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Mainstreaming Conservation Agriculture in Malawi: knowledge gaps and institutional barriers

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Mainstreaming Conservation Agriculture in Malawi: knowledge gaps and institutional barriers

Conservation agriculture (CA) practices of reduced soil tillage, permanent organic soil coverage and intercropping / crop rotation, are being advocated globally, based on perceived benefits for crop yields, soil carbon storage, weed suppression, reduced soil erosion and improved soil water retention. However, some have questioned their efficacy due to uncertainty around the performance and trade-offs associated with CA practices, and their compatibility with the diverse livelihood strategies and varied agro-ecological conditions across African smallholder systems. This paper assesses the role of key institutions in Malawi in shaping pathways towards more sustainable land management based on CA by outlining their impact on national policy-making and the design and implementation of agricultural development projects. It draws on interviews at national, district and project levels and a multi-stakeholder workshop that mapped the institutional landscape of decision-making for agricultural land management practices. Findings identify knowledge gaps and institutional barriers that influence land management decision-making and constrain CA uptake. We use our findings to set out an integrated roadmap of research needs and policy options aimed at supporting CA as a route to enhanced sustainable land management in Malawi. Findings offer lessons that can inform design, planning and implementation of CA projects, and identify the multi-level institutional support structures required for mainstreaming sustainable land management in sub-Saharan Africa.

Keywords: Climate-smart agriculture; policy; political agronomy; institutions; climate change; southern Africa.

1. Introduction

Global challenges surrounding food insecurity, poverty alleviation and climate change require uptake of sustainable land management (SLM) practices that can provide multiple benefits including improved productivity, maintenance of ecosystem integrity and ecosystem services. As one set of SLM practices, Conservation Agriculture (CA) incorporates minimum tillage, permanent organic soil coverage and crop rotation / intercropping, and is widely advocated by international agricultural development organisations (e.g. FAO, 2011; CGIAR, 2013). Persuasive 'multiple-wins' messages and success stories from across a range of agricultural settings (e.g. Pretty *et al*., 2011; Rusinamhodzi *et al*., 2011; Nyasimi *et al*., 2014) have helped CA become a dominant narrative in global and regional agricultural planning. This has led to CA receiving support in national agriculture and rural development policy and projects (e.g. Arslan *et al*., 2014; Whitfield *et al*., 2015), and to become a focus for private and third sector interventions (Godfray *et al*., 2010; Lipper *et al*., 2014; Pretty and Brahuchra, 2014; Wall *et al*., 2014). Despite enthusiasm for CA across levels, uncertainty around performance and trade-offs associated with CA practice and its compatibility with diverse livelihood strategies and varied agro-ecological conditions have caused some to question its universal efficacy (e.g. Giller *et al*., 2009, 2015; Andersson and Giller, 2012; Powlson *et al*., 2014; Rosenstock *et al*., 2014; Pittelkow *et al*., 2015). This has led to greater recognition of the need for context-specific guidance on CA as part of an integrated suite of agricultural land management practices (Thierfelder *et al*., 2016).

CA has gained increasing stakeholder interest and government commitment in sub-Saharan Africa (SSA). In this paper, we focus on CA in Malawi as a national case study of particular interest due to its vulnerability to climate change (Davis, 2011; Abson *et al*., 2012) and its policy efforts to ensure that agriculture, particularly maize production, is at the forefront of national economic development (Harrigan, 2003; Chirwa and Dorward, 2013). As with many SSA countries, Malawi faces significant food insecurity and high levels of poverty, challenges which are exacerbated by population growth and climate change. The latter is leading to greater rainfall variability (Tadross *et al*., 2009), notably prolonged dry spells within the maize growing season (Simelton *et al*., 2013; Sutcliffe *et al*., 2016). CA has been widely advocated by government, Non-Governmental Organisations (NGOs) and development partners as a vital innovation for smallholder farmers to enhance maize yields and help crops withstand dry spells (Ngwira *et al*., 2014). However, despite government support, uptake of CA practice remains low at <2% of Malawian smallholder farmers (Phiri *et al*., 2012).

Discrete choice experiments studying farmers' practices and willingness to adopt CA demonstrate that many farmers are not amenable to adoption without receiving subsidies (Ward *et al*., 2015). This may be linked to the impacts of the Malawi Agricultural Input Subsidy Programme on farmer expectations and decision-making (Dorward and Chirwa, 2011). Past interventions initiated by international organisation, the private sector, NGOs and government have given way to mixed messages about the performance and optimal configuration of CA practice across different agro-ecological zones and in multi-faceted agricultural development projects. For example, analysis of Concern Worldwide agricultural projects shows that a lack of clarity in the main messages regarding CA practices and their benefits led to confusion and disillusionment among farmers (Uluko and Chimungu, 2015), with some abandoning CA practices. Similar issues of CA abandonment are noted across southern Africa (Baudron *et al*., 2011; Andersson and D'Souza, 2014).

The institutional environment within which agricultural innovations are developed and promoted is the subject of enquiry for the emergent academic field of political agronomy (Sumberg and Thompson, 2012). Findings from political agronomy studies emphasise the importance of critical reflection on incomplete knowledge and an opening up of informational and institutional spaces to develop and apply participatory processes of knowledge exchange and governance (Whitfield, 2015). Agricultural development and land management decision-making remain multi-level and inherently political processes. Effective innovation requires: (1) transparent reflection on, and collective approaches to addressing, knowledge gaps; (2) negotiated knowledge of 'what works, for whom, and in what circumstances' as a basis for action (Pawson, 2002); and (3) consistent, supportive and enabling institutions, policies and actions across levels (from field level activity to international strategies) (Kilelu *et al*., 2011). In Malawi, it has been hypothesised that multi-level institutional inefficiencies, policy conflicts and gaps, together with incomplete knowledge, limit the effectiveness of the CA agenda (Andersson and D'Souza, 2014). This study advances the use of political agronomy analyses across multiple governance levels to identify actions required to enable more integrated CA planning.

By combining institutional mapping and interview-based project and policy case study research, this paper aims to identify knowledge gaps and institutional barriers that constrain the CA agenda in Malawi. We specifically assess the role of key organisations, including the National Conservation Agriculture Task Force (NCATF) and Climate-Smart Agriculture Alliance (CSAA), in shaping the institutional environment and the ways in which knowledge (and knowledge gaps) are translated across it. The paper achieves this through multi-level analysis by:

i.) Mapping the institutional environment of government, donor and NGO sector CA organisations in Malawi and the (dis)connections between them;
ii.) Analysing the planning processes for existing CA initiatives within selected districts and key donor-supported programmes; and
iii.) Identifying knowledge gaps and challenges from the perspectives of multiple stakeholders across the Malawian CA community.

The implications are discussed with a view to developing collaborative research programmes and identifying the institutional changes required to support shifts towards greater CA uptake as part of strategies for SLM across sub-Saharan Africa.

2. Material and Methods

We followed an iterative qualitative research process between March 2014 and June 2015. Interviews were held before and after a national multi-stakeholder workshop, with the aim of framing the workshop and aiding interpretation of the findings. Interviews also enabled assessment of changes in the institutional landscape over this 15 month period.

The multi-stakeholder workshop was held in May 2014 in Lilongwe. Twenty-eight participants attended, representing 18 organisations (Table 1), including representatives of government ministries, UN FAO, CGIAR institutions, universities, NGOs and the National Smallholder Farmer Association of Malawi (NASFAM). Invitations were sent to 40 stakeholders identified following an analysis of national policy and CA practice documents, and to all the individuals / organisations listed in the NCATF Database.

Table 1. CA Stakeholder Organisations that attended our National multi-stakeholder CA Workshop, Lilongwe, May 2014.

Organisation	Type of Organsiation	Level of social organisation
African Institute of Corporate Citizenship	NGO	International & National
Care-Malawi	NGO	National & District
Catholic Relief Services	NGO	International, National & District
Concern Universal	NGO	International, National & District
Concern Worldwide	NGO	International, National & District
Department of Agricultural Research Services	Government institution	National
Department of Land Resources and Conservation	Government institution	National (& Chair of NCATF)
FAO Malawi	International / multilateral organisation	International
Forestry Research Institute of Malawi	Government institution	National
Kusamala Agriculture and Ecology Research Institute	NGO	District & Community
Lake Chilwa Basin Climate Change Adaptation Programme	Research	National & District
Lilongwe Agriculture Development Division	Government institution	District
Lilongwe University of Agriculture and Natural Resources	Research	National
Malawi Oilseeds Sector Transformation Project	Private sector	National
Ministry of Agriculture (Animal and Livestock Production)	Government institution	National
National Smallholder Farmers' Association of Malawi	Farmers' Group	National, District & Community
Total Land Care	NGO	National & District
World Agroforestry Centre	International / multilateral organisation	International

The workshop built on the analysis of national policy and CA project documents (listed in Supplementary Material) undertaken using a content analysis approach (Mayring, 2000). This enabled institutional mapping of the activities and organisational partnerships across the actors in the CA landscape in Malawi. Information within the documents was extracted, coded and organised chronologically to construct a history of CA development, through which institutional and policy change was traced. This informed workshop activities and allowed the identification, categorisation and analysis of relationships between organisations. The first workshop session involved creating institutional maps (Aligica, 2006) that positioned organisations on a matrix which graphically

represented the national CA institutional landscape, based on their perceived organisational role in relation to 'research or action' (x axis) and their level of activity from 'local to international' (y axis). This was followed by a group exercise to draw lines between organisations to represent existing partnerships, including links to those not at the workshop. The final workshop activity identified CA implementation challenges and barriers with a view to translating challenges into knowledge gaps and researchable questions through a researcher-facilitated causal chain exercise (Krueger and Casey, 2009) undertaken in 4 groups of 6 -8 participants. This exercise was based on a series of participatory questions ('*why*?', '*where*?', '*when*?' and '*for whom*?') until the questioning reached points at which answers were unknown, disputed or lacked evidence to back up respondents views. These points were identified as priority knowledge gaps and used to collaboratively develop research project concept notes. The workshop activities created a picture of the connections (and disconnections) between: (1) various organisations within the CA landscape in Malawi; (2) CA knowledge (and knowledge gaps) and CA advocacy and practical land management guidance across Malawi; and (3) the multiple levels at which CA initiatives are taking place.

The contextual nature of history and politics behind connections and disconnections was followed up through a series of 45 semi-structured interviews undertaken throughout the year succeeding the workshop. Interviewees included 22 of the workshop participants and at least one participant from each of the 18 organisations that had been present. The 45 interviewees comprised project level NGO staff (n=7), private-sector actors (n=3), research institution staff (n=8), district level officials (n=16) and national and regional level policy-makers (n=11). They were identified using a snowball sampling strategy. The district-level focus of follow-on interviews is important given national commitments to decentralisation (under the Decentralisation Policy 1998). Associated funding is directed to districts through the Local Development Fund (Government of Malawi, 2011) for sectors involved in natural resources management (agriculture, water, land, environment and climate change) alongside national pushes for community empowerment in natural resource management initiatives (Zulu, 2012). The period of interviews represented a time of significant change in national level institutional support for CA. During this time, the national CSAA was initiated (matching the shift in emphasis in climate and agriculture development debates and donor programmes) and the joint meeting of *3rd Biennial CA symposium and 1st Climate Smart Agriculture Forum* was held in May 2015, with 116 delegates.

Semi-structured interviews elicited respondents' views on district level support available for CA project implementation and links to agricultural extension advice at village / farm level. The national workshop highlighted this as a key area in need of consideration. Interviews at the district level included discussions with the District Commissioner and various District Executive Committee staff for 8 districts: Nkhata Bay, Ntcheu, Zomba, Kasungu, Dedza, Nsanje, Lilongwe and Dowa. These districts were highlighted by members of the National Climate Change Technical Committee as priority areas for climate adaptation interventions. They are also areas where donors are actively supporting CA projects. In addition to the semi-structured interviews, we held focus groups with officials in three districts (Nkhata Bay, Ntcheu, Zomba chosen as representative of north, central and southern regions respectively) to discuss priority interventions for reducing vulnerability to climate change in the agricultural, water and forestry sectors. These cross-sectoral focus groups enabled assessment of the extent to which CA is advocated as a district level strategy to enhance farmers' adaptive capacity for dealing with changing climatic conditions.

National assessments of CA organisations identified 5 major cross-district projects that are leading on the push for greater CA uptake (Whitfield *et al*., 2014). Of these, two were chosen for further investigation of their project-level planning based on their scale of activity (the donor-funded Enhancing Community Resilience Programme (ECRP)) and on their significance among national CA organisations (Total Land Care (TLC)). The ECRP projects offers an opportunity to study a national-scale programme (CEPA, 2015) and to assess the positioning of CA as one of a suite of project interventions that cut across agriculture, forestry and energy sectors. We undertook semi-structured interviews with ECRP project managers (n=6 of the 45 interviews) in three study districts (Kasungu, Dedza and Nsanje) as part of a wider programme of research investigating ECRP project design and implementation (Wood *et al*., 2016). Total Land Care, as a major Malawi-based land management NGO, has been encouraging CA since their establishment in 1999 (Bunderson *et al*., 2002) and has taken a leading role on the NCATF. Our TLC project level research involved semi-structured interviews (n=4 of the 45 interviews) with project staff in Lilongwe and Dowa.

3. Results

Findings are presented for each research objective prior to an integrated discussion highlighting the multi-level CA governance linkages in Malawi and their broader significance to analyses of SSA farming systems.

i. The Institutional Environment of Conservation Agriculture in Malawi

In some parts of southern Africa, CA has been promoted as a low-input agricultural system (Haggblade and Tembo, 2003). However, content analysis of policy and project documents shows that in Malawi, CA guidance has been aligned to initiatives aimed at increasing yields by using inputs such as fertilisers and hybrid maize seeds supported through the Government Agricultural Input Subsidy Programme (Dorward and Chirwa 2011). A similar alignment of CA inclusion in agricultural development projects (i.e. encouraged with enhanced agricultural inputs) is seen across donor-supported schemes. These follow from the emphasis of the first explicit CA initiative, introduced by the NGO Sasakawa Global 2000, in 1998. The Global 2000 project incentivised adoption of minimum tillage amongst resource poor smallholders by providing input packages including fertilisers and hybrid maize seeds to farmers who agreed to shift to CA. This is a model of CA advocacy that has since been replicated across Malawi and has cumulatively acted to sustain a high-input form of CA, a practice that regional meta-analyses suggest are an appropriate route to enhancing maize yields in low rainfall areas (Rusinamhodzi *et al*., 2011). This alignment can explain the reticence of farmers to shift to, or stick with, CA practices, when subsidies for agricultural inputs are not available (Ward *et al*., 2015); or when they are faced with additional labour requirements for the basin planting systems advocated in no till systems (Bunderson *et al*., 2002; Thierfelder *et al*., 2016).

Project-level extension staff and Lead Farmer training programmes established through the Sasakawa Global 2000 Initiative were designed to fill gaps in budget-constrained state extension services and have become mainstreamed in CA projects nationally. This addresses continent-wide weaknesses identified in the ability of extension services to provide climate advice (Christopolos, 2012) and encourages multi-level, multi-stakeholder partnerships which have been shown to be vital to the

success of climate compatible development initiatives more widely (Dyer *et al*., 2013; Mathur *et al*., 2014).

CA advocacy in Malawi has been largely driven through NGOs, such as Sasakawa Global 2000, Total Land Care, Care Malawi, Concern Worldwide, World Vision International and Concern Universal, all of which remain active across Malawi. This has led to internationally-funded CA projects that have operated in the absence of nationally-developed strategies or technical CA guidelines. Consequently, there has been confusion over what exactly CA is, and what it constitutes in a Malawian context. This confusion contributed to the need for national CA guidelines that were formally agreed through the NCATF in 2013 (Ligowe *et al*., 2013).

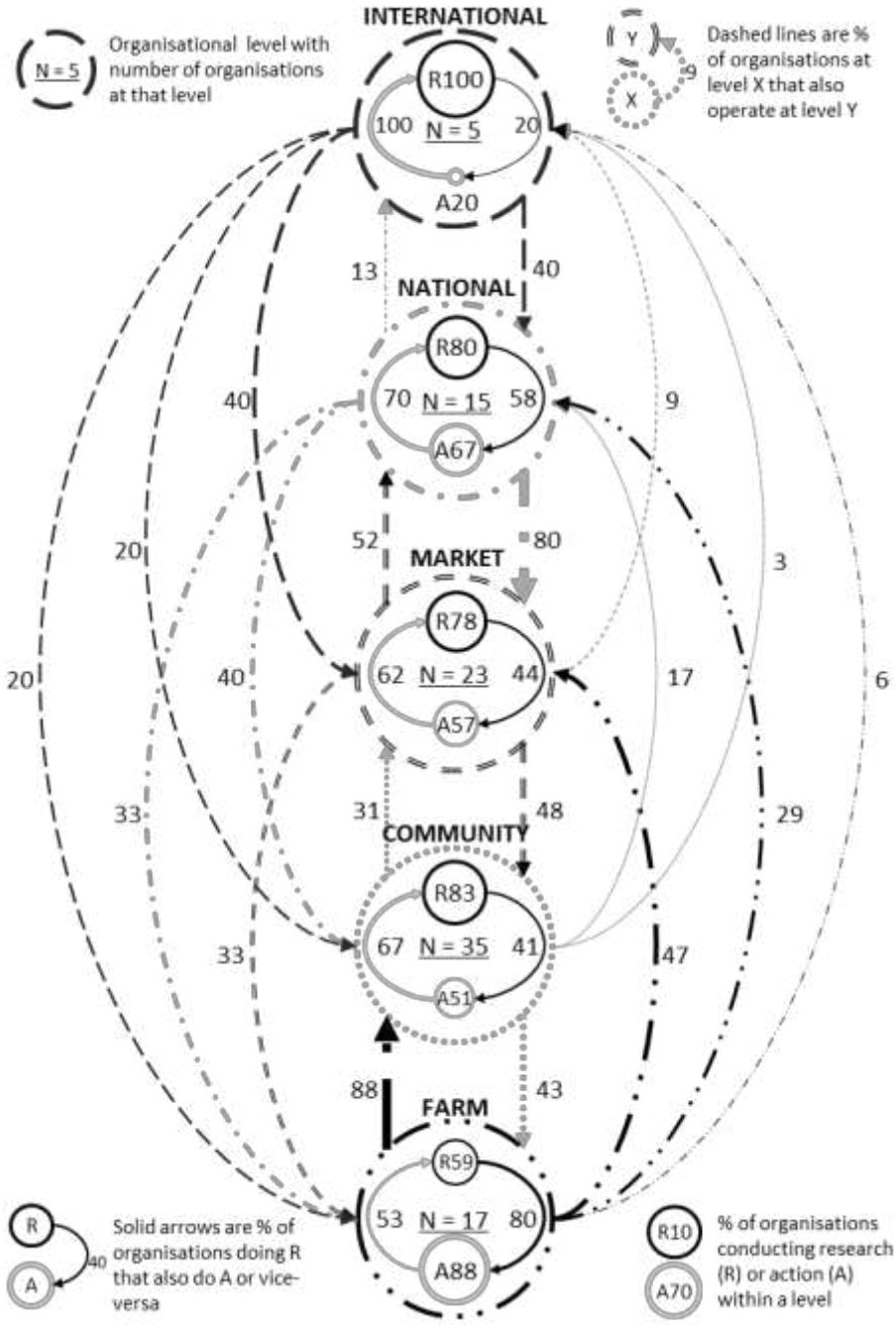
The NCATF was established in 2002 and re-launched in 2007 after a number of unproductive years following the 2002 and 2005 famines that led to a focus on drought-tolerant maize cultivars and improved national storage systems. Impetus for the re-launch was provided by the establishment of the Conservation Agriculture Regional Working Group (CARWG) for southern African states in 2007, which called for the development of national CA coordinating bodies and enhanced support from the UN Food and Agriculture Organization (FAO). The Malawi NCATF is currently chaired by the Farmers' Union of Malawi, with the secretariat located within the Ministry of Agriculture, Irrigation and Water Development's (MoAIWD), Department for Land Resources and Conservation (DLRC). The mandate of the NCATF is to play a supporting and coordinating role for CA organisations and activities across Malawi. It works to discuss alignment of national agricultural policy with the priorities and strategies of these organisations and to provide guidance to agricultural development district staff, including extension workers who are tasked with providing land management advice that is locally appropriate and can address climate change adaptation needs. The NCATF aims to ensure there is a national CA investment framework and to provide consistency in the definition, practice and promotion of CA. This framework is being developed on the basis of an existing document produced by TLC. However, a consultancy call (in November 2015) from the Government DLRC recognised the continued need for an "*in-depth inventory of messages and practices advocated by different partners who are promoting CA in Malawi*". Through funding from Irish Aid and UN FAO, NCATF activity has included a national baseline survey of CA adoption and practice (Mloza-Banda and Nanthambwe, 2010) and the establishment of CA demonstration plots. However, consistent messages or links to context-specific advice for different agro-ecological zones remain lacking, despite 14 years of NCATF activities.

National agricultural research stations began CA trials in the 1990s and have grown in scope and scale from an initial focus on testing the productivity impacts of land management strategies. They operate in partnership with NGOs and CGIAR institutions. These efforts have improved understandings of the agro-ecological zone-specific performance of, and thresholds in, CA practices (Wall and Thierfelder, 2009; Mashingaidze *et al*. 2012). Efforts to undertake these trials within farm sites, such as those in Ntcheu (Mloza-Banda and Nanthambwe, 2010), are starting to generate much-needed data on farmers' experiences and improving understanding about agricultural inputs and labour associated with CA (Ito *et al*., 2007; Ngwira *et al*., 2012, 2013).

The institutional analysis conducted within the national multi-stakeholder workshop highlighted the diverse range of remits held by different organisations across the national CA landscape. The institutional mapping exercise demonstrated that organisations were viewed as being variously positioned both in terms of their scale of activity and their position on the continuum between

research into, and active promotion of, CA (Figure 1). ICRAF, in the case of the Evergreen Agriculture for Sustainable Food Production project, and Washington State University, in the case of the Kulera Biodiversity Project, provide input from (and links to) regional academic research initiatives. However, there is a greater emphasis on supporting actions aimed at changing farmers' land management practices with only a few links to formalising ongoing research, which was typically viewed as "*monitoring and evaluation of interventions*" in cases where organisations stated a dual research/action classification.

Figure 1. Level of activity of the 18 organisations represented at Malawi CA National Workshop (May 2014) and their active relationships.



Numbers are % of the total number of organisations (N) at each level. Solid circles are scaled to the % of organisations conducting research or action the solid arrows linking these show the % that do both. Dotted circles represent an organisational level and the dotted arrows linking levels show the % of organisations at one level that also operate at the level linked by the arrow.

Network analyses were extended by asking workshop attendees to draw lines between organisations to display active collaborations. This exercise showed the central co-ordination role provided by the NCATF, with many expressing a desire for greater communications through the NCATF. Group discussions and subsequent semi-structured interviews both stressed the need for a clearer remit and the need to address capacity limitations of the NCATF, in terms of their ability to facilitate partnership working and to resolve disputes or disagreements. For example, an interviewee from an UN agency highlighted that: "*disagreements across the group (NCATF) are a cause of the lack of harmonised national CA guidelines*". Similarly, a senior government official noted that "*sectoral representatives are acting for their individual departments rather than being able to identify important cross-cutting areas for useful discussion*".

Good examples of evolving multi-stakeholder partnerships were identified and formed the basis for group discussions around new connections that could ensure closer collaborations. For example, the formal involvement of NASFAM and MoAIWD in the Evergreen Agriculture Project was highlighted as an example where both local farmer group leaders and government extension staff were able to successfully reinforce messages as a route to enhanced CA uptake. Similarly, the Concern Worldwide Conservation Agriculture Programme has worked collaboratively with private-sector partners from the Auction Holdings Limited Commodities Exchange who have provided important links to markets that created enabling conditions for successful project implementation. Group discussions also identified limits to the multi-level nature of existing projects and partnerships. This included the lack of direct private-sector inputs despite the national coverage and importance of companies responsible for seed supply and agricultural product supply. Typically, it was viewed that most collaborative partnership activity currently only takes place at the community or farm level, with few inputs from researchers and with little impact on action at the level of markets, institutions and national policy. Many project staff detailed a lack of any partnership with research organisations that they felt led them to rely predominantly on small-scale internal project evaluations as an evidence base for action and future project planning. An NGO representative noted "*the need for research is paramount to help us to understand how CA can help with rural women's empowerment and to identify barriers in ensuring positive uptake".*

During 2015, with funding from the African Union's New Partnership for African Development (NEPAD) initiative and NGO support from World Vision International, the DLRC commenced extension of the work and remit of the NCATF through establishment of a national Climate-Smart Agriculture Alliance (CSAA). This parallels international efforts to ensure that land and agricultural matters are framed in debates and policies around climate change (e.g. UNCCD, 2015) and the recognition that CA has been endorsed as Climate Smart Agriculture contributing to both climate change adaptation and mitigation (e.g. Pretty and Bharucha, 2014; Knaepen *et al*., 2015). However, our interviews highlight that at the national level, the changes remain poorly explained and are causing uncertainty in relation to forward-planning of CA initiatives. This coincided with a time when the debate to create a national CA investment framework was beginning to develop a mutual understanding of the concept. For example, a senior official in an international body stated that the "*lack of meetings in first half of 2015 means that it seems that the NCATF / CSAA is as good as dead*". Others stressed a lack of significant changes in the framing of CA debates and national CA guidelines despite consultations across organisations. Interviewees also stated that the CSAA (as with NCATF) was dominated by a small number of powerful individuals from organisations who have been influential through the last 20 years of CA discussions.

They highlighted a lack of flexibility in amending CA guidelines to incorporate local insights, or different social / environmental contexts, which has been shown as essential for successful project design and implementation in community-based natural resource management initiatives across southern Africa (Dyer *et al*., 2014).

Donor support to the NCATF provided by the FAO, and links to major USAID projects, also ceased during the time of this study (2014-15). As a result, co-ordination and advocacy lost momentum at the national level. Many of the CA relevant meetings at this time saw discussions focus on legal and logistical debates around a shift to establishing the CSAA and to exploring the potential of gaining charitable trust status to help provide financial support. Consequently, the project and policy planning input required from farmer bodies (such as NASFAM) has not advanced in the manner outlined as essential during workshop discussions and as advocated in international CA declarations (ICAAP-Africa, 2014).

Forward plans for the CSAA stress an important cross-ministerial role for the National Council of Environment and the Environmental Affairs Department (EAD) to facilitate the linkages required between different sectoral ministries and to external bodies. However, a recent Parliamentary Natural Resources Committee report has highlighted difficulties in such cross-ministerial and multi-level interventions, stating that "*although it (EAD) is charged with the responsibility of providing cross-sectoral coordination, monitoring, overseeing compliance, and facilitating integration of environmental concerns, in all development programmes, the enforcement aspect of these responsibilities is compromised by virtue of it being a government department*" (Parliament of Malawi, 2015; p.9). The report goes on to highlight the "*compromised statutory mandates*" (p.9) that exist within the EAD. Similarly, re-constitution, capacity development and empowerment of the NCATF and its alignment to a national CSAA will be necessary steps towards facilitating more integrated climate-resilient land management practices.

ii. Planning processes for CA initiatives within districts and donor-supported programmes

District-level findings from all eight study districts confirm that CA is an important component of District Development Plans across Malawi and is not just focused in the most drought-prone districts in the south. For example, focus group meetings held in three districts (Nkhata Bay (north), Ntcheu (central) and Zomba (south)) all highlighted that significant capacity and institutional support is available for climate adaptation planning, both from District Commissioners and from District Agricultural Development Officers, District Environment Officers, District Water Officers and District Forestry Officers. As well as an awareness of climate risk to ongoing planning activities, many of the priority interventions to reduce vulnerability to climate change were CA related (Table 2). The importance of training and awareness-raising to plan for, and implement, such interventions underlines a role for a national coordinating body. The fragmentation of CA approaches, driven by donor-supported projects without national government co-ordination and engagement of research institutions, has impeded effective CA implementation outside of project sites.

Table 2. Main findings of district focus groups to assess priority interventions to reduce vulnerability to climate change in Nkhata Bay, Ntcheu and Zomba Districts, Malawi.

a. Nkhata Bay
• New crop varieties and farming technologies
• Tree/fruit farming
• Formulation and management of small commercial farmers groups, including in effective record-keeping and establishing/managing a system for group finances
• Maintenance of vetiver, bananas and trees to be planted in irrigation and fish farming schemes

b. Ntcheu
• Conservation agriculture practices
• Nursery raising and planting and management of water-retaining trees
• Management of buffer zones along river banks
• Early maturing crop varieties and associated cultivation practices
• Construction and management of fish ponds
• Soil and water management techniques and practices

c. Zomba
• Soil and water conservation practices
• Irrigation water management
• Fisheries pond construction and management
• Construction and use of smoking kilns
• Sustainable forest management principles and land resource conservation

In terms of district to project-level linkages, our studies of ECRP projects in Kasungu, Dedza and Nsanje show that balancing of project priorities at the design phase has typically failed to reconcile different stakeholder priorities. There were particularly limited opportunities for local people to be actively involved (Wood *et al*., 2016). This finding was corroborated by interviews with district staff and project managers who outlined problems in communicating and integrating between levels: "*the chain of command is really too long*" (District officer, Lilongwe); "*transmitting information takes a long time*" (NGO project staff) and "*trickle down of information to the field-level can be difficult*" (NGO project staff). Given that CA is only one of multiple interventions within ECRP projects, complexity is evident due to the multiple messages that project staff have to deliver and the focus of farmers on the initiatives that produce more immediate, short-term benefits, such as irrigation systems and village loan and saving schemes.

Our analysis of TLC-managed CA projects in Lilongwe and Dowa Districts identified similar communication problems between district staff, extension workers operating across Extension Planning Areas (EPAs) and the traditional leadership systems that guide land tenure and natural resource management decision-making. Tensions between project staff and district officers are particularly apparent in relation to the need to ensure sustained uptake of CA approaches. One district officer stated that "*what is happening is that an NGO comes in without involving us in any of its activities, but when the NGO goes, they want us to continue their work with the farmers*" (District officer, Dowa). These findings stress the need for greater clarity in the explanation of national CA guidelines and their use to develop locally-appropriate practices. This will require a clear institutional

framework that allows two-way communications between extension workers and farmers and with National Government and district officials. It is noteworthy that CA training sessions were held in late 2015 for district and EPA extension staff. In our semi-structured interviews that followed this training, respondents noted that two-way discussions of national guidelines would help to prioritise actions at district level and their explanation to community leaders and lead farmers. One EPA-based extension worker stated that "*my view is that most of the times the farmer and our views are not considered; it is more top-down the way things are done*" (District Official, Lilongwe).

The institutional and communications environment that comprise the national CA landscape shows the input of various actors at different levels contributing to a broader agenda, for which there is an impetus within national policy documents and coordination efforts through the NCATF. However, questions remain about the connectedness of efforts within and beyond the NCATF remit and under the MoAIWD and devolved District Development Plans, and the extent to which a growing research endeavour is informing project activity and national policy.

iii. Research priorities and institutional support for sustainable land management

The role of a national coordinating body acting as the knowledge-broker and facilitator across state and non-state actors is vital to supporting shifts in land management required to address climate change challenges. However, national workshop participants stressed the need for more regular and active engagement / participation with the NCATF. It was highlighted that the coordination of good practices should not be limited to a small subset of the community, or to sharing only through annual or bi-annual meetings. Part of the issue here has been the strong links to certain non-state actors with concerns aired that not all NGOs have equal access to discussions, or to opportunities to influence the CA guidelines being developed and used by government departments. The weak connections to farmers' groups such as NASFAM and to the Farmers' Union were highlighted where connections to improved representation of farmer needs and communication systems could be strengthened across all levels.

Some developments through the study period show positive advances, notably through outreach to the 116 delegates present at the 3rd Biennial Conservation Agriculture Symposium. However, over half of our 45 interview respondents continued to report uncertainty around national efforts to enhance uptake of CA by smallholder farmers. The current lack of NCATF membership for community-based organisations, such as farmer groups and NASFAM, indicates the need to enhance local-level inputs from land managers directly into national coordinating structures. Coordination and facilitation capacity were identified as underlying constraints that conditioned the challenges experienced (Table 3). Indeed, the shift in emphasis towards broader discussion around CSA was deemed by many as complicating the message of CA and its link to increased yields. For example, project staff working on ECRP in Kasungu stated that "*the message of CA needs to be one of increased maize yield, not one of climate change, as farmers are confused by talk of carbon and coping strategies*".

The knowledge gaps that emerged relate to different levels of operation and governance (Table 3) and highlight the need for research input from different disciplines. Field level knowledge gaps correspond largely to agronomy, hydrology or plant and soil science, whereas those at the scales of communities, markets and institutions are socio-economic. At the national and international level, research gaps are

largely political. Future research needs to be multi-level and use integrated trans-disciplinary research approaches to inform practitioners and policy-makers to better support CA through multi-stakeholder partnerships. In this way, CA uptake could be enhanced using advances in collaborative working through new research-action partnerships.

Table 3. Challenges and associated knowledge gaps on CA in Malawi (X = priority gap in research information) as identified in multi-stakeholder national workshop with indication of the level at which associated collaborative research is required.

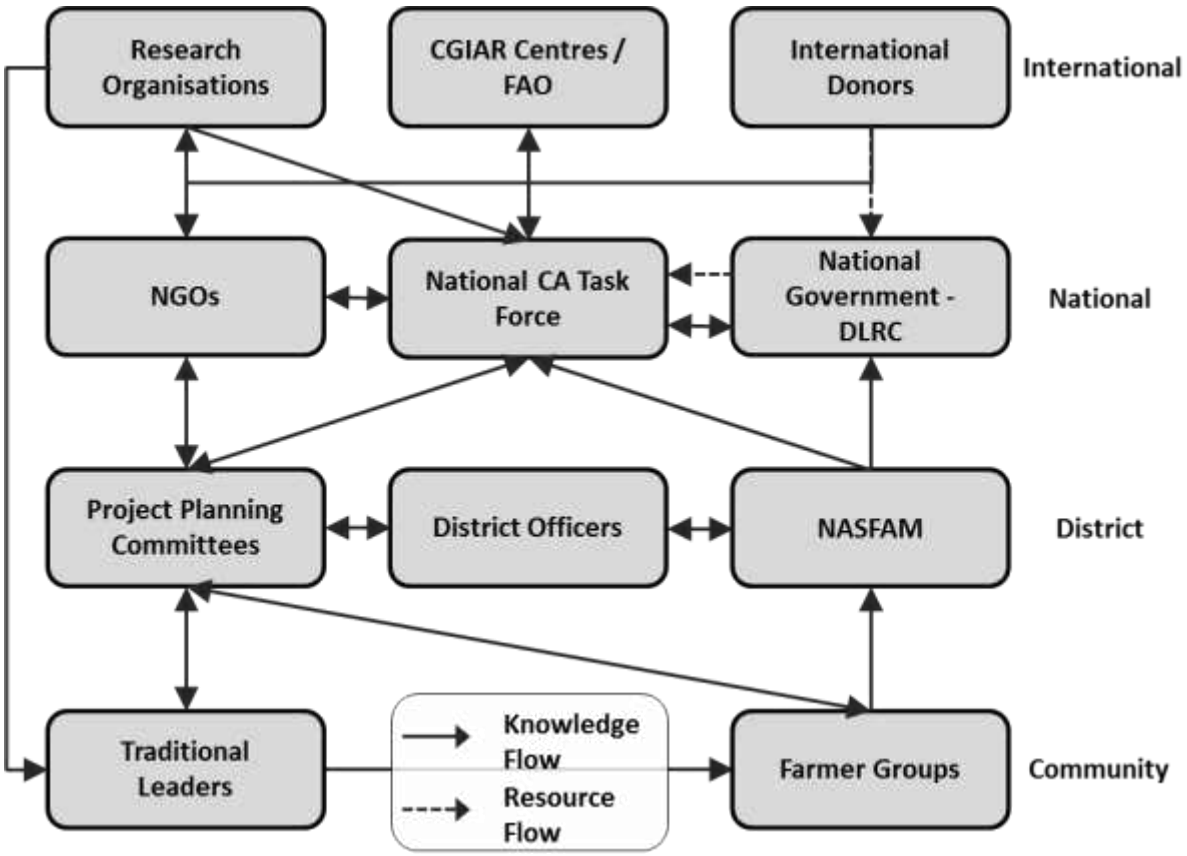
Identified challenge for action	National (policy)	Organisational Level		Agronomic (fields, crops, water, weather)
		Institutions and Markets	Farming System (farm, community)	
Agronomic performance of CA across Malawian agro-ecosystems			X	X
Effectiveness of cover crops as an alternative to mulch			X	X
Temporal trade-offs in CA productivity			X	X
Effectiveness of communication systems		X	X	
Context specific needs, priorities and constraints of farmers			X	
Project dynamics and optimal duration periods		X	X	
Value or added benefit assessment of having a national strategy	X	X		
National target prioritisation and agreed measures (including definitions of adoption)	X	X	X	
Best ways to coordinate action across CA projects	X	X		
Understanding what creates perceptions and norms and how to influence them			X	
Best ways to demonstrate and disseminate CA practice	X	X	X	

4. Discussion – A Roadmap for collaborative CA projects and institutional coordination

Findings from our multi-level, multi-stakeholder study add new insights and evidence supporting the main messages of an assessment by Mloza-Banda and Nanthambwe (2010; p.5), which highlighted the need to '*foster cooperation and dialogue between scientists, suppliers, farmers, government, and educational institutes*' to address the inefficiencies and constraints of the existing CA organisational landscape in Malawi. We have expanded this by setting out a roadmap of new research and

institutional support arrangements to address capacity and knowledge gaps at, and across, multiple governance levels and by providing a collaborative structure to facilitate this (Figure 2).

Figure 2. New forms of multi-level, multi-stakeholder collaborations proposed for CA organisations in Malawi capable of supporting transitions to more context-specific CA guidance.



One key element in design and implementation of CA projects is integrated research and action across levels to target the constraints identified by practitioners. Such new forms of collaborative research will address knowledge gaps that underpin CA uptake and implementation constraints and inform coordinated extension advice. The research agenda outlined in Table 3 represents a stakeholder-led, solution-focused set of priorities. The institutional mapping of CA organisations suggests that the capacities for individual organisations to perform the multifaceted actions to address these knowledge gaps is currently limited. Partnership and coordination across CA organisations will be invaluable. This represents an important mandate for coordinating bodies such as the NCATF and CSAA, acting as brokers of innovation across research and action communities and stakeholders at different levels.

Greater multi-stakeholder partnership working would allow the integration of practical advice (and actions) with research and ensure that local context and knowledge systems are more comprehensively utilised. Partnership development needs to draw on the strengths of different organisations and to recognise the vitally important role for farmers' groups and traditional leaders in ensuring that locally-appropriate agricultural extension advice is provided in each project. This also requires greater inclusion of local knowledge that farmers have been practicing to sustain their land's productivity. For CA in Malawi, use of local contextual knowledge is particularly challenging due to the

powerful "*one size, fits all*" messaging around the basic CA tenets of reduced soil tillage, permanent soil cover and intercropping / crop rotation (Bunderson *et al*., 2002). These have led to simplified national guidance (Ligowe *et al*., 2013) rather than context-specific advice required to realise increased crop yields in different agro-ecological zones (Thierfelder *et al*., 2016). This national situation matches that seen for the African smallholder context more widely (e.g. Giller *et al*., 2009, 2015), notably in the ability of CA to enhance crop yields without being linked to enhanced agricultural inputs (Pittelkow *et al*., 2015). Changing the national dynamic of CA communications is vital, to move away from 'top-down' instruction to more inclusive planning processes that assess how best to use CA practices as part of an integrated set of actions capable of leading to agricultural development and enhanced adaptive capacity to climatic variability.

Our roadmap focuses on facilitating multidirectional flows of knowledge across actors and levels within the CA community in Malawi to achieve context appropriate, coordinated action. We highlight that national level bodies such as the NCATF and CSAA have an important role to play. To this end, capacity-building, greater inclusivity and communications are key steps to the greater empowerment of members of this group. Such empowerment is necessary to ensure members' ability to affect project design, implementation and government extension service training and policy development.

Experiences from study districts highlight positive examples where CA has been integrated successfully with other initiatives such as irrigation projects and provision of village loan schemes (Wood *et al*., 2016). These findings build from the emerging literature on how cross-sectoral, multi-stakeholder partnerships can be developed in support of more community-led natural resource management initiatives (e.g. Dyer *et al*., 2013). In the case of CA in Malawi, the role of NGOs, donors and/or the private sector in providing financial support (or input subsidies) to smallholder farmers as outgrowers can be particularly influential given their ability to provide short-term incentives (Ward *et al*., 2015) when the longer-term impact on maize yields remains difficult to determine and explain. This is particularly important given that regional meta-analyses suggest that the main benefit of CA is increased stability of crop yields in dry climates (Rusinamhodzi *et al*., 2011; Brouder and Gomez-Macpherson, 2014; Giller *et al*., 2015).

The temporal delay in benefits of CA practices and the likelihood that the greatest value will be seen in the enhanced ability to withstand dry spells early in the growing season (Sutcliffe *et al*., 2016) mean that further research is vital to compare CA smallholders' yields and resilience to those of non-CA smallholders. Extreme weather events such as the floods affecting southern Malawi in 2015 and the droughts in 2016 offer important events in which to undertake objective study of differences in yields between CA and non-CA practices. New forms of CA research based on collaborative working and co-design of management options for field testing are essential. They require analysis to show the direct impacts on yields, labour and fertilizer inputs and on livelihood security. Recognising the different needs, priorities and strengths of farmers, NGOs, private sector and government staff is a critical component in developing new forms of collaborative, low-cost research embedded within agricultural development projects. Partnerships are needed for new CA project initiatives with research organisations working with NGOs and community groups to empower them to lead on the monitoring and evaluation of impacts on crop yields, labour inputs and economic benefits of CA practices.

5. Conclusions

This study provides new empirical evidence on the need for, and opportunities associated with multi-stakeholder, multi-level partnerships grounded in community engagement and ongoing collaborative research. Our findings identify the current knowledge gaps and institutional barriers that constrain shifts towards greater CA uptake in Malawi. They highlight institutional, capacity and communication limitations with the current coordinating body (the NCATF) and that this is complicated by the development of a national Climate Smart Agriculture Alliance. We have drawn on our findings to set out an integrated roadmap of research needs and policy options aimed at supporting CA uptake in Malawi. Our results offer important lessons that can inform improved multi-level design, planning and implementation of CA projects in a context specific manner. Multi-level case study analyses of this nature can inform ongoing efforts to improve institutional support for successful sustainable land management programmes in sub-Saharan Africa and enhancing the climate resilience of farming systems.

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