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Mainstreaming climate adaptation into sectoral policies in Central Africa: Insights from Cameroun.

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Abstract

While considerable advances have been made in mainstreaming climate adaptation into sectoral policies in most regions across Africa, little is known about Central Africa (CA) even though the sub-region has enormous potentials to mitigate greenhouse gas emissions through the Congo basin forest. This paper presents an in-depth analysis of the progress made in mainstreaming climate adaptation into sectoral policies in CA based on insights from Cameroun. To achieve this, 30 strategic policy documents published by the government of Cameroun covering different aspects of climate adaptation were exploited. Additional information was obtained from interviews with 27 stakeholders working in relevant government ministries/institutions and international organizations. Results show that significant progress has been made to mainstream climate adaptation into the forestry and energy sectors. This has been facilitated by the putting in place of national policies that consider climate change impacts and mitigation/adaptation in these sectors. Meanwhile, little progress has been recorded in the water and agricultural. The lack of progress in these sectors can be attributed to the absence of national policies that take into account climate change impacts in these sectors. Overall results show that the National Adaptation Plan of Action has played a key role in enhancing the mainstreaming of climate adaptation into sectoral policies in Cameroun. Notwithstanding the progress recorded, many obstacles such as the lack of human and financial resources still exist. Stakeholders proposed a series of potentially useful solutions to tackling obstacles hindering cross-sectoral mainstreaming initiatives. This paper contributes to contemporary debates on the extent to which adaptation mainstreaming is happening at national level in sub-Saharan Africa, and reveals the obstacles that need to be addressed in order to sustain this initiative in CA and other regions of the continent.

Keywords: Climate change; mainstreaming climate adaptation; sectoral policy; Cameroun; Central Africa

1 Introduction

The challenge of adapting to climate change and variability is not new given that people and communities have lived with climate variability for a long time, and have developed management

decisions to cope with it (Berrang-Ford *et al*, 2011). However, the ways in which societies have adapted to date, and the range of adaptation mechanisms, may not be sufficient to deal with the new challenges posed by climate change such as increased extreme flood events (Levine *et al*., 2011). Societies most vulnerable to climate change are also those that are very sensitive to climate perturbations and least able to adapt to a changing climate and other stressors including development pressures (Levine *et al*., 2011).

While there is still uncertainty on the magnitude of climate change, there is high confidence that the global climate is changing (Dessai *et al*., 2013). Therefore, better informed and more drastic sequences of adaptation measures may be needed to substantially improve the living conditions of communities. In fact, the need to adapt to climate change is now widely recognised as evidence of its impacts on social and natural systems keep increasing and greenhouse gas (GHGs) emissions continue unabated (Wise *et al*., 2014). This has brought climate change adaptation to the forefront of most scientific enquiries and sectoral policy negotiations (Tchakert and Dietrich, 2010; Dessai *et al*., 2013; Ampaire *et al*., 2017; Epule *et al*., 2017; Okpara *et al*., 2018).

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities" (IPCC, 2007, p. 869). The urgency associated with adaptation is how it can be facilitated, supported, planned and sustained.

Although sectoral adaptation planning may be constrained by uncertainties inherent in both climatic and non-climatic drivers, the timing of impacts and their spatial distribution and adaptation plans will generally be accepted if society can benefit from such plans, including the reduction of climate impacts (Wilby *et al*., 2010). There are many scales and actors involved in sectoral adaptation processes ranging from individuals in response to climate extremes to governments on behalf of society, sometimes in anticipation of change or in response to a socio-natural hazard. Adaptation therefore involves the interdependence of agents through their relationships with each other, with the institutions in which they reside, and with the resource base on which they depend (Adger, 2003). Institutions play a key role in climate adaptation because understanding the institutional dimensions of climate change adaptation is crucial to mainstreaming climate adaptation into sectoral policies (Cuevas, 2018).

To meet the challenges of promoting inclusive and sustainable development while adapting to the impacts of climate change and mitigating against further warming in line with the Paris Agreement and the Sustainable Development Goals (SDGs), there is a need to mainstream climate adaptation into all sectors and institutions/organs of government (England *et al*., 2018). This is especially so in regions

where people, communities and sectors face the greatest climate-related threats (MEA, 2005) under conditions of institutional weaknesses (Jones *et al*., 2009).

Whilst considerable progress has been made in mainstreaming climate adaptation into sectoral policies in East and West Africa (Lauer and Eguavoen, 2016; Alhassan and Hadwen, 2017; Ampaire *et al*., 2017; Pardoe *et al*., 2017), little is known about the Central Africa (CA) sub-region (i.e. Cameroun, Central Africa Republic, Chad, Equatorial Guinea, Gabon, Congo, Democratic Republic of Congo). Paradoxically, this sub-region is home to the Congo basin forest, which is the second largest rain forest in the world after the Amazon (Tiani *et al*., 2015; Bele et al., 2011). A recent study has revealed that the Congo basin harbors the most extensive tropical peatland complex at ca. 145,500 km^2 with an estimated 30.6 Petagram (Pg) of carbon stored in these peatlands (Dargie *et al*., 2017). The sub-region offers enormous potentials for global initiatives to mitigate climate change through different forest conservation initiatives and also to improve the livelihoods of people living in and around the Congo basin (Brown *et al*., 2011; Dargie *et al*., 2018). However, the state of climate adaptation in the sub-region is not known; and Ludwig et al. (2014) reported that out of 517 peer reviewed articles published on regional climate adaptation initiatives in Africa, only 14 covered countries in this sub-region.

2 Theoretical framework

Mainstreaming involves the articulation of information, policies and measures into ongoing development planning and decision-making to address climate change; considering that it is easier to start with existing policies and practices, rather than creating new ones (Lebel *et al.,* 2012; Ayers *et al*., 2014). Through this concept, climate risks can be easily incorporated into policy and practice to support short and long-term development planning. The mainstreaming concept is not new given that it has been used to address other global issues such as gender inequality, poverty alleviation, millennium development goals, and HIV/AIDS (Kabeer, 2003; Lebel *et al.*, 2012). The concept is widely used in climate adaptation is because climate change is a cross-sectoral challenge that poses significant risk to many development sectors and hence cannot be addressed in isolation (Vincent and Colenbrander, 2018).

There are many benefits that can be derived from mainstreaming climate adaptation into sectoral policies such as; increasing coherence and synergies across different sectors to achieve adaptation goals, reducing duplication and cost of "adaptation" implementation, and minimizing the degree to which adaptation policies contradict each other (Alhassan and Hadwen, 2017). The concept has been applied to address climate adaptation in different sectors such as disaster management (Heazle *et al.*, 2013), development issues (Sietz *et al.,* 2011; Ayers *et al.,* 2014; Lauer and Eguavoen, 2016), integrated water

resources management (He, 2013), and water and sanitation development planning (Alhassan and Hadwen, 2017). The wide application of the mainstreaming concept in climate adaptation in different sectors therefore provides an opportunity to examine to what extent climate adaptation has been mainstreamed into the water, agriculture, forestry and energy sectors in the CA sub-region and how it can be enhanced.

This paper addresses the following questions: (i) to what extent has climate adaptation been mainstreamed into sectoral policies; (ii) what are the constraints impeding adaptation mainstreaming; (iii) what steps are needed to address inherent constraints/obstacles in order to facilitate adaptation mainstreaming across sectoral policies. This article contributes to existing studies (focusing on adaptation mainstreaming) by highlighting the progress made by the government of Cameroun and the challenges that need to be addressed to support climate adaptation mainstreaming into different sectoral policies. Furthermore, through this kind of analysis important lessons can be learnt for informing future research on adaptation mainstreaming in the other countries of CA sub-region and beyond.

>>>>>>>>>>>>>>>> **Insert Figure 1**>>>>>>>>>>>>>>>>>>>>>>

3 Methodology

3.1 Study area

The Republic of Cameroun (Figure 1) is a democratic country situated in the Gulf of Guinea between West and Central Africa and stretches to Lake Chad. It is bounded on the West by Nigeria, on the North East by Chad, on the East by Central Africa Republic and by Gabon, Equatorial Guinea, and Republic of Congo in the South. The country has a total surface area of about 475,650 km^2 (Alemagi *et al*., 2014).

Monsoon circulation is the main source of rainfall in Cameroon with the coastal areas receiving the highest amount of rainfall with annual totals sometimes above 3850 mm/year while the northern part receives the lowest amount of rainfall ranging between 600-1500mm/year (UNDP, 2010). There are four main agro-ecological zones in Cameroun (Sudano-Sahel, Savanna, Coastal and Maritime, and Forest) (UNDP, 2010). Agriculture is the backbone of country's economy, accounting for about 41% of its Gross Domestic Product (GDP) (World Bank, 2007) and employing more than 55% of the workforce (WRI, 2007). It is mostly rain-fed thus exposing this sector to climate variability and risks of future climatic changes.

According to Ayonghe (2001) temperatures have increased in Cameroon since the 1930s with a net increase of 0.95ºC between 1930 and 1999. Although it is projected that temperatures will continue to rise across the country due to climate change, there is no consensus among climate models on the

projected mean annual rainfall in Cameroon, however, heavy precipitation events are expected to increase (Crawford *et al*., 2011). There is therefore need to fast-track the mainstreaming of climate adaptation into sectoral policies so that the risk pose by climate change and variability can be reduced to a minimum while exploring other opportunities that could arise from this change.

In this study, water resources, agriculture, forestry and the energy sectors were selected to examine to what extent climate adaptation has been mainstreamed in these sectors based on the following reasons: Firstly, previous studies in the sub-region have revealed that water resources in the region are very vulnerable to climate change especially in the Sudano-sahel areas (Nkiaka *et al*., 2017a; Nkiaka *et al*., 2017b; Nkiaka *et al.,* 2018). Due to this vulnerability, many researchers have advocated that climate adaptation should be mainstreamed into water governance at the sub-regional level (Okpara *et al*., 2018). Secondly, like the rest of Africa, agriculture is the primary sector that supports the livelihoods of millions of people in the sub-region and it is mostly rain-fed thus, exposing it to the vagaries of weather and climate change (Sultan and Gaetani, 2016). Furthermore, it has been argued that the agricultural sector holds the key to achieving the SDGs including mitigation agendas in fragile regions (England *et al*., 2018). Thirdly, the sub-region's energy sector has great potentials for hydropower development in the continent with an overall potential of 133 GW (Kenfack *et al*., 2017). Even though hydropower plays an important role in climate change mitigation through the reduction of greenhouse gas emissions, it is also very vulnerable to climate change (Wang *et al*., 2014; Berga, 2016). Lastly, the sub-region's forestry sector offers enormous potentials for global initiatives to mitigate climate change through different forest conservation schemes in the Congo basin (Brown *et al*., 2011; Dargie *et al*., 2018).

Cameroun was selected as the case study for this research because a number of adaptation initiatives have been reported in Cameroun and the country has also benefitted from some adaptation finances (UNDP, 2010; Ford *et al*., 2015; Nachmany *et al*., 2015). In addition the country has the highest number of published peer reviewed articles relating to climate adaption compared to other countries of the sub-region (Ludwig *et al*., 2014), offering the opportunity to explore a broad base literature on the theme of this study. More so, over the years Cameroun has earned the reputation of being a "laboratory" for institutional reforms in Central Africa (Atyi et al., 2013).

>>>>>>>>>>>>>>>>>**Insert Table1** >>>>>>>>>>>>>>>>>>

3.2 Research method

The research strategy adopted in this study was an in-depth qualitative method involving the analysis of strategic policy documents published by the Government of Cameroun; complemented by

semi-structured interviews with key stakeholders in relevant government ministries/institutions and organizations working in partnership with Cameroun to mainstream climate adaptation into sectoral policies.

Analysis seeks to ascertain whether mainstreaming climate adaptation was considered in the strategic policy documents published by the government in the water, agriculture, forestry and energy sectors aimed at addressing climate change. Mainstreaming is considered to occur when (i) climate change adaptation/mitigation is mentioned in the policy document(s); and (ii) specific actions are included to account for and enable the mainstreaming of climate adaptation. In this study, sectoral policy refers to any initiatives or projects put in place by government aimed at mainstreaming climate adaptation in water, agriculture; or mitigation goals in the forestry and energy sectors. Policy documents highlighting sector-specific initiatives or projects put in place through the technical assistance of development partners (e.g. World Bank, United Nations Development Program, World Conservation Union, and Global Water Partnership) aimed at addressing climate change were also consulted.

Document analysis followed a systematic procedure with focus to examine how climate adaptation/mitigation has been mainstreamed into sectoral policies since 1994 after the country ratified the United Nations Framework Convention on Climate Change (UNFCCC). Systematic procedure employed consists of searching and synthesizing research evidence on the state of knowledge on a given topic or based on research questions, an approach that has previously been used mostly in health sciences although it has started receiving significant attention within the climate science community (Grant and Booth, 2009; Epule *et al*., 2017; Okpara *et al*., 2018).

Sectoral documents were systematically analyzed through "keyword searches" to identify and isolate texts indicating specific climate-related problems and adaption actions. Keywords used include: 'climate/climatic change adaptation', 'drought', 'flood', 'mitigation' 'environmental protection', 'environmental education', and 'climate change communication'. Keyword searches led to detailed reading of selected documents to identify relevant details dealing with policy provisions, including the range of initiatives and action plans proposed. A total of 30 policy documents including the National Adaptation Plan of Action (NAPA) and the Growth and Employment Strategic Paper were included in the review (Table 1). In total three documents were available from the water sector; one from the agricultural sector; three from the forestry sector and five from the energy sector were reviewed. NAPA was used to identify the specific adaptation actions each sector should focus on. Considering that mainstreaming climate adaptation cannot occur in a vacuum, policy documents that facilitate the mainstreaming of climate adaptation either directly or indirectly were also consulted targeting

198 specifically to understand; (i) how the government organizational structure has been re-configured to
199 accommodate climate change and environmental protection; (ii) how information related to climate
200 change is disseminated to the general public; (iii) how new academic departments have been created
201 and educational curriculum re-adapted to accommodate climate change and environmental education;
202 and (iv) how climate change adaptation is funded and the various constraints involved. In fact the role
203 of institutions and their configuration, information dissemination and education in enhancing climate
204 adaptation cannot be overemphasized.

205 To provide additional information not captured in the selected documents, analysis was
206 complemented by semi-structured interviews with stakeholders working in different capacities (13
207 government officials, 4 academics, 4 NGO experts, 2 civil society actors and 4 experts working with
208 international organizations) (Table 2). To identify potential interviewees, a broad inventory of
209 institutions responsible for mainstreaming climate adaptation/mitigation into sectoral policies either
210 directly or indirectly was carried out using two criteria; (a) function; and (b) knowledge and abilities.
211 The function criterion refers to institutions that are formally responsible for climate change issues and
212 include government departments that prepare policy, legal and regulatory documents in the area of
213 environment and climate change. The knowledge and abilities criterion refers to institutions that have
214 relevant knowledge and skills related to climate change. Contacts were established between the
215 researcher and permanent secretaries in the identified ministries/institutions. The permanent secretaries
216 then established links between the researcher and the different directors and staff in the
217 ministries/institutions responsible for mainstreaming climate adaptation policies in the different sectors
218 considered in this paper. The same approach was used to establish links between the researcher and staff
219 working with international organizations by first contacting the head of each organization; while the
220 lecturers interviewed during the study were contacted directly by the researcher. A snowball sampling
221 technique (Atkinson and Flint, 2001) was also employed to identify other interviewees.

222 This study was not aimed at investigating implementation effectiveness of sectoral policies on
223 the ground[1]. The study was limited to Yaoundé the capital of Cameroun which is the seat of government
224 institutions where policies are developed. The interview questions were framed to cover the main issues
225 and sectors under investigation (agriculture and food security, water resources, energy, forestry) and all
226 interviewees were asked the same questions. Among the government officials interviewed, five were
227 selected from the Ministry of Environment, two from the Ministry of Energy and Water Resources, two
228 from the Ministry of Agriculture, two from the Ministry of Forestry, and one each from the Ministry of

[1] Policy implementation is considered in this study as a potential area for future research.

Scientific Research and the Ministry of Public Contracts (Table 2). The interviews were conducted mostly in English and took place from October 24th to December 23rd 2016 and were audio recorded and later transcribed and coded. The participants interviewed were stakeholders actively involved in climate change issues at different capacities within their respective ministries/institutions and a total of 27 stakeholders were interviewed. (See Table 2 for a complete list of experts and their affiliations).

>>>>>>>>>>>>>>>>>**Insert Table2** >>>>>>>>>>>>>>>>>>

4 Results

4.1 To what extent has climate adaptation been mainstreamed into sectoral policies?

Cameroun's response to climate change and environmental protection is reflected in the country's national policies and the inclusion of climate adaptation within key development plans (Nachmany *et al*., 2015). The country developed its first National Adaptation Plan of Action (NAPA) in 2005 which was later updated in 2015 to accommodate new challenges aligning with the socio-economic vision set out in the Growth and Employment Strategic Paper (GESP). The NAPA elaborates the framework directives to guide the future coordination and implementation of adaptation initiatives across different sectors. The revised NAPA published in 2015 takes into account many areas of intervention including: agriculture, fishery, forestry, water, energy, urban infrastructure, tourism, education and scientific research, rural economy, telecommunications, gender and protection of vulnerable populations (MINEPDED, 2015).

4.1.1 Forestry Sector

In the forestry sector, Cameroun put in place a national policy for sustainable forest management and biodiversity conservation in 1996 (MINEP, 1996). Under this policy, many protected areas have been created across the country as well as many forest regeneration projects and some three million trees have been planted according to experts in the Ministry of Forestry. Furthermore, as of 2007, the surface area covered by protected areas and forest reserves in Cameroun was about 30% of the 19.631 million hectares of total forest area in the country (Alemagi *et al*., 2014). Many other protected areas classified as forest reserves, wildlife sanctuaries, national parks and zoos have also been created (Lambi *et al*., 2012). In fact, it is well recognized that protected areas play a significant role in the mitigation of global climate change through carbon sequestration (Melillo *et al*., 2016). Apart from climate mitigation, protected areas can also contribute to climate change adaptation by helping reduce the impacts of climate change-induced natural disasters such as floods, landslides, hurricanes, tidal waves and storm surges.

Furthermore, verification and certification in forest exploitation is compulsory in Cameroun and the country has signed the Voluntary Partnership Agreement (VPA) of the European Union's Forest Law Enforcement, Governance and Trade (FLEGT) program and African Forest Law Enforcement and Trade (AFLEG) (Savilaakso *et al*., 2017; Tegegne *et al*., 2017). The introduction of forest certification schemes has led to positive changes in management practices and increased social and environmental performance potential and could contribute to the sustainable management of forest resources in Central Africa (Atyi et al., 2013). It is reported that through such innovations in governance and cooperative action among multiple stakeholders, the rate of deforestation have been reduced while at the same time allowing continued economic growth (Chow *et al*., 2013). Hence, protected areas help in climate change adaptation by simultaneously reducing poverty, protecting biodiversity and ecosystems services, and removing atmospheric greenhouse gases (Scarano 2017).

Cameroon is a member of two multilateral REDD+ initiatives: the Forest Carbon Partnership Facility (FCPF) of the World Bank and the UN's Collaborative Programme on Reducing Emissions from Deforestation and forest Degradation in developing countries (UN–REDD) and through such initiatives, several REDD+ projects are at the development or implementation stage in Cameroon (Tegegne *et al*., 2017).

Therefore, by putting in place a national policy for sustainable forest management, creating many protected areas, signing the VPA, FLEGT and AFLEG cooperative agreements and joining several multilateral initiatives such as REDD+, the government of Cameroun has directly or indirectly mainstreamed climate adaptation into the forestry sectoral policies. Through such initiatives, Cameroun has contributed to significantly reduce the rate of illegal logging and deforestation and contributed to sequester significant amounts of carbon which are efforts aimed at mitigating global climate change using forest conservation.

Other actions that indicate adaptation mainstreaming in this sector include the "Operation Green Sahel" that was launched in 1980 as a strategy to stop the advancement of the desert, prevent and reduce soil degradation in arid and semi-arid areas and restore degraded lands. Although this initiative was stopped due to economic crisis, it was re-launched in 2008 and aims to plant more than 10 million trees across the country (MINEP, 2004). This initiative is considered by government officials as part of Cameroun's contribution to mitigate climate change and is fully funded by the Public Investment budget since 2008 (MINEPDED, 2015).

Other forest related policies that draw from the National Adaptation Plan of Action include; (i) the putting in place of a forest fire monitoring, prevention and early warning system; (ii) increase

scientific research activities to characterize the positive and negative effects of climate change on forest ecosystems; (iii) support and reinforce the implementation of REDD+ initiatives by involving the local communities; and (iv) develop social indicators to monitor the well-being of the population living around protected areas.

At the sub regional level Cameroun is a founding member of the Forestry Commission of Central Africa (COMIFAC), member of the Congo Basin Forest Partnership (CBFP), and the Conservation and Rational use of Central Africa Forest Ecosystems (ECOFAC) (MINEP, 2004). The different initiatives indicate that Cameroun has made significant progress aimed at mainstreaming climate adaptation/mitigation in the forest sector.

4.1.2 Energy Sector

The country focus in this sector is mainly on the development and modernization of the energy sector. The main climate adaptation policy mainstreamed in the energy sector revolves around the promotion of the use of renewable energy and enhancing energy efficiency in the country; and to also facilitate the use of renewable energy within the context of expanding rural electrification (ARSEL, 2014). Under this policy, several rural electrification projects using renewable energy sources have been executed in the country (Kenfack *et al*., 2016). Since the 2012 financial year, the importation of solar or wind energy installation and operating equipment are exempted from value added tax (ARSEL 2014). This policy is intended to encourage the importation of renewable energy equipment as part of the national energy policy and strategic action plan aimed at increasing the resilience of Cameroun's energy sector to climate change and variability (MINEE, 2006). Renewable energy can enhance climate change adaptation by providing energy to power early warning systems, telecommunication systems, health clinics and portable water systems in rural areas (Ley, 2017).

Other policies in the energy sector are articulated in NAPA and include; (i) diversification of energy sources in the context of climate change; (ii) construction of new hydropower dams and rehabilitation of existing ones; (iii) encourage the use of renewable energy and enhancing energy conservation through new technologies. In fact, the role of hydropower production in mitigating greenhouse gas emissions cannot be overemphasized, which can explain why many hydropower projects are under execution in Cameroun including; Lom-Pangar dam, Mvele hydro-power project, Mekin hydro-power project, Bini à Warak hydro-power project, and Ngodi hydro-power (MINEE, 2015; ARSEL, 2017). This vision is also outlined in the GESP in accordance with the recommendation of the World Bank. The strategy is to stimulate the development of hydropower to lower electricity cost, reduce carbon emissions and insulate sub-Saharan African countries from increases in the price of fossil fuels

(World Bank, 2009). Such policy initiatives are also geared towards reducing the country's carbon footprint through the use of renewable energy (World Bank, 2009). Hydropower dams reduce the impacts of climate change on water resources because regulated basins with large reservoirs are more resilient to water resources changes, less vulnerable to climate change and also act as storage buffer against climate change (Berga 2016).

In the area of biomass consumption, Cameroun is engaged in a process to freely distribute improved fuel-efficient cooking stoves to local communities to reduce pressure on the cutting down of trees for firewood (MINEE, 2015). This project is financed by Carbon revenues and is facilitated in the country by CO2balance and the African Centre for Renewable Energy and Sustainable Technology (ACREST) (Muthiah, 2014). Such initiatives also enhance climate change adaptation by simultaneously reducing poverty, protecting biodiversity and ecosystems services, and removing atmospheric greenhouse gases (Scarano, 2017). Our analysis show that substantial progress has been made to mainstream climate change adaption in the energy sector in Cameroun.

4.1.3 Water sector

The law governing the water sector adopted in 1998 recognizes water as a national good that is not infinite and needs to be protected and managed efficiently. In the absence of a national water policy in Cameroun, integrated water resources management (IWRM) is recognized as a starting point to mainstream policies on the sustainable management of water resources under a changing climate (MINEE, 2009). The vision in the IWRM action plan is to; (i) make water accessible to all citizens; (ii) preserve natural ecosystems which are dependent on water; (iii) increase agricultural production and reduce food insecurity through the efficient management of water resources (MINEE 2009; GWP, 2010).

However, to improve the sustainable management of water resources in a changing climate, the goals set out in NAPA that mainstream climate adaptation in the water sector include; (i) reduce socio-economic vulnerability to climate change through the rational management of water resources; (ii) reduce the exposure of the population to health risk posed by climate change by upgrading urban drainage infrastructure; (iii) continue to collect relevant hydro-meteorological data that can enhance research and pursue capacity building in research institutions to understand the occurrence of extreme events and how they can be predicted in real time; (iv) continue to fight against desertification and develop water harvesting infrastructure in arid areas; (v) put in place an early warning and health surveillance system for water borne diseases; (vi) reinforce the treatment and prevention of water-related diseases that may become recurrent as a result of climate change.

At the regional level, Cameroun has adhered to numerous policies, strategies and plans that promote the mainstreaming of climate adaptation in the development and management of water resources including; United Nations Framework Convention on Climate Change (UNFCCC), African Water Vision, African Union Sharm el-Sheikh Declaration on water and sanitation, strategic framework for water security and climate resilient development, regional water policy of Economic Community of Central African States (2009), the financing strategy for the water sector in Central Africa (2010), the 2025 development vision of the Lake Chad Basin Commission (LCBC), the Lake Chad Basin Strategic Action Program (2008), the Congo-Oubangui-Sangha River Basin Strategic Action Plan. The Government of Cameroun has also adhered to numerous international agreements in the area of water security and climate resilient development all aimed at mainstreaming climate adaptation in the water sector (GWP 2014). Yet, adaptation has not been mainstreamed in this sector due to numerous constrains enumerated in section 4.2 below.

4.1.4 Agricultural Sector

A national strategy for the development of agricultural sector was put in place in 2006. Although mainstreaming climate adaptation is not explicitly considered in that policy document, the main goals in the strategic plan that are relevant to climate adaptation include; (i) to develop a sustainable agriculture and food supply system; (ii) enhance the sustainable management of natural resources; (iii) develop adapted financial mechanisms in the sector; (iii) manage the risk of food insecurity; and (iv) develop an adapted institutional framework for the agricultural sector.

Through NAPA, Cameroun intends to mainstream climate adaptation in the agricultural sector to make its agricultural system resilient to climate change and improve the adaptive capacities of the various actors in this sector. To achieve these goals, the following policies are envisaged to be mainstreamed in the farming sub-sector; (i) provide weather and climate information services to rural communities through community radios to help farmers plan farming activities; (ii) improve farming systems by enhancing agronomic research and put in place a national strategy to disseminate research results; (iii) promote adaptation process through the use of improved crop varieties, improve soil management for nutrient and water conservation and promote the use of fertilizer to increase yields; (iv) agricultural diversification to reduce vulnerability by promoting agroforestry in the different agro-ecological zones; (v) free distribution of farm inputs to smallholder farmers; and (vi) update the land tenure policy to address gender imbalance to ensure that women can easily access land for agricultural purposes.

391 In the agro-pastoral sub-sector; (i) provide weather and climate information services to
392 pastoralists using community radios; (ii) rehabilitate existing weather stations to observe the evolution
393 of climate and its impact on livestock; (iii) develop community water points for cattle and put in place
394 village committees to manage these water points; and (v) develop an agro-pastoral policy that takes into
395 account climate adaptation.
396 In the fishery sub-sector; (i) provide weather and climate information services to the fishermen
397 using community radios; (ii) improve the management of fishing and aquaculture activities around dams
398 to improve the exploitation of different fish species to avoid scarcity; and (iii) promote the creation of
399 community fish ponds and develop new techniques to improve the treatment, drying and conservation
400 of fishery products. All these initiatives are aimed at enhancing adaptation to climate change and show
401 that country has good intentions to mainstream climate change adaptation in the agricultural sector.
402
403 **4.2 What are the constraints impeding adaptation mainstreaