Are local development plans mainstreaming climate-smart agriculture? A mixed-content analysis of medium-term development plans in semi-arid Ghana

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Abstract

In Africa, climate change impacts including, but not limited to, erratic rainfall and prolonged droughts are already affecting farmers' productivity and disrupting households' livelihoods. Following this realization are recommendations for implementing climate-smart agriculture (CSA) as adaptation and resilience pathways to address the negative ramifications of climate change impacts. While CSA mainstreaming is strong at the global and national levels, it remains a challenge at the local level. To understand CSA mainstreaming at the local level, this paper utilizes mixed-content analysis to deconstruct eleven local development plans for the 2018–2021 plan period for the Upper West Region, a semi-arid region of Ghana. Results show that CSA mainstreaming is a challenge, despite a general awareness of climate change impacts on agriculture. The plans lacked adequate data on local climate change trends and impacts leading to discrepancies among CSA problematization, development goals, objectives, and strategies—raising serious concerns about ownership and localization of CSA in semi-arid Ghana. Also, awareness of climate finance opportunities to support CSA interventions was absent in the plans. This paper suggests a review of the national guidelines for preparing local development plans by integrating resources for CSA, climate assessment and information systems, and climate finance opportunities. This should be complemented by building institutional capacity and partnerships with nongovernmental organizations as well as other development partners working on CSA at the local level.

Keywords Climate change · Climate-smart agriculture · Mainstreaming · Local development plans · Semi-arid regions · Ghana

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1 The challenge of climate-smart agriculture mainstreaming

The reality of climate change is without a doubt. Climate change impacts various aspects of society including health, infrastructure, and the economy (*see* Intergovernmental Panel on Climate Change (IPCC) 2014). These impacts are expected to be severe in regions and countries whose economic development depends on the climate (Abidoye and Odusola 2015, p. 277; Collier et al. 2008, p. 337). It is for this reason that the agriculture sector remains relevant to climate change deliberations (Dinesh et al. 2018, p. 1; Tankha et al. 2020, p. 108). Not only is the sector a major contributor to Greenhouse Gas (GHG) emissions, it is also negatively affected by climate change impacts (Brida et al. 2013, pp. 521–523; Tankha et al. 2020, p. 108).

This nexus—climate change and agriculture—has subsequently informed the emergent idea of Climate-Smart Agriculture (CSA), which “is an approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change” (Lipper et al. 2014, p. 1068). Climate-smart agriculture seeks to manage agriculture production through adaptation, mitigation, and resilience (Tankha et al. 2020, p. 109; Food and Agriculture Organization [FAO] 2017, p. 1; Khatri-Chhetri et al. 2020, p. 30; Tankha et al. 2020, p. 109). The CSA concept was introduced in 2010 at The Hague Conference on Agriculture, Food Security, and Climate Change. In 2013, the United Nations (UN) Food and Agriculture Organization (FAO) published its first edition of a CSA Sourcebook, followed by the second edition in 2017. Additionally, CSA is captured in different international development agenda like the UN’s Sustainable Development Goals (FAO 2017, p. iv).

To ensure that CSA is captured in local, regional, and national development planning and policies, mainstreaming—which refers to the “integration of policies and measures to address climate change into ongoing sectoral and development planning and decision-making” (Klein et al. 2005, p. 84)—is strongly recommended. It is thus not surprising that CSA is mainstreamed in regional and national climate change policies in Africa (Zougmore et al. 2018, p. 5). The rationale is underpinned by the continent’s risk to climate change impacts (IPCC 2014, p. 1202) since African economies are dependent on agriculture (Abidoye and Odusola 2015, p. 277; Collier et al. 2008, p. 337; Bhatasara and Nyamwanza 2018, p. 3; Mwongera et al. 2017, p. 193; Zougmore et al. 2016, p. 1). Despite these mainstreaming efforts in Africa, national climate change policies have not been adequately mainstreamed into local development plans, undermining efforts to implement

adaptation and mitigation interventions in Africa (Diko 2018, pp. 147–149; Nkiaka and Lovett 2018, p. 56). This has made implementing the recommendation to mainstream CSA into local development planning a challenge.

One reason for CSA mainstreaming challenges at the local level can be attributed to CSA being ambiguous and controversial (Clapp et al. 2018, p. 81; Newell et al. 2018, p. 59; Taylor 2018, pp. 96–98), both as a concept and in its application. Additional reasons for CSA mainstreaming challenges at the local level include poor stakeholder collaboration and coordination, path dependency, inadequate financing, and a knowledge gap between climate change information, research and policy (Chandra et al. 2018, pp. 526–527; Clapp et al. 2018, p. 81; Dinesh et al. 2018, p. 4; Taylor 2018, p. 95).

Generally, there is a paucity of literature on CSA mainstreaming in local development plans as most researchers have focused on national discourses (*e.g.*, Clapp et al. 2018; Faling and Biesbroek 2019; Totin et al., 2018; Zougmore et al. 2016; Zougmore et al. 2019) and CSA adoption by farmers and their implications for agriculture productivity (*e.g.*, Khonje et al. 2018; Ng’ombe et al. 2017; Tankha et al. 2020). These studies are important for understanding the factors that can inhibit or enhance farmers’ adoption of CSA. Equally important, however, are studies that examine the institutional contexts of CSA at different levels of governance (Chandra et al. 2018, p. 527; Newell et al. 2018, pp. 53–55; Totin et al. 2018, pp. 1–3).

For Africa, local governments in partnership with different nongovernmental organizations (NGOs) implement different interventions to support agriculture production. They are often the main actors facilitating the implementation of national policies through the preparation and implementation of local development plans (Diko 2018, pp. 141–142; Pieterse et al. 2020, pp. 1–2; Santhia et al. 2018, p. 590). Thus, without proper mainstreaming of CSA into local development plans, many farmers may be deprived of interventions that seek to build their adaptive and resilience capacities to climate change impacts.

Subsequently, this paper focusing on CSA mainstreaming in local development plans of Ghana’s Upper West Region argues for the need to strengthen climate change mainstreaming at the local level. The study makes two contributions with regard to CSA and climate change mainstreaming issues at the local level. First, it provides insights into whether global development ideas are diffused and localized through local development plans. Second, it contributes to the emergent discourse on the dynamics and intricacies of human and social practices that occur in specific socio-ecological and institutional contexts (Xiang 2019, p. 7).

2 An overview of climate-smart agriculture mainstreaming

Climate-smart agriculture targets adaptive and resilience practices that address climate change impacts on agriculture production (FAO 2017, p. 1; Tankha et al. 2020, 109), minimizing the sector's contribution to GHG emissions (Faling and Biesbroek 2019; Steenwerth et al. 2014, p. 533) while increasing farmers' income (Akrofi-Atitianti et al. 2018, p. 10; FAO 2017, p. 1). CSA forms part of the global call to mainstream climate change in agriculture production (Chandra et al. 2018, p. 526; Newell et al. 2018, p. 54; Tankha et al. 2020, pp. 108–109). As a concept, scholars identify CSA to be ambiguous and controversial (Clapp et al. 2018, p. 81; Newell et al. 2018, p. 59; Taylor 2018, pp. 96–98) as there are variations in its framings and goals across different countries and regions (Chandra et al. 2018, pp. 534–536; Zougmore et al. 2016, pp. 1–2; Totin et al. 2018, p. 12), which can limit CSA mainstreaming efforts (Mwongera et al. 2017, p. 201).

Since CSA features prominently in international development, it is crucial for scholars to understand its mainstreaming (Tankha et al. 2020, p. 109) in relation to localization, political mobilization and processes, power dynamics, and institutional context for policy formulation and adoption (Campbell et al. 2014, pp. 39–40; Clapp et al. 2018, pp. 82–83; Dinesh et al. 2018, p. 4; Newell et al. 2018, pp. 56–57; Rai and Fisher 2016, p. 7). Unfortunately, research on the institutional context—the setting of CSA mainstreaming—is minimal and recent (Tankha et al. 2020, p. 111; Totin et al. 2018, p. 11). Furthermore, there is little knowledge about the policies and funding mechanisms to facilitate the mainstreaming of CSA across different governance scales (Harvey et al. 2014, p. 86). Nonetheless, the literature that exists points to different institutional factors that contribute to CSA mainstreaming challenges. For instance, comprehensive regulatory frameworks are crucial for enabling stakeholders in the agriculture sector to mainstream CSA (*see* Brandt et al. 2017; Engel and Muller 2016; Faling and Biesbroek 2019). Additionally, CSA policies have often focused on engineering and technological solutions, which are inadequate to address climate change impacts on agriculture (Newell et al. 2018, p. 54; Totin et al. 2018, p. 2) because they fail to account for social, cultural, and institutional contexts. Funding also affects many aspects of CSA mainstreaming (Chandra et al. 2018, p. 536). International aid, for example, can engender or reduce the domestication of CSA (Newell et al. 2018, p. 63). Some scholars also observe the potential risk of path dependency and greenwashing in CSA mainstreaming since some of its elements already exist in many communities across different countries

(Bhatasara and Nyamwanza 2018, p. 93; Chandra et al. 2018, pp. 531–532). Here, path dependency and greenwashing can lead to branding, for example, agriculture modernization as a climate-smart initiative. Such challenges are often attributed to CSA's advanced knowledge requirement that warrants extra efforts in scaling-up the understanding of the concept among actors (Bhatasara and Nyamwanza 2018, pp. 91–94; Neufeldt et al. 2013, p. 4; Zougmore et al. 2016, p. 13).

Ultimately, while different tools and frameworks have been developed to facilitate CSA mainstreaming at different scales (*see* Brandt et al., 2017; FAO 2017; Mwongera et al. 2017), the diffusion of CSA remains a challenge globally (Tankha et al. 2020, p. 109), because CSA is often hindered by social-ecological and institutional factors (Partey et al. 2018, pp. 292–293). It is for this reason that scholars argue that ensuring farmers' adoption of CSA requires understanding its institutional contexts (Chandra et al. 2018, p. 36; Harvey et al. 2014, p. 83; Newell et al. 2018, p. 63; Totin et al. 2018, p. 12).

2.1 Climate-smart agriculture mainstreaming in Africa

In Africa, CSA is being mainstreamed into subregional and national development plans to achieve food security and poverty reduction goals amid climate change impacts (Zougmore et al. 2018, p. 5). For instance, through the New Partnership for Africa's Development (NEPAD) and Economic Community of West African States (ECOWAS) Agricultural Policy, ECOWAS has tasked its members to mainstream CSA into national policies and local development plans (Zougmore et al. 2016, p. 13). Some multi-stakeholder national science-policy dialogue platforms have also been created in countries such as Ghana, Mali, and Senegal to create awareness, mobilize political support, and advocate for CSA mainstreaming in national development plans (Zougmore et al. 2016, p. 11; Zougmore et al. 2019, p. 367) but not without challenges. Many actors from farmers to policymakers often do not understand the CSA concept, technologies, and practices (Partey et al. 2018, p. 292). This lack of understanding engenders simple goals that do not account for the potential benefits and trade-offs associated with CSA (Campbell et al. 2014, p. 40). The coordination of different agencies and units working on agriculture and climate change issues are also not well integrated (Zougmore et al. 2016, p. 6), thus constraining the development planning processes that can stimulate CSA mainstreaming at both the national and local levels.

Compared to institutional aspects, research on CSA adoption by farmers abound in Africa. The predominance of CSA adoption studies (*e.g.*, Khonje et al. 2018; Martey et al. 2020; Ng'ombe et al. 2017) thus gives impetus for a need to

understand the institutional aspects of CSA mainstreaming (Chandra et al. 2018, p. 39; Harvey et al. 2014, p. 85). In Malawi, for example, knowledge gaps concerning the transition of conservation science into policies and actions as well as poor collaboration among stakeholders were barriers to effective CSA mainstreaming (Dougill et al. 2017, p. 31). Again, given that there are challenges with climate change mainstreaming in Africa (see Diko 2018; Dougill et al. 2017; Nkiaka and Lovett 2018; Pasquini et al. 2015; Santhia et al. 2018), CSA provides an avenue to further understand the institutional contexts of climate change mainstreaming in Africa and elsewhere.

2.2 Climate-smart agriculture mainstreaming in Ghana

Generally, climate change mainstreaming in Ghana has been progressive—beginning with the *Growth and Poverty Reduction Strategy (GPRS II)* for the 2006–2009 plan period (Diko 2018, p. 144). Since then, the Government of Ghana has sought to give “special consideration” to climate change at all levels of development planning (National Development Planning Commission [NDPC] 2011, p. 14; NDPC 2013, p. 16), especially in the preparation of local development plans (known as Medium-Term Development Plans (MTDPs)). The current medium-term national development policy framework—*An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All (First Step) 2018–2021*—also seeks to enhance “climate change resilience at all levels and across all sectors” by “deepening the mainstreaming of climate change in national and sub-national development planning and budgeting processes” in addition to “promoting and documenting improved climate-smart indigenous agricultural knowledge” (NDPC 2017, p. 95).

Indeed, there is a clear recognition of the nexus between climate change impacts and agriculture in Ghana. The country’s Environmental Protection Agency (EPA) notes the Agriculture, Forestry, and Other Land Uses (AFOLU) sector as the largest contributor to national GHG emissions, constituting approximately 54.4% of Ghana’s overall emissions (EPA 2019, p. 30). Farmers in Ghana are already experiencing climate change impacts such as erratic rainfall, rising temperatures, frequent droughts, losses of arable land through desertification, outbreaks of crop and livestock pests and diseases, and salinization of agricultural soils from sea level rise and tidal flooding (World Bank and Ministry of Food and Agriculture [MoFA] 2020, p. 2).

In light of these climate change impacts, different initiatives have been undertaken in Ghana. First, a National Climate

Change Committee (NCCC) was established in 2010. The NCCC has subsequently developed four national documents on climate change, namely: *National Climate Change Policy Framework* and *National Climate Change Adaptation Strategy* in 2010, the *National Climate Change Policy* in 2014, and the *National Climate Change Policy Action Programme for Implementation* in 2015 (Diko 2018, p. 144; Essegbey et al. 2015, pp. 6–13).

On CSA, the Consultative Group for International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture, and Food Security working with the Government of Ghana published a working paper on CSA titled, the *National Climate-Smart Agriculture and Food Security Action Plan of Ghana (2016–2020)* in 2015 (see Essegbey et al. 2015). This was followed by an *Investment Framework for Mobilization of Resources into Climate Smart Agriculture (CSA) in Ghana* in 2018 (see FAO and MoFA, 2018). In partnership with the World Bank, Ghana’s Ministry of Food and Agriculture (MoFA) also published the *Climate Smart Agriculture Investment Plan for Ghana* in 2020 (see World Bank and MoFA 2020). All these publications provide the policy direction for CSA and its integration into agriculture. These documents account for different agroecological zones and the multilevel nature of implementing these plans in Ghana’s decentralized local government system. They also demonstrate Ghana’s effort through the MoFA, with development partners such as CGIAR, the World Bank, and FAO to promote CSA. So far, various CSA actors, technologies, practices, and investments have been profiled for different agroecological zones (Essegbey et al. 2015, pp. 2–4). Some field studies have also been conducted to develop investment frameworks and equip districts with information and knowledge on existing CSA opportunities and attract funding to support the agriculture sector. These studies reveal financing and incoherent policy alignments in addition to ad hoc and ineffective implementation of CSA practices and technologies due to insufficient integration into sectoral policies and local plans (Essegbey et al. 2015, p. 24). It is thus apparent that these challenges are embedded in the realities of development planning in Ghana. Indeed, despite nationally mandated guidelines requiring attention to climate change issues in MTDPs, Adu-Boateng (2015, p. 5) observed tensions between local development and national climate change priorities, thereby leading to “climate change policy divergence” (Diko 2018, p. 149). In addition, there is seemingly some path dependency (Diko 2019, p. 518) in mainstreaming climate change into urban development plans in Ghana. These development planning realities give impetus to further examine the institutional context of climate change mainstreaming.

