupting material and social pathways. The rifts include agroecological rifts – robbing the soil of organic material and biota as well as nutrients – and social knowledge – farmers' close observation of ecological processes with agroecosystem landscapes (Schneider and McMichael 2010).

Background

This paper draws on a long-term research and development project based in northern Malawi, called the Soils, Food and Healthy Communities project, which is now a farmer-led non-profit organization, called SFHC. Malawi is in south-eastern Africa, where the majority of people are smallholder farmers, growing maize as their primary staple, alongside groundnuts, beans, sweet potatoes and various cash crops, particularly tobacco. . As one of the countries expected to be most affected by climate change, and one where rural smallholder households already struggles with poverty and food insecurity, Malawi is an interesting case study to examine these questions. Malawi has a current population of 16.4 million, over 80% of whom live in rural areas and rely on agriculture for their food and livelihoods and is one of the poorest countries in the world, with an 70% of the population living below the poverty line, with higher rates in rural areas (World Bank 2014). About one in three Malawian households experience chronic food insecurity and calorie deficiencies (Ecker et al. 2011; FAO 2014). The majority of arable land in Malawi is devoted to maize production, and almost half of the Malawian diet consists of maize, which contributes to high rates of undernutrition, which measured by child stunting (height for age) has remained at about 50% for over two decades (NSO & ORC Macro 2010; Ecker and Qaim 2011; FAO et al. 2014).

The country became a democratic system in 1994, following 30 years of dictatorship under Kamuzu Banda, whose regime had supported a modernization vision of agriculture – subsidized fertilizers, hybrid maize and rural depots for crop sales. Structural adjustment policies were imposed in the 1990s, leading to removal of fertilizer subsidies, decline in agricultural credit availability, closure of rural depots for farm sales, and other a decline iin agricultural extension supports. Hospitals coped with high levels of child malnutrition. A new government in 2005 re-established subsidies for fertilizer and hybrid maize seed, through the Farm Input Subsidy Program (FISP), provided to about 1.5 million households each year(Chirwa and Dorward 2013). This program, which accounts for 70 percent of the total budget of the Ministry of Agriculture, has contributed to an increase in maize production and to a lesser extent income (Chirwa and Dorward 2013; FAO 2014), but food insecurity and undernutrition remain high, with ongoing debates about policy effectiveness (Bezner Kerr 2012; Ecker and Qaim 2012; Malawi Times 2016).

The SFHC Project Background

In 1997, the first and third authors did 55 in-depth interviews with families of children who were severely malnourished and had been admitted to hospital. They learned that farmers had little knowledge of alternatives to fertilizers or alternative crops to rely on, and as a consequence, with depleted soils, and little ability to purchase fertilizer, their maize yields declined, and they had few food options for children. There were often crucial gender dimensions; some men were drinking

heavily, spending the limited family resources on alcohol, and women also feared reprisal if they spoke out, with 44% reporting physical violence from spouses (Bezner Kerr 2005). So while the bigger political economy picture of structural adjustment, imposed by international financial institutions, was a key to understanding their families' dilemmas, addressing gender inequality was also crucial if food sovereignty was to be achieved.

SFHC was initiated as a pilot project in 2000 when a small group of staff and researchers approached 7 villages near the hospital and asked them to consider experimentation with various organic methods to improve food security, soil fertility, and ultimately child nutrition. Using a participatory action research model, a Farmer Research Team (FRT) was formed, initially made up of 18 men and 12 women from the 7 villages, comprising a range of ages, marital status and food security conditions. The FRT learned about different legume options, developed their own on-farm experiments, and taught other farmers who were interested in trying out these options. While initially only 183 farmers tried out different legume options to improve soil fertility, over a few years this number increased to thousands of farmers (Bezner Kerr et al. 2007a). Iterative dialogues, research and reflection with participating farmers allowed for identification of conflicts between different generations, classes and genders over the use of these legumes and the additional labor required for these practices (Bezner Kerr et al. 2005; Bezner Kerr et al. 2007b; Bezner Kerr et al. 2016). We developed discussion groups to address these issues, making efforts to be sensitive to cultural concepts and practices and power imbalances (Bezner Kerr et al. 2008). Over time SFHC and collaborating researchers were able to document improvements in nutrition (Bezner Kerr et al. 2010), reduced reliance on fertilizer (Msachi et al. 2009) as well as other environmental benefits (Snapp et al. 2010).

The emphasis in SFHC was on farmer-to-farmer teaching, farmer experimentation and leadership. As SFHC farmers developed a stronger united vision, they began to articulate an alternative agricultural vision for their communities, which they contrasted to the dominant neoliberal model of agriculture that relied on purchased fertilizers and seeds (Bezner Kerr 2010; Msachi et al. 2009). Farmers helped to build a community seed legume bank, managed all seed collection and distribution and took over more and more of the project management, eventually making up the majority of the project staff and forming a non-profit organization that is farmer led. We began a new phase of our work in 2012, the Malawi Farmer-to-Farmer Agroecology project (or MAFFA), in which we are expanding in northern Malawi and starting work in central Malawi using this 'farmer-to-farmer' approach for our teaching with over 6500 households, in collaboration with several universities (Nyantakyi-Frimpong et al., 2016).

In this article, we will draw from over a decade of participatory research conducted with farmers, to discuss how agroecological approaches intersect, overlap and at times contradict with concerns about resilience and food sovereignty in our work. We will then consider the broader theoretical implications of our findings.

Methods

The overall design is a longitudinal mixed methods case study of a participatory agriculture nutrition project. In-depth interviews, structured surveys, participatory workshops and informal observations were all used (Table 1). The research methods have been described in detail in earlier publications (Bezner Kerr 2005b; Bezner Kerr et al. 2007; Bezner Kerr et al. 2008; Satzinger et al. 2009; Bezner Kerr et al. 2016; Bezner Kerr 2014; Bezner Kerr et al. under review).

Table 1. Research methods, sample size, and topics covered, 2000–2016.

Year	Method	Sample size	Topics covered
2000	In-depth interviews	30 households	Farming practices, food security, nutrition.
2006	In-depth interviews	42 people	Discussion groups, farming practices, gender relations.
2007	In-depth interviews	23 people	Food security, nutrition, farming practices.
2007-12	Structured survey	200 – 303 households	Farming practices, nutrition, food security
2009	In-depth interviews	33 households	Farming practices, gender relations, food security.
2010	In-depth interviews, focus groups	25 people, 6 focus groups with 10-15 people each	Climate change, farming practices, gender and community relations, food security, nutrition.
2011/13	Structured survey	306 and 352	Climate change, farming practices, gender and community relations, food security, nutrition.
2012	In-depth interviews	50 households	Food security, farming practices, gender relations, child care.
2013	In-depth interviews	25 households, 3 focus groups	Climate change, farming practices, gender and community relations, food security, nutrition.

This study uses a Participatory Action Research approach, an engaged research epistemology and methodology, which involves people in dialogue, critical reflection and analysis of their circumstances, followed by methodical, applied research aimed to transform society, address their problems and eliminate oppression (Fals-Borda and Rahman 1991; Chevalier and Buckles 2013). Part of the action research approach is one that relies on 'complexity thinking' – non-linear, contingent and context-specific approaches rather than reductionist models (Rogers et al. 2013). Complexity approaches in action research mean that, in place of 'case studies', researchers and stakeholders are cooperatively working to address a problem, through iterative research processes that foster reflection and shared learning (Rogers et al. 2013).

Complementary Frames

Agroecological Approaches

The work really began with the soil, drawing from farmers' own experiences. Having been encouraged to rely solely on fertilizer by Banda for over 3 decades, some of the indigenous ways to enrich soils, such as intercropping legumes, had declined, while other methods – burning newly cleared forest land – worked better at a time when there was greater availability of forest. Farmers working on the same plot of land for many decades, adding fertilizer to monocropped maize plots, spoke with despair about the quality of their soils and how it was being destroyed by this approach (Bezner Kerr 2010). We introduced double intercrop of legumes (e.g. pigeonpea, peanut and soyabean) and the notion of incorporating legume residue into the soil soon after harvest, already tested in on-farm trials (Snapp et al. 1998) as a simple alternative. Farmers can intercrop edible grain or perennial legumes. The grain legumes provide a food source, but also fix nitrogen from the atmosphere, such that when the leaves and roots are incorporated directly into the soil they add nitrogen, other nutrients and organic matter. Farmers can harvest the edible grain, and then grow another crop in the improved soil the following

year (e.g. maize). Interviews conducted in 2007 and 2009 and again in 2012 farmers emphasized this fundamental shift in thinking about legume residue replacing or reducing fertilizer use – even beginning to refer to legume residue as their fertilizer. As one farmer observed, when asked if anything had changed as a result of their involvement with SFHC:

> I have been for many years farming in a garden which my grandfather was using and the soil was very poor, I was applying fertilizer but still I was having poor harvest and we were running out of food now and again. But since SFHC project started, the issue of burying residue and intercropping and crop rotation has improved the soil in my garden very much. At first I did not know how to bury residue in the garden, but now I have learnt how to do it. (*Male farmer, 48 years old, joined SFHC in 2001. Semi-structured interview 16, May 15, 2009).*

Legumes as a rotation crop had been tested and promoted in Malawi under British colonialism, but the top-down model didn't draw on indigenous knowledge or innovation, instead assuming colonial superiority reinforced through a 'Master Farmer' approach (Kalinga 1993). Non-edible perennial legumes such as *mucuna* or *Gliricidia sp.* have been shown to be quite effective at improving soil fertility, and have been actively promoted by both government and non-governmental organizations at various points in Malawian history, with limited success. Using a participatory action model, we asked farmers to select from a range of different legume options, and to test it themselves. Seeing other farmers, themselves also food insecure, testing different legume options was a key to the rise in interest in trying out this method:

> I knew before about burying crop residue for a long time, the government has been saying for a long time, but I didn't take notice. The encouragement of the FRT [Farmer Research Team] made me decide to try it. With SFHC I heard this and I am grateful. (*Female farmer, 38 years old, joined SFHC in 2007. Semi-structured interview 6, April 23, 2009*).

This approach is both linked to some core ideas in agroecology – drawing on indigenous knowledge and fostering farmer experimentation and innovation (Gliessman 2010; Snapp 2008) but is also intimately connected to food sovereignty. The right to food is at the core of a food sovereignty approach, as cited in the LVC position on food sovereignty:

> 'Food is a basic human right. Everyone must have access to safe, nutritious and culturally appropriate food in sufficient quantity and quality to sustain a healthy life with full human dignity." (LVC Position on Food Sovereignty, cited in Wittman et al. 2010:197).

While non-edible legumes might be more effective at improving soil fertility, they are not feasible for those farmers with limited landholdings – one cannot set aside half of your one acre farm for improving soil fertility for a season, when that is your main source of food and livelihood. Grain legumes, such as pigeonpea, groundnut and soybeans, were the most popular option for farmers to utilize to improve soil fertility (Bezner Kerr et al. 2007a).

Reducing Exploitation

The work, however, didn't remain in the soils. Through participatory action research methods, which encourage reflection and dialogue, we learned about key unequal power dynamics that were making the legumes beneficial for some, but not others (Bezner Kerr 2008). Men, for example, were sometimes taking the legume harvest, selling it, and keeping the money for their own benefit. Women had the added labor of incorporating legume residue into the soil soon after harvest, without realizing the full benefit of this harvest. Early on we began to address these unequal power dynamics at the household level, through dialogue, discussion groups and different participatory educational strategies devised by the Farmer Research Team, such as recipe days (Patel et al. 2015; Bezner Kerr et al. 2016). This approach could be considered part of agroecology, which encourages a holistic approach to the food system, taking into account people's labor and the different uses of plants and animals within that system. Food sovereignty, in turn, emphasizes freedom from oppression as a fundamental tenet:

> "Food sovereignty implies new social relations free of oppression and inequality between men and women, peoples, racial groups, social classes and generations." (La Vía Campesina 2007:1)

Another type of oppression that was reduced by this increased reliance on legumes was that of commodification of rural labor, through the oppressive class forces that reliance on purchased fertilizer created. In order to buy fertilizer, smallholder farmers had to get access to cash, and to do so, the poorer farmers had to either get credit at exorbitant interest rates, or work for other wealthier farmers during the growing season, getting cash or food at the expense of their own farm's productivity (Bezner Kerr 2005b). Social relations in Malawi were fundamentally transformed with the imposition of colonial capitalist system, which imposed the commodification of labor relations in order to generate money for the 'hut tax' (Bezner Kerr 2005a; Bryceson 2006). The rift was widened through the dual system of agriculture exacerbated under Banda, which took the exchange value of smallholder farmers, sold their crops on the international market, and invested the surplus in estate tobacco, creating a new political elite of allies to the Banda regime (Bezner Kerr and Patel 2014; Ellis et al. 2003; Kydd and Christiansen 1982). Growing legumes, and thus rebuilding soil health, reduced or eliminated this need for cash and thus dependency on *ganyu*, a form of informal on-farm work on other people's farms, often highly exploitative (Bezner Kerr 2005b). In interviews many farmers described increased maize yields, greater dietary diversity, and reduced reliance on *ganyu* on other people's farms:

> 'Since joining SFHC, I don't run out of food. For two years now, I don't even buy food, until last month [April, harvest] we had food at our house. In the past, before joining the project, I was having shortage of food always, sometimes food only for 6 months, and we were doing ganyu most of the times to buy food.' *(Semi-structured interview 6, May 5, 2009, Male farmer, 69 years old, joined SFHC in 2002).*

As one woman farmer mused when asked if she found that the extra labor required for applying compost to her soil took her away from other tasks:

> "Yes, it is extra work for us, but it doesn't stop us from doing additional activities, we can always plan ahead. Even planting more crops is extra work, but it doesn't stop us. In the past, we would finish our food in August, and then we would have to do *ganyu* while preparing the fields. We would take turns, some days doing *ganyu*, other days doing land preparation. So now that we are applying compost to our fields, it is not extra work." *Semi-structured interview, female farmer, 26 years, January 18, 2016. Mphati village area.*

This rebuilding of soils can be seen not just as reworking the metabolic rift (Wittman 2009), but as fundamentally *repairing* the metabolic rift (Schneider and McMichael 2010). Farmers' labor in their soils, which helps to re-close the loop of organic material, nutrients and energy within their farms, (a key principle in agroecology), also re-establishes a dependence on natural systems and breaks the dependency on industrial inputs.

Linking to Resilience

But what of resilience? In recent years, SFHC has focused on the implications that climate change holds for smallholder farmers in Malawi, and has supported experimentation with different agroecological practices as a form of climate change adaptation. A longitudinal study in 31 villages by 425 farmers was established to test whether different cropping, livestock, agroforestry and livelihood diversification strategies could improve food security and adaptation to climate change. Farmers were invited to participate based on their level of household food security (ie low), HIV status (if known) and age (to ensure inclusion of youth). Using an agroecological approach, each household selected several strategies to test including some of the following elements: 1) integration of trees (reforestation, use of fruit trees and/or agroforestry); 2) soil fertility and/or conservation strategy; 3) crop diversification, including legume intercrops and 4) livelihood diversification, such as dimba gardens with small-scale irrigation, livestock and bee-keeping.

These efforts have led to significant improvements in household food availability and dietary diversity (Bezner Kerr et al., under review), thereby building food sovereignty. A key approach that farmers

have used is that of diversification – increasing the number of crops and varieties grown on their farmers – which is itself a key principle of agroecology (Kremen and Miles 2012). Specific crops that farmers increased in production included pigeonpea (one of the key legumes in the 'doubled-up' legume intercrop system tested by SFHC) and sorghum. Sorghum is an indigenous grain species which had been grown two generations ago in the region as a 'back-up crop' to maize, but which had declined dramatically due to a combination of government supports for maize, encouragement of monocropping as part of a modernization approach, and gendered labor dynamics, which prioritized maize at the expense of sorghum (Bezner Kerr 2014). SFHC learned of the loss of sorghum from elderly farmers in discussions about historical cropping systems, and began experimenting with it as a more drought-tolerant grain option for farmers as part of an agroecological approach (Bezner Kerr 2014). There was also a significant increase in the total number of crops planted on farm, as well as a highly significant increase in the percentage of fields intercropped (Bezner Kerr et al. under review).

More diverse farming systems – both in terms of number of crops and varieties, and intercropping - have been shown to support a variety of ecological processes, including pollination, soil and water conservation improved water quality, weed suppression,provide protection and shade, and pest control (Hooper et al. 2005; Snapp et al. 2010; Tilman et al. 2001).

In interviews about their agroecological experiments on climate change adapation, farmers consistently named crop diversity as a key approach, describing it as a means of building resilience in the face of inconsistent rainfall patterns, and a decline in the total rainfall amount each year (Bezner Kerr et al. 2016). As one village elder farmer said:

> 'The times are changing and the rains vary and are unpredictable, and it is good to have many crops in case maize fails.*' (Chilida focus group discussion, June 25, 2013)*

Another woman farmer said when asked what she was learning from her agroecological experiments:

> ''In terms of cropping patterns I'm seeing a big change, because in the past I used to grow only maize, but not with this issue of climate change, I will have something even if the rains are poor". *(Semi-structured interview with woman farmer, January 2012).*

Growing more legumes and incorporating the residue into the soil not only reduced dependence on chemical inputs, it also meant that farmers would not be forced to sell their harvest to pay off debts incurred. Having more diversity in their diets also made the maize last longer.

> 'In the past there were problems. We only had maize so we'd run out long before harvest. Or we'd harvest, but we'd have little maize, but you sell some of it. Now we keep some for the children, even the legumes help.' (*Interview January 11, 2016, Male farmer, 37 years old, joined SFHC/MAFFA 3 years ago*)

In addition to building ecological resilience through increased agrobiodiversity, farmers also described increased *social* resilience, through greater cooperation and support, both within households in terms of increased gender equity in the division of labor and decision-making (Bezner Kerr et al. 2016; Patel et al. 2014), and within communities. The participatory approaches, which used dialogue-based, transformational approaches to addressing gender inequality, were a form of feminist deliberative democratic praxis (Bezner Kerr et al. 2016), thus linking to the notion in food sovereignty to democratize the food system (Wittman et al. 2010). In describing changes within households, farmers often wove together the changes in soils, food security, health and social relations, reflecting these mutually reinforcing processes:

> 'Food security in our house has improved greatly. Relationships with our friends has improved as we share food with them. The community has trust with us because they have seen that what we do is beneficial. We now have enough money, we don't borrow money anymore as we sell our crops and we have no problems. My wife through SFHC she has opened her own account, we now have money to pay school fees and uniforms for our children.' *Semi-Structured Interview 26, May 2009, Male farmer, 54 years old, joined SFHC in 2004.*

> The children are healthy because I have enough soya for porridge and groundnuts to mix in the vegetables and even just eating them as a snack. I have good fertile soils because of burying residue in my garden. As a result I have plenty food for my family and then I have again enough for selling. Therefore I always have money in my pocket, at first I was growing maize on the same land with very little harvest. I was running short of food most of the times and we were having problems with different types of illnesses. We were very poor because each time I find money I was thinking of buying food than anything, because of shortage of food. After harvest we were having food only for 3 to 4 months. When the family has no food there is no peace. I am my wife were having conflicts. But now we are happy, there is no reason to have conflicts. Because everyone is healthy there is now development, as no one is busy with illnesses due to poor feeding or harvest. Everybody is happy and has food. *Semi-Structured Interview 18, May 2009, Male farmer, 49 years old, joined SFHC in 2004.*

There were numerous instances of community collaboration around climate change adaptation. After 4 years of climate change experimentation at the household level, over half of the participants reported that their community had taken action about climate change in the past 3 years. There were several different types of collaboration. The livestock was managed at a community level: the participating farmers constructed a village corral for the pigs, contributed feed (e.g. maize stalks), cared for the pigs and even purchased medicine if the pigs became sick. Villages received 2 pigs, and once the pigs reproduced, the offspring were distributed to other participating farmers. As a diverse group, including those who were HIV positive, highly food insecure or a youth, the livestock care fostered cohesion and helped the participating farmers to work as a team. Some villages constructed a community kiln to make fuel-efficient clay stoves, which they had learned about on a farmer exchange. The stoves were initially distributed to fellow villagers, and then participants began to sell the stoves as an income-generating activity. Participating farmers viewed the stove production and use as climate change adaptation because they reduced pressure on local forests (as fuel use) and provided income as a buffer in times of food shortages.

A third type of community organizing was done with finger millet production. As a more drought-tolerant grain, finger millet could strengthen farmers' resilience in times of reduced rainfall, but current growing practices are also quite destructive. Typically, local farmers clear a forested area, burn the cut trees and broadcast the seeds, which has been typical practice for millet for over one hundred years (Bezner Kerr 2014). Several farmers began experimenting with growing finger millet in ridges, instead of clearing forest. In one village, all the participating farmers began to grow millet this way, and produced enough yield that they could sell some, keep some for seed and consumption, and distribute to an additional 40 farmers in 4 neighboring villages. They met with the village leaders and requested that only 'serious' farmers willing to try these new methods be given the seeds, and they also shared other climate change adaptation strategies with the village leaders. They viewed these activities as experiments, testing different strategies to build resilience in the face of climate change and other threats. Thus this approach – of cooperation, experimentation and knowledge sharing, could be viewed as part of the repairing the knowledge rift that Schneider and McMichael (2010:466) argue accompanies the metabolic rift. Farmers are drawing on situated, observational knowledge of agroecosystems, experimenting with new ways of growing crops as they apply agroecological principles, and re-learning indigenous knowledge related to 'lost' crops such as sorghum, in ways that re-build socio-ecological relations. In this way, resilience is fundamentally linked with both agroecological approaches, and food sovereignty, which emphasizes valuing cultural knowledge.

Contradictory Frames

There are contradictory aspects, however, between these three concepts, which became apparent in this long-term work. While using agroecological methods worked to reduce oppression and reliance on commodified inputs, those without land were fundamentally at risk of exploitation from their efforts. Tenants – those who came from southern Malawi where there is less land available both due to higher population levels and greater land inequalities – improved the soils on rented land, only to have it seized by village leaders (Bezner Kerr 2013). Widows in northern Malawi, which has a patrilineal

system of land inheritance, lost access to land when their husbands' relatives seized it (Bezner Kerr 2013). Food sovereignty can be truly achieved using agroecological methods without access to adequate land – contradicting the principle of freedom from oppression. Nor is it adequate to emphasize agroecological and food sovereignty concepts, without taking steps to end deeply entrenched gender inequalities, including access to land and domestic violence (Bezner Kerr et al. 2016).

Similarly, while building on local observation and knowledge of changing rainfall patterns, and having open dialogue with farmers, there was a disjuncture between this respect for indigenous knowledge, and current international scientific consensus on the causes and solutions to global climate change. Many farmers linked the declining total rainfall and greater unpredictability of rainfall patterns to local deforestation, in part caused by tobacco production, alongside overpopulation:

> People have been making a lot of charcoal in their area and a lot of trees have been cut. I think that's why climate has changed. *(Female farmer, 28 years, Qualitative Interview July 29, 2013).*

> We think that because we have carelessly cut down the trees then the result is no rains. Overpopulation leading to bare lands due to wanton cutting down of tress. Strong winds which remove clouds that would bring rains. *[Focus Group Discussion, Maunda Soko Village – July 30, 2013]*.

There was a lot of interest in reforestation in part because of the perception that planting more trees would bring the rains back. As one woman expressed in a focus group:

> Trees too, we are thinking that it is good to come with trees because first of all the trees improve the soil and that helps the soil keep the moisture.
>
> We want to make sure we will plant lots of trees because we have this feeling that the erratic rains are from the deforestation so if we plant lots of trees, we might bring the rains back. *(Woman farmer, focus group discussion in Luhomero, January 2012).*

In valuing and supporting indigenous values and knowledge, alongside agroecological principles, planting trees is being fostered, but in doing so appears to be inadvertently supporting the promise of reversing climate change with these practices, something not possible without broader reductions in greenhouse gas emissions. Dominant narratives which blame local producers and rural poor people for deforestation are also being reinforced, rather than examining the ways in which agricultural expansion, contradictory policies, combined with corrupt governments are accelerating deforestation in Malawi (Zulu 2010).

While participatory research and agroecological approaches focused on building food sovereignty have significantly changed farming practices, changing dominant narrative about farming and climate change is a greater challenge. Over the past 5 years the Government of Malawi has increased their rhetoric about climate change and the need for adaptation. The government's focus, however, has been to address deforestation by rural dwellers, including for charcoal production (which is primarily for urban dwellers). The government also began promoting 'drought-tolerant' crops, mainly different hybrid varieties of maize, as a form of climate change adaptation, thereby encouraging further dependence on purchased inputs. There was little discussion of the other causes of climate change, such as the use of cars, electricity, or expanding agricultural production through deforestation.

In this context, learning about agroecological practices using participatory research methods empowered farmers to experiment with different practices which they saw would increase their resilience. They spoke articulately about the ways in which soil moisture was better retained when organic matter was added, which acted as a buffer during dry spells. They also described the reduced risk from growing a greater diversity of crops. But their most chilling response, a sentiment heard many times in the final year of the project, was that if they planted trees, the rains would come back, since deforestation was the cause of climate change. To be sure, there is some evidence that reforestation could change local and regional hydrological cycles (Moore et al. 2012), but current scientific understanding about the long-term causes of climate change do not support a wholesale change in rainfall patterns without significant global reductions in greenhouse gas emissions.

Knowledge about climate change and farming here was a combination of their own experience, (observed deforestation, increased tobacco production and charcoal making), our scientific intervention (discussion of agroecological approaches, explanations about climate change) and government hegemonic narratives, which blamed the farmers themselves for the dramatic changes in rainfall patterns. This hybrid knowledge, while spurring significant change in farming practice, also reinforced unequal power dynamics in unexpected ways. Smallholder farmers, who in Malawi would be responsible for less than 1% of global greenhouse gas emissions, are blaming themselves and their rural communities for the dramatic changes in rainfall patterns, which they have observed over a generation. This realization amongst the research team has led to new efforts, both to develop effective ways to share current knowledge on climate change, that translates across cultural, gender and income divides, and to discuss more often and openly about broader political economy dynamics which themselves are implicated in climate change. At the time of writing this paper, we have just drafted a new curriculum which integrates agroecology, nutrition, social equity and climate change, written with smallholder farmers, and we will be testing it in the coming years.

Conclusion

Drawing on long-term participatory research in Malawi, in this study the conceptual and empirical links between agroecology, food sovereignty and resilience are discussed. We demonstrate that under climate variability, smallholders who use a diverse range of agroecological farming practices can build food sovereignty and resilience. Some critics have argued that due to the nature of the current capitalist world economy, this farming approach may be unsuitable for smallholders who are using agroecological options not out of choice but of necessity due to limited alternatives (Bernstein 2009). Others suggest that agroecology takes a longer time to yield benefits, and that given projected climate dynamics, farmers in the Global South, who are more vulnerable to climatic changes and have more degraded lands need a much quicker change in food production (e.g. Tomich et al. 2011; Foley et al. 2011; Godfray and Garnett 2014; Mueller et al. 2012). Based upon our empirical evidence, we argue that even for the labour-stressed, poor smallholder households, agroecology can be used to build farmer resilience to climate change, and this farming approach can yield food security, nutritional benefits and more equitable households and communities in the short term, not just the long term, thus contributing to food sovereignty. In doing so, we argue that agrarian communities are repairing the metabolic rift and the related knowledge rift. These efforts are not without contradictions and challenges. These approaches are likely to be inadequate at addressing oppressive class and gender relations for those classes and groups without access to land and overt political efforts to transform these relations. Disjunctures between scientific and indigenous understandings of climate change make it challenging to completely marry agroecology, resilience and food sovereignty. Despite these contradictions, our experience over the last decade and half in working with smallholder farmers in Malawi that utilize approaches from all three concepts gives us hope that potential transformative solutions can arise from this imperfect union.

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