Fig. 1 Study location. Source: Maps developed using data downloaded from ArcGIS Online

3 Socio-ecological profile of the Upper West Region

The Upper West Region is one of the 16 administrative regions in Ghana (Fig. 1). It is also one of five administrative regions with a semi-arid climate—the other four are Upper East, North East, Northern, and Savannah Regions. Using a simple random sampling approach, the Upper West Region was selected as the study area for this research. The region covers an area of 18,476 square kilometers and is characterized by Guinea and Sudanese savanna vegetation interspersed with grassland and woodland of drought-resistant trees, with one rainy season and an average rainfall of 115 mm (Ghana Statistical Service 2013, p. 1). The region's population was 702,110 in Ghana's 2010 Population and Housing Census (Ghana Statistical Service 2013, p. 4) and over 83% of the region's population is rural (Ghana Statistical Service 2013, p. 21).

Agriculture constitutes 70% of Ghana's land uses, and it is the primary employer of residents especially in the Volta, Northern, and Upper West regions (World Bank and Ministry of Food and Agriculture, 2020, p. i). In the Upper West region,

72.8% of the economically active population is employed in the agriculture, forestry, and fishery sector (Ghana Statistical Service 2013, p. 65). Akin to the Northern Region, farmers in the Upper West region often do not have “access to modern inputs, extension services, irrigation, electricity, markets, and roads to support the development of a vibrant agriculture sector” (World Bank and Ministry of Food and Agriculture, 2020, p. i). All these conditions contribute to making the region more vulnerable to climate change impacts such as severe droughts, with critical implications for agriculture productivity and food security (Padgham et al. 2015, p. 44).

Despite the high proportion of employment in agriculture (Ghana Statistical Service 2013, p. 65), the region is characterized by high levels of food insecurity, malnutrition, and limited access to social services (Ghana Statistical Service 2020, pp. 41–42). Climate change impacts and structural underdevelopment have led to many adaptations and resilience realities (see Lolig et al. 2014; Lawson et al. 2020). As a result, smallholder farmers in both urban and rural areas are increasingly trying to adapt to the effects of climate change through the adoption of different strategies including dry season farming, small-scale irrigation, water harvesting, and conservation (Fagariba et al. 2018, pp. 12–13; Nyantakyi-Frimpong and Bezner-Kerr

2015, pp. 51–54). These socio-ecological conditions provide an appropriate context to analyze CSA mainstreaming in the region.

4 A climate-smart agriculture mainstreaming assessment framework

This research employed a mixed-content analysis to deconstruct local development plans (hereafter referred to as MTDPs) to understand CSA mainstreaming in Ghana. The content analysis provided the analytical framework to examine text data (Krippendorff 2004, p. 18) from the eleven 2018–2021 MTDPs for Metropolitan, Municipal, and District Assemblies (MMDAs) of the Upper West Region of Ghana (Fig. 1)—four Municipal and seven District Assemblies.

4.1 Elements of the assessment framework

To understand CSA mainstreaming in the 2018–2021 MTDPs from the Upper West Region, the study tailored the suggested report structure by the NDPC guidelines for preparing MTDPs in Ghana to general mainstreaming assessment frameworks (Fatemi et al. 2020, p. 4; Pieterse et al. 2020, p. 4). In the NDPC guidelines, there are seven recommended chapters namely: (1) Profile/Current Situation/baseline; (2) Prioritization/key Development Issues; (3) Development Goal, Adopted Objectives and Strategies; (4) Development Programs and subprograms; (5) Annual Action Plan; (6) Monitoring and Evaluation Plan; and (7) Communication Plan. The recommended chapters were reframed in relation to the eight CSA modules of the FAO's second edition CSA sourcebook (*see* FAO 2017). Chapter (2) was reframed as problematization, chapters (3) and (4) merged and captioned as Development Programs, and chapters (6)

Table 1 Assessment framework for climate-smart agriculture (CSA) mainstreaming in MTDPs

Parameters	Indicators ^a	Label
Climate change profile	Climate trends—past, present, future	PCT
	Climate change impacts	PCC
Climate-smart agriculture and problematization	Problems/priorities of water management	PrWM
	Problems/priorities of climate-smart livestock production	PrLP
	Problems/priorities of climate-smart crop production	PrCP
	Problems/priorities of climate-smart soil and land management	PrLM
	Problems/priorities of climate-smart forestry	PrF
	Problems/priorities of climate-smart fisheries and aquaculture	PrFA
	Problems/priorities of genetic resources for food and agriculture	PrGMO
	Problems/priorities sustainable food systems and value chains	PrVC
Development programs on CSA	Clear goals related to CSA priorities or problems	DPG
	Clear objectives for each goal related to CSA priorities or problems	DPO
	Clear strategies for goals and objectives related to CSA problematization	DPS
Projects on CSA (Focus on projects identified in the Program of Action)	Projects on water management	PjWM
	Projects on climate-smart livestock production	PjLP
	Projects on climate-smart crop production	PjCP
	Projects on climate-smart soil and land management	PjLM
	Projects on climate-smart forestry	PjF
	Projects on climate-smart fisheries and aquaculture	PjFA
	Projects on genetic resources for food and agriculture	PjGMO
	Projects on sustainable food systems and value chains	PjVC
	Identifies implementation period for annual projects	API
	Identifies funding sources for annual projects	APF
	Identifies implementation agencies for annual projects	APA
Monitoring, evaluation; and communication plan	Identifies clear strategies to monitor and evaluate CSA projects	ME
	Identifies clear strategies to disseminate information about CSA	CS
Terminology count	Number of mentions of “Climate Change”	NCC
	Number of mentions of “CSA”	NCSA

^aIndicators are derived based on the review of FAO Climate-Smart Agriculture Sourcebook (2nd Eds.) The indicators are examined in the plans with explanations and examples from the Sourcebook as a guide

and (7) merged as Monitoring, Evaluation, and Communication Plan. Table 1 summarizes this study's assessment framework. A Microsoft Excel Assessment Tool was developed for each MTDP and linked to an overall template for the Region, where the excel sheet had been programmed to compute mainstreaming scores. The text data and the pages in the MTDPs where the text data were extracted were entered manually into the assessment tool.

4.2 Scoring criteria

The quantitative scoring employed in this study allowed for comparison between the MMDAs and some level of generalization for the region. However, germane to this assessment was an aim to identify strengths, gaps, and weaknesses to inform improvements in mainstreaming akin to other assessment frameworks (Fatemi et al. 2020, p. 5; Godschalk and Rouse 2015, pp. 21–23; Pieterse et al. 2020, p. 3). The indicators for each parameter were scored between zero (0) and two (2) depending on the extent to which the indicator has been met in the MTDPs. These scores were determined by reviewing the various chapters and sections of the MTDPs that corresponded to the parameters in Table 1. The following explains the various scoring values:

- *Not Applicable (NA)* Assigned when district and national conditions and/or legal regulations inhibit their adoption. This is not included in the overall plan score and therefore does not negatively affect CSA mainstreaming in the MTDP.
- *Not Present (0 points)* The MTDP does not provide evidence or information of the indicator in the MTDP.
- *Low (1 point)* The MTDP meets the indicator in part by mentioning or discussing the indicator but does this at a basic level with little to no evidence and does not or partly connects to CSA or climate change throughout the plan.
- *High (2 points)* The MTDP explicitly addresses the indicator with reliable evidence (e.g., national and local assessment reports, baseline studies, consultant reports, academic studies, etc.) and connects to CSA or climate change throughout the plan.

The scores were aggregated across the indicators to represent the overall total for each indicator as well as the MTDPs. The maximum value possible for each MTDP is 56 and 22 for the region's indicator score. This was converted to percentages to standardize the scores for easy comparison. The degree of CSA mainstreaming was determined to be

either *Poor* (less than 50%), *Weak* (50–59.9%), *Moderate* (60–69.9%), *Strong* (70–79.9%), or *Very Strong* (80–100%).

Similar to Fatemi et al. (2020) and Pieterse et al. (2020), the scores were the basis for quantitative comparison and the text data associated with each score formed the basis of qualitative content analysis. The content analysis provided context and evidence of CSA or otherwise in the plans as well as a validation of the quantitative assessment.

5 Climate-smart agriculture mainstreaming in local development plans

5.1 Use of climate change and CSA in MTDPs

The average number of times the term “climate change” appeared in the eleven MTDPs was 34.3 and 5.5 for CSA (including terms like climate-smart indigenous agriculture). Lawra Municipality's MTDP recorded the lowest count (7) for climate change, while the Nadowl-Kaleo District recorded the highest count (73). Wa East District, Sissala East Municipality, and Lawra Municipality did not use CSA in their MTDPs, with the highest CSA count occurring in the Damafiamma-Bussie-Issa District MTDP (32). The counts are illustrated in Fig. 2.

5.2 Information on climate change and its impacts in MTDPs

Overall, only two out of eleven MTDPs reviewed had weak mainstreaming (Table 2). All the MTDPs scored low on the climate trends indicator as these plans provided basic to no reliable evidence of past, present, and future climate information. For instance, in summarizing climate trends in the Lambussie District, the plan notes:

Over the past decade, there have been dramatic changes in the climatic conditions in terms of climate variability and change due to the general global warming as observed the world over. The situation has resulted in some climate change stressors in the district and if unchecked, will lead to more devastating stressors going into the future (Lambussie District Assembly 2018, p. 65).

Generally, the plan narratives depict awareness of climate change and its impacts. With the exceptions of Wa East District and Wa West District MTDPs, the other nine explicitly identify the impacts of climate change on agriculture. In the

Fig. 2 Use of the terms CSA and climate change in MTDPs

Table 2 Mainstreaming scores for climate change and CSA information in profile of MTDPs

MMDA	PCT	PCC	Total	Score (%)	Mainstreaming
Daffiama-Bussie-Issa District	1	2	3	75	Strong
Jirapa Municipality	1	2	3	75	Strong
Lambussie District	1	2	3	75	Strong
Lawra Municipality	1	2	3	75	Strong
Nadowli-Kaleo District	1	2	3	75	Strong
Nandom District	1	2	3	75	Strong
Sissala East Municipality	1	2	3	75	Strong
Sissala West District	1	2	3	75	Strong
Wa East District	1	1	2	50	Weak
Wa Municipality	1	2	3	75	Strong
Wa West District	1	1	2	50	Weak

Nandom District MTDP, climate change impacts on agriculture were explained as follows:

The effect of climate change on agriculture which is the mainstay of the people is enormous leading to a high reduction of yields across major crops cultivated emanating from poor soil fertility. In [addition] to this are the annual occurrence of diseases such as meningitis... in the district (Nandom District Assembly 2018, p. 9).

The absence of climate data in the majority of the MTDPs is problematic, as reliable data is critical for understanding the location, extent, and severity of climate change impacts to inform appropriate strategies in building adaptive and resilience capacities of the agriculture sector both in the present and for the future.

5.3 CSA and problematization of the agriculture sector

For problematization, the MTDPs identify key CSA-related problems and/or priorities for water management, livestock production, crop production, soil and land management, forestry, fisheries and aquaculture, and sustainable food systems and value chains. Overall, Daffiama-Bussie-Issa District (78.6%), Jirapa Municipality (71.4%), and Nandom District (71.4%) had strong CSA mainstreaming (Table 3). Two MTDPs had moderate CSA mainstreaming (Sissala East Municipality and Wa East District), and the rest either had poor or weak CSA mainstreaming.

Five out of eleven MTDPs problematized crop production in connection to CSA compared to the other indicators. None of the plans problematized or prioritized

Table 3 Mainstreaming scores for problematization of CSA in MTDPs

MMDA	PrWM	PrLP	PrCP	PrLM	PrF	PrFA	PrGMO	PrVC	Total	Score (%)	Mainstreaming
Daffiama-Bussie-Issa District	1	2	2	1	2	2	NA	1	11	78.6	Strong
Jirapa Municipality	1	1	2	1	2	2	NA	1	10	71.4	Strong
Lambussie District	1	1	1	1	2	1	NA	1	8	57.1	Weak
Lawra Municipality	1	1	1	1	1	1	NA	1	7	50	Weak
Nadowli-Kaleo District	1	1	2	1	1	0	NA	1	7	50	Weak
Nandom District	2	2	1	1	2	1	NA	1	10	71.4	Strong
Sissala East Municipality	1	1	1	2	1	1	NA	2	9	64.3	Moderate
Sissala West District	2	1	2	1	0	0	NA	0	6	42.9	Poor
Wa East District	2	1	2	0	2	0	NA	2	9	64.3	Moderate
Wa Municipality	1	1	1	1	1	1	NA	1	7	50	Weak
Wa West District	1	1	1	1	1	1	NA	1	7	50	Weak

Genetically Modified Organisms (GMOs)—likely because laws in Ghana prevent their adoption. Furthermore, CSA-related water management problems were high in Sissala West District, Wa East District, and Nandom Districts' MTDPs. Two MTDPs—Daffiama-Bussie-Issa District and Nandom District—scored high on CSA-related livestock production problems; only the Sissala East Municipality MTDP scored high for CSA-related land management problems; three MTDPs—Wa East District, Nadowli-Kaleo District, and Sissala West District—did not problematize fishery and aquaculture as CSA-related; and Wa East District and Sissala East Municipality's MTDP scored high on CSA-related value chain problems (Table 3).

Specifically, Nadowli-Kaleo District MTDP identifies water management development issues as “*inadequate protection and development of water resources*” (Nadowli-Kaleo District Assembly 2018, p. 102), while in the Nandom District water management issues identified included “*unreliable rainfall pattern*” (Nandom District Assembly, 2018, p. 66) and “*low level of irrigated agriculture*” (Nandom District Assembly, 2018: 72). The problematization of MTDPs across the eight CSA indicators of the

assessment revealed the potential of increasing agriculture productivity through CSA in the region. However, because of the lack of climate change data in the MTDPs, there is limited contextualization of agriculture problems and/or priorities in relation to climate change impacts.

5.4 Climate-smart agriculture goals, objectives, and strategies

This section examined the extent to which CSA is mainstreamed into the goals, objectives, and strategies of the eleven MTDPs. Table 4 shows that eight out of the eleven MTDPs had very strong CSA mainstreaming. Wa Municipality's MTDP, for example, aims to “*safeguard the natural environment and ensure a resilient built environment*” with objectives to reduce environmental pollution, combat deforestation, desertification, and soil erosion, and promote sustainable use of forest and wildlife resources. In the MTDP, strategies such as “*the enforcement of National Wildfire Management Policy*” and knowledge promotion on climate-smart initiatives were related to CSA (Wa Municipal Assembly 2018, p. 136).

Table 4 Mainstreaming scores for CSA goals, objectives, and strategies in MTDPs

MMDA	DPG	DPO	DPS	Total	Score (%)	Mainstreaming
Daffiama-Bussie-Issa District	2	2	2	6	100	Very Strong
Jirapa Municipality	2	0	0	2	33.3	Poor
Lambussie District	2	2	2	6	100	Very Strong
Lawra Municipality	1	1	1	3	50	Weak
Nandom District	2	1	1	4	66.7	Moderate
Nadowli-Kaleo District	1	2	2	5	83.3	Very Strong
Sissala East Municipality	2	2	2	6	100	Very Strong
Sissala West District	1	2	2	5	83.3	Very Strong
Wa East District	1	2	2	5	83.3	Very Strong
Wa West District	1	2	2	5	83.3	Very Strong
Wa Municipality	2	2	2	6	100	Very Strong

The MTDPs had very strong mainstreaming despite having poor and weak CSA mainstreaming in the problematization section, illustrating transitional gaps from problematization to CSA goals, objectives, and strategies—except for the Nandom, Daffiama-Bussie-Issa, and Lawra Municipality Districts MTDPs. The strong CSA mainstreaming in problematization in Daffiama-Bussie-Issa District MTDP resulted in very strong CSA goals, objectives, and strategies, while CSA mainstreaming in Nandom MTDP was moderate. The Jirapa District MTDP scored poor, despite a strong CSA mainstreaming under problematization, due to the lack of clear objectives and strategies on CSA. The difference between the MMDAs lies in the way the goals, objectives, and strategies are linked to climate change impacts on agriculture in the MTDPs.

5.5 Climate-smart agriculture projects

The analysis identified water management projects in all eleven MTDPs. However, only three MTDPs (Daffiama-Bussie-Issa District, Nadowli-Kaleo District, and Wa East municipalities) scored high on water projects that aligned with CSA such as the “*rehabilitation of dams and dugouts*” (Nadowli-Kaleo District Assembly 2018, p. 161). In the other MTDPs, water management projects were formulated vaguely or linked to urban water systems rather than agriculture.

The Sissala West District and Wa West District MTDPs scored high on climate-smart livestock projects. For example, the Wa West District MTDP had a project to “*promote livestock and poultry development for food security and income*” (Wa West District Assembly 2018: 172–173). Other MTDPs had projects on livestock production without emphasis on CSA as in the case of Wa Municipality. Also, the Sissala East Municipality MTDP had no CSA project although the plan stipulates a strategy to “*expand local production of livestock*” (Sissala East Municipal Assembly 2018, p. 225). Six of the eleven MTDPs scored high on climate-smart crop production projects. An example is the Daffiama-Bussie-Issa District MTDP, which had a project to support “*the development and introduction of climate-resilient crops*” and “*farmers to establish project fields on climate-smart agriculture*” (Daffiama-Bussie-Issa District Assembly 2018). Projects for climate-smart soil and land management are quite mixed. Four MTDPs scored high on projects for soil and land management (e.g., Lambussie District), four MTDPs scored low (e.g., Lawra Municipality), and three made no mention of such projects (e.g., Jirapa Municipality). The Lambussie MTDP, for instance, acknowledged climate stressors in land degradation and proposed a project to “*sensitize and support communities on the establishment of woodlot plantations on degraded lands*” (Lambussie District Assembly 2018, p. 258). Some MTDPs recognized CSA soil and land

management issues without presenting corresponding projects (e.g., Wa East Municipality). Furthermore, eight of the eleven MTDPs identified projects for climate-smart forestry. The Daffiama-Bussie-Issa District, Nandom District, Sissala West District, and Wa West District MTDPs received high scores for climate-smart forestry. The projects focused on tackling bush fires and implementing tree planting initiatives to increase tree cover. Yet, Jirapa, Lawra, and Wa East District MTDPs had no projects on climate-smart forestry.

There were challenges in CSA mainstreaming for projects on fishery and aquaculture; six MTDPs had no projects for the sector. Only the Daffiama-Bussie-Issa District and Jirapa Municipality MTDPs scored high on projects that mainstreamed CSA in fishery and aquaculture. Aquaculture is not a major agricultural activity in the region and may explain the poor mainstreaming. Nonetheless, the Nadowli-Kaleo district MTDP, cognizant of the potential of aquaculture, has projects for “*construction of learning/demonstration fish farms in the district*” and “*conduct studies to establish all water sources for fish farming*” (Nadowli-Kaleo District Assembly 2018, p. 162). Projects on developing value chains were identified in all the MTDPs. This notwithstanding, only four of the eleven plans had high scores. Projects included “*train and resource extension staff in post-harvest handling technologies*” (Lawra Municipal Assembly 2018, p. 144) and “*improve techniques for production, storage, processing and packaging to meet market demands*” (Sissala East Municipal Assembly 2018, p. 259). In some MTDPs, there were projects focused on improving knowledge on CSA—with no specific emphasis on particular agriculture activities. Here, the projects want to “*Train 5000 farmers in climate-smart agriculture*” (Nandom District Assembly, 2018, p. 139) and “*Train DDOs [District Agriculture Development Officers] and AEAs [Agriculture Extension Agents] to promote and introduce climate-smart agriculture technologies.*” (Sissala West District Assembly 2018, p. 256). Key CSA projects from the MTDPs are summarized in Table 5.

Overall, CSA mainstreaming in projects was strong in the Daffiama-Bussie-Issa District and Wa West District MTDP, whereas it was moderate for Sissala West District MTDP, and poor or weak in the other MTDPs as illustrated by Table 6. For the most part, the projects in the MTDPs are not fundamentally defined in relation to CSA goals and objectives and are characterized by ambiguity to clearly define their premise and direction within districts’ climate and agriculture situations.

5.6 Implementation framework for CSA projects

The implementation framework provides information about the implementation period for projects, their funding sources, and implementing agencies (*see* Table 6 for examples). Six MTDPs (Daffiama-Bussie-Issa, Lambussie,

Table 5 Key climate-smart agriculture projects in MTDPs for the Upper West Region. Source: Compiled from the MTDPs of the 11 MMDAs (2018–2021) in the Upper West Region of Ghana

MMDA	Key CSA projects	Time frame				Inductive budget (GHC)			Implementation agencies		
		2018	2019	2020	2021	Government of Ghana	Internally generated fund	Donor	Lead	Collaborating	
Daffiama-Bussie-Issa	Promote greenhouse farming	X	X	X	X	Not provided	Not provided	20,000	Donor	District assembly	
	Collaborate with other districts and NGOs in the country and beyond on improved climate-smart indigenous agricultural knowledge	X	X	X	X	Not provided	Not provided	Not provided	DOA, Donor	District assembly	
	Build the capacity of 10No. Agriculture Extension Agents on improved climate-smart indigenous agricultural knowledge	X	X	X	X	20,000	Not provided	40,000	DOA, Donor	District assembly	
	Support development and introduction of climate resilient crops	X	X	X	X	30,000	Not provided	0.00	DOA, Donor	District assembly	
	Assist farmers to establish sub-project fields on climate-smart agriculture	X	X	X	X	30,000	Not provided	30,000	DOA, Donor	District assembly	
Jirapa municipality	Increase extension delivery to 24 communities with water bodies for fish production from 2019–2021	X	X	X	X	15,000	Not provided	20,000	DOA	MA, WVI, CIDA	
	Facilitate the formation of 20 Aquaculture groups in 20 communities from 2019–2021	X	X	X	X	15,000	Not provided	20,000	DOA	MA, WVI, CIDA	
	Implement Flagship on “Aquaculture for Jobs” in 40 communities from 2019–2021	X	X	X	X	15,000	Not provided	20,000	DOA	MA, WVI, CIDA	

Table 5 (continued)

MMDA	Key CSA projects	Time frame					Inductive budget (GH¢)			Implementation agencies		
		2018	2019	2020	2021		Government of Ghana	Internally generated fund	Donor	Lead	Collaborating	
Lambussie District	Sensitive and support farmers with climate resilient crop varieties	X	X	X	X		10,000	Not provided	40,000	DOA	EU, GTZ	
	Sensitive and support communities on the establishment of woodlot plantations on degraded lands	X	X	X	X		40,000	Not provided	20,000	DDA	NADMO, EPA	
	Engage farmers for identification and development of climate-smart indigenous agricultural knowledge and practices	X	X	X	X		5000	Not provided	10,000	DOA	Department of Social Welfare and Community Development	
Lawra municipality	Technology improvement and packaging training in vegetable production	X					10,000	Not provided	Not provided	BAC	DA/clients	
	Train and resource extension staff in post-harvest handling technologies	X	X	X	X		1500	Not provided	3000	DOA	DA	
Nadowli-Kaleo District	Create awareness on climate adaptation and mitigation technologies in agriculture production in 10 communities	X	X	X	X		2000	2000.00	Not provided	DOA	District assembly	
	Conduct studies to establish all water sources for fish farming	X	X	X	X		8000	8000	Not provided	DA	LED team	
	Construction of learning/demonstration fish farms in the district	X	X	X	X		16,000	8000	Not provided	DA	LED team	
	Construction and rehabilitation of dams and dugouts	X	X	X	X		200,000	200,000	Not provided	DADU	DA	

Table 5 (continued)

MMDA	Key CSA projects	Time frame				Inductive budget (GHC)			Implementation agencies		
		2018	2019	2020	2021	Government of Ghana	Internally generated fund	Donor	Lead	Collaborating	
Nandom district Sissala East municipality	Train 5000 farmers in climate-smart agriculture	X	X	X	X	20,000	Not provided	20,000	DOA	Forestry commission	
	Support to improve techniques for production, storage, processing and packaging to meet market demands	X	X	X	X	Not provided	Not provided		DOFA	MPCU	
	Create irrigable buffer dams for agriculture productivities	X	X	X	X	Not provided	Not provided	Not provided	DOFA	MPCU	
Sissala West district	Train DOA staff and Agriculture Extension Agents to promote and introduce climate-smart agriculture technologies	X	X	X	X	Not provided	Not provided	44,000	DOA	District assembly	
	Educate farmers to adopt new, climate-resilient crops and agriculture practices	X	X	X	X	Not provided	Not provided	65,000	DOA	District assembly	
Wa East district	Create awareness on climate adaptation and mitigation technologies in agriculture production in 10 communities	X	X	X	X	8000	Not provided	Not provided	DOA	District assembly	
Wa municipality	Introduce farmers to climate resilient crops	X	X	X	X	22,000	Not provided	42,000	DOA, EPA	NGOs	

Table 5 (continued)

MMDA	Key CSA projects	Time frame				Inductive budget (GH¢)			Implementation agencies		
		2018	2019	2020	2021	Government of Ghana	Internally generated fund	Donor	Lead	Collaborating	
Wa West district	Encourage farmers to use drought resistant crops in farming	X	X	X	X	0.00	Not provided	10,000	DOA	Development partners	
	Encourage farmers to embrace modern technological practices in their farming	X	X	X	X	10,000	Not provided	20,000	DOA	Development partners	
	Promote livestock and poultry development for food security and income	Not provided				Not provided	Not provided	Not provided	Not provided	Not provided	
	Sensitive farmers on the need to seek advice from agriculture extension officers on promoting and documenting improved, climate-smart, indigenous agricultural knowledge	X	X	X	X	10,000	Not provided	30,000	DOA	Development partners	

BAC = Business Advisory Council, CIDA = Canadian International Development Agency, DA = District Assembly, DOA = Department of Agriculture, DADU = District Agricultural Development Unit, DOFA = Department of Food and Agriculture, EU = European Union, GTZ = German Technical Cooperation, MA = Municipal Assembly, MPCU = Municipal Planning Coordinating Unit, NADMO = National Disaster Management Organization, WVI = World Vision International

Table 6 Mainstreaming scores for CSA Projects in MTDPs

MMDA	PjWM	PjLP	PjCP	PjLM	PjF	PjFA	PjGMO	PjVC	Total	Score (%)	Mainstreaming
Daffiama-Bussie-Issa District	2	1	2	1	2	2	NA	1	11	78.6	Strong
Jirapa Municipality	1	1	1	0	0	2	NA	1	6	42.9	Poor
Lambussie District	1	1	1	2	1	0	NA	1	7	50	Weak
Lawra Municipality	1	1	2	1	0	0	NA	2	7	50	Weak
Nandom District	1	1	1	2	2	0	NA	1	8	57.1	Weak
Nadowli-Kaleo District	2	1	1	1	1	1	NA	1	8	57.1	Weak
Sissala East Municipality	1	0	1	2	1	0	NA	2	7	50	Weak
Sissala West District	1	2	2	0	2	0	NA	2	9	64.3	Moderate
Wa East District	2	0	2	0	0	0	NA	2	6	42.9	Poor
Wa West District	1	2	2	2	2	1	NA	1	11	78.6	Strong
Wa Municipality	1	1	2	1	1	1	NA	1	8	57.1	Weak

Nandom District, Sissala West District, Wa West Districts, and Wa Municipality) had very strong CSA mainstreaming for their implementation framework. Project funding sources were the Government of Ghana, the District Assemblies, and NGOs and development partners/donors. The Jirapa Municipality (50%) and Lawra Municipality (50%) MTDPs had weak mainstreaming, while Wa East District MTDP (16.7%) had poor CSA mainstreaming (Table 7). In these MTDPs, implementing agencies and the implementation period were not specified for the majority of their projects.

5.7 Monitoring, evaluations, and communication of CSA interventions in the plan

The last parameter focused on CSA mainstreaming in the monitoring, evaluation, and dissemination of MTDPs. In four of eleven MTDPs, CSA mainstreaming for the Monitoring and Evaluation (M&E) plan was high compared to two MTDPs that scored high on the communication plan (Table 8). Yet not all CSA projects were captured in both the M&E and communication plans—with some projects worded differently. Overall, MTDPs of two districts (Wa

West District and Wa Municipality) had very strong CSA mainstreaming for monitoring, evaluation, and dissemination. Specifically, the Wa West District and Wa Municipality MTDPs have a detailed matrix for dissemination consisting of activities, purpose, audience, method/tool, and timeframe as well as responsible agencies for dissemination for each project. Additionally, each project had an indicator, baseline data, a target for each year, frequency of M&E, and the agency responsible for the M&E plan. For the remaining nine districts, the indicators were either generic and/or presented at a basic level with little to no evidence on monitoring, evaluation, and dissemination of CSA projects in the MTDPs. Thus, the identification and implementation of strategies to monitor and evaluate CSA-related projects and to disseminate information about CSA were limited and unclear.

Overall, the Daffiama-Bussie-Issa District and Wa Municipality MTDPs had very strong and strong CSA mainstreaming, respectively. These MTDPs relatively contextualized their problems and priorities, strategies, and projects in the agriculture sector in relation to climate change impacts (Table 8). Furthermore, the MTDPs for the Upper West

Table 7 Mainstreaming scores for implementation framework for CSA projects in MTDPs

MMDA	API	APF	APA	Total	Score (%)	Mainstreaming
Daffiama-Bussie-Issa District	2	2	2	6	100	Very Strong
Jirapa Municipality	1	1	1	3	50	Weak
Lambussie District	2	2	2	6	100	Very Strong
Lawra Municipality	1	1	1	3	50	Weak
Nandom District	2	2	2	6	100	Very Strong
Nadowli-Kaleo District	2	1	1	4	66.7	Moderate
Sissala East Municipality	2	1	1	4	66.7	Moderate
Sissala West District	2	1	2	5	83.3	Very Strong
Wa East District	1	0	0	1	16.7	Poor
Wa West District	2	2	2	6	100	Very Strong
Wa Municipality	2	1	2	5	83.3	Very Strong

Table 8 Mainstreaming scores for monitoring, evaluations, and dissemination of CSA and the overall MTDPs

MMDA	Monitoring, evaluations, and dissemination					Overall CSA mainstreaming		
	ME	CS	Total	Score (%)	Mainstream	Total	Score (%)	Mainstream
Daffiama-Bussie-Issa District	1	1	2	50	Weak	39	81.3	Very strong
Jirapa Municipality	1	1	2	50	Weak	26	54.2	Weak
Lambussie District	1	1	2	50	Weak	32	66.7	Moderate
Lawra Municipality	1	1	2	50	Weak	25	52.1	Weak
Nandom District	1	1	2	50	Weak	29	60.4	Moderate
Nadowli-Kaleo District	1	1	2	50	Weak	33	68.8	Moderate
Sissala East Municipality	2	1	3	75	Strong	32	66.7	Moderate
Sissala West District	1	1	2	50	Weak	30	62.5	Moderate
Wa East District	2	1	3	75	Strong	26	54.2	Weak
Wa West District	2	2	4	100	Very Strong	33	68.8	Moderate
Wa Municipality	2	2	4	100	Very Strong	35	72.9	Strong

Region showed strength in their awareness of climate change impacts, framing of CSA goals, objectives, and strategies, and the identification of funding agencies and implementation schedule for CSA projects. There were weaknesses in information for climate change trends, the problematization of CSA, formulation of CSA projects, and the dissemination plans for CSA project implementation. The only apparent gap was the absence of GMOs as an element of CSA practice (Table 9).

6 Mainstreaming strengths, gaps, and weaknesses

From the analysis, CSA mainstreaming in MTDPs remains a challenge. Mainstreaming in three of the MTDPs was rated poor; two rated weak; five rated moderate; and one rated strong (Table 8). Despite the calls for CSA mainstreaming in local development plans (Newell et al. 2018; Rai and Fisher 2016), the findings illustrate this has not adequately materialized in the semi-arid region of Ghana, where CSA is essential to climate adaptation for the agriculture sector. Generally, the MTDPs demonstrated strength concerning awareness of climate change impacts but provided little evidence of the climate trends that undergird their awareness of climate change impacts (Table 9). For instance, the spatiotemporal dimensions of climate change in the MTDPs were absent, although such relevant geographic information and contextual climate realities of people and places over time and across environmentally dependent sectors and livelihoods are vital for promoting targeted CSA (Pieterse et al. 2020, p. 13).

For problematization, the best performing indicator in the MTDPs is related to crop production and forest management. Aspects such as sustainable value change, water, and land management that critically support and enhance agriculture

productivity and production had low connections to climate change in the MTDPs. This weakness is crucial since their poor management can derail efforts to promote CSA in crop and livestock production, especially for semi-arid areas such as the Upper West Region. The limited attention to fishing and aquaculture in the MTDPs is another major weakness. This can be attributed to the climatic conditions of semi-arid regions that have caused MTDPs to focus on other agriculture activities. Yet, given the appropriate technology and investments, the region can utilize fishing and aquaculture as a potential to provide alternative livelihoods, especially for households living in proximity to rivers in the region. Herein lies the relevance of the science-policy interface (*see* Stringer and Dougill 2013), where local authorities can partner and engage researchers to identify appropriate technology (Dinesh et al. 2018, p. 8) to harness the potential of rivers that transect the region for fishing and aquaculture. Such partnerships should include NGOs and Community-Based Organizations—many of which are already practicing some form of CSA. While such multi-stakeholder science-policy platforms have been identified at the national level in Ghana and other countries (Zougmore et al. 2019, p. 367), it is equally important for similar platforms to occur at the local level as they play key roles in CSA mainstreaming in Africa. Furthermore, despite the advantages of GMOs for addressing climate change impacts on agriculture (Heisey and Day-Rubenstein 2015, p. 5), this was visibly and completely missing in all the MTDPs. This is because, currently, there are no policies or regulatory frameworks for the adoption and utilization of GMOs in crop and livestock production in Ghana. This gap, while not peculiar to Ghana, underscores the relevance of institutional environments such as legal and regulatory frameworks (Heisey and Day-Rubenstein 2015, p. 15) for CSA mainstreaming at both the national and local levels (Harvey et al. 2014, 84; Zougmore et al. 2016, p. 13).

Table 9 Mainstreaming scores for CSA of MTDPs in the Upper West Region

Parameters	Indicators	Score	Percent- age score (%)	Mainstreaming
Climate Change Profile	Climate trends—past, present, future	11	50.0	Weak
	Climate change impacts	20	90.9	Very strong
Climate-Smart Agriculture and problematization	Problems/priorities of water management	14	63.6	Moderate
	Problems/priorities of climate-smart livestock production	13	59.1	Weak
	Problems/priorities of climate-smart crop production	16	72.7	Strong
	Problems/priorities of climate-smart soil and land management	11	50.0	Weak
	Problems/priorities of climate-smart forestry	15	68.2	Moderate
	Problems/priorities of climate-smart fisheries and aquaculture	10	45.5	Poor
	Problems/priorities of genetic resources for food and agriculture	NA	NA	NA
	Problems/priorities sustainable food systems and value chains	12	54.5	Weak
Development Programs on CSA	Clear goals related to CSA priorities or problems	17	77.3	Strong
	Clear objectives for each goal related to CSA priorities or problems	18	81.8	Very strong
	Clear strategies for goals and objectives related to CSA problematization	18	81.8	Very strong
Projects on CSA (Focus on projects identified in the Program of Action)	Projects on water management	14	63.6	Moderate
	Projects on climate-smart livestock production	11	50.0	Weak
	Projects on climate-smart crop production	17	77.3	Strong
	Projects on climate-smart soil and land management	12	54.5	Weak
	Projects on climate-smart forestry	12	54.5	Weak
	Projects on climate-smart fisheries and aquaculture	7	31.8	Poor
	Projects on genetic resources for food and agriculture	NA	NA	NA
	Projects on sustainable food systems and value chains	15	68.2	Moderate
	Identifies implementation period for annual projects	19	86.4	Very Strong
	Identifies funding sourcing annual projects	14	63.6	Moderate
	Identifies implementation agencies annual projects	16	72.7	Strong
Monitoring, Evaluation; and Communication Plan	Identifies clear strategies to monitor and evaluate CSA projects	15	68.2	Moderate
	Identifies clear strategies to disseminate information about CSA	13	59.1	Weak

Goals, objectives, and strategies related to CSA diverged from findings on climate trends and problematization of the agriculture sector in the MTDPs—with the majority of the plans having very strong mainstreaming. While this illustrates mainstreaming strength, a careful examination of the goals, objectives, and strategies in the MTDPs shows they were adopted directly from the medium-term national development policy framework—*An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All (First Step) 2018–2021*—without localization. For instance, except for the Sissala East MTDP, all other plans adopted the national goal of “*Safe-guard the natural environment and ensure a resilient built*

environment” verbatim (NDPC 2017, p. 144). Again, the only national strategy with direct use of climate-smart agriculture—“*Promote and document improved, climate-smart, indigenous agricultural knowledge*” (NDPC 2017, p. 188)—was adopted verbatim in all MTDPs except for Jirapa and Sissala East Municipalities and Lawra district. Here, awareness about climate change has not resulted in effective localization (Tankha et al. 2020, p. 110) in the MTDPs. The limited contextualization and alignment of agriculture goals with local problems and climate realities can render strategies and projects ineffective when addressing climate change impacts on agriculture. Again, this raises concerns for localization as the CSA agenda

and programs appear to be firmly grounded at the international and national level (Chandra et al. 2018, p. 526) but have not been adequately translated into projects locally (Dougill et al. 2017, p. 31; Tankha et al. 2020, p. 109). Here, Diko (2018, p. 149) draws attention to a need for strengthening the oversight responsibilities of the NDPC in plan preparation processes in Ghana.

Another mainstreaming weakness is a lack of clear identification of climate finance opportunities for CSA projects in the MTDPs (Table 5). While the MTDPs showed strong mainstreaming because they provided sector-related agencies for project funding and implementation—mainly the central government and the local authority (i.e., MMDAs)—the specific funds were unclear. This lack of clarity in sourcing climate funds demonstrates a lack of innovation in attracting alternative funding opportunities by local authorities to address climate change impacts (Diko 2019, 520) on the agriculture sector. Secondly, the omission of climate financing in MTDPs demonstrates the overreliance on central government transfers (Musah-Surugu et al. 2019, pp. 628–629). This overreliance can be detrimental to CSA initiatives in the Upper West Region due to the twin challenges of inadequate funds—owing to competing local projects—and endemic delays in the transfer of statutory funds from central to local governments that plague local development in Ghana (Yeboah and Obeng-Odoom 2010, p. 89). Additionally, the lack of mention of climate finance in the plans can be attributed to an absence of clarity on how climate finance opportunities can be accessed by local authorities in Ghana (Diko 2019, p. 520; Musah-Surugu et al. 2018, p. 73). While the three national CSA documents (*see* Climate-Smart Agriculture in Ghana section) allude to this concern, these reports do not provide any pathways to address this challenge beyond suggesting the existence of climate finance opportunities for local authorities in Ghana. Additionally, while international aid through climate finance arrangements can affect CSA mainstreaming, this influence is still dependent on country-specific institutional arrangements that create the conditions for effective integration of climate change issues at both national and local levels of development planning (*see* Chandra et al. 2018; Harvey et al. 2014; Newell et al. 2018) in addition to ensuring climate financial and budgetary compliance at the local level (*see* Musah-Surugu et al. 2018). Hence, in the absence of explicit climate financial arrangements by the Government of Ghana—information about available bilateral, multilateral, and private-sector climate finance—local authorities will continue to be constrained in linking their CSA interventions to climate finance opportunities.

The CSA mainstreaming challenge in the MTDPs in Ghana can be traced to the limitations of nationally

mandated plans and their guidelines. While in the absence of such mandates and poor institutional capacity, development planning authorities in Ghana might not be able to prepare MTDPs, such mandates and their guidelines are not adequate for mainstreaming important development issues (Diko 2018, p. 149; Norton 2005, p. 61) such as climate change at the local level. Here, the capacity deficit is reflected in a problematic way in the sense that downscaling from national blueprints to local context is not explicit in guidelines for the preparation of the MTDPs—further consolidating the need for strengthening the oversight and compliance responsibilities of Ghana's NDPC. Thus, while the NDPC guidelines stipulate the mainstreaming of cross-cutting issues such as climate change into MTDPs, findings reveal how limited the guidelines are in promoting CSA mainstreaming. Again, nationally mandated plans and their guidelines also create “look-alike plans” (Bunnell and Jepson 2011, p. 342) that are “incomprehensible when considered as an entity... [since]... it is very difficult to grasp ‘the big picture’ of what is planned” (Anderson 1995, p. 17). In this study, there were transitional gaps from problematization to CSA goals, objectives, and strategies to project formulation in the MTDPs. For West African countries like Ghana, such transitional gaps are aggravated by the poor conceptual understanding of climate-related concepts like CSA among policymakers (Partey et al. 2018, p. 292). Therefore, for CSA mainstreaming, the guidelines for preparing MTDPs should point local authorities to resources on climate assessment and information systems, CSA principles and techniques, climate finance opportunities, and also build the capacity of MMDAs to utilize these resources when preparing their MTDPs.

Overall, a reconsideration of climate adaptation planning processes must reflect the context-specific realities of semi-arid regions. With its unique climate vulnerabilities, CSA can contribute to its climate adaptation and resilience. With the high level of awareness of climate change, the development of capacity (i.e., human and financial) for planning is critical if CSA is to be effectively and efficiently mainstreamed into local development plans in semi-arid regions. For this reason, new institutional arrangements that come with funding opportunities and robust human resource capacity are necessary for mainstreaming adaptation measures such as CSA into development planning (Atanga et al. 2017, p. 221; Partey et al. 2018, p. 293; Zougmore et al. 2016, p. 13) processes in semi-arid regions.

7 Implications for socio-ecological practice research

This paper looked at how CSA is reflected in the content of local development plans. As outputs of the development planning processes, local development plans provide

insights into how “human actions and social [and institutional] processes take place in specific socio-ecological context” (Xiang 2019, p. 7). Indeed, various studies have called for an understanding of the institutional dimensions of CSA mainstreaming in addressing climate change impacts in different socio-ecological systems—such as agriculture production in semi-arid regions. Findings from this research contribute to this knowledge gap by providing evidence of the level CSA mainstreaming into local development plans. It demonstrates how local development plans—referred to as MTDPs in Ghana—fail to effectively connect climate change impacts to CSA practices in a semi-arid region of Ghana. Since CSA provides a way to mobilize political support, promote sustainable agriculture production, increase farmers’ income, and build their adaptive and resilience capacities to climate change impacts, the current practices of CSA in the local development plans can render proposed strategies and projects ineffective, inefficient and counter-productive, thereby increasing the risks and vulnerabilities of the socio-ecological system within which CSA is practiced.

Subsequently, the strong momentum of CSA at the global level and in national development plans needs to be channeled and contextualized locally where the impacts and response to climate change take place. Climate-smart agriculture mainstreaming in local development plans with particular attention to specific socio-ecological contexts is vital to ensure this transition. Therefore, to effectively practice CSA in semi-arid socio-ecological systems, actions, and social processes related to capacity development efforts of local planning authorities in Africa, and elsewhere, are imperative. Such efforts should enable better use of assessment tools, reliable and up-to-date information to explicitly identify the places, people, and agriculture activities at risk of climate change impacts as well as identify and invest in context-specific CSA practices to help build adaptive and resilience capacities against climate change impacts.

The study also reinforces the challenge of localization and the need to address the transitional challenges of national climate policies in the local development plans. It also speaks to the emergent discourse that draws on practice research as a source of knowledge to reveal practical issues in different socio-ecological and institutional contexts. Here, it is clear that while CSA has attained global and national relevance, further research on CSA that empirically engages (in)formal local development actors, practitioners, and community perspectives is necessary to contribute to building the needed knowledge on effective and efficient mainstreaming and localization practices. As this study only focused on a review of existing local development plans, future studies must understand the knowledge and level of awareness

of key socio-ecological practitioners such as government officials and local planners regarding CSA practices at the national, regional, and local levels. Also, empirical studies that contrast CSA planned activities against what exists, and their outcomes, in different socio-ecological contexts are necessary for providing additional insights for policy and practice in Africa and beyond.

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Declaration

Conflict of interest The authors declare that there are no conflicts of interest.

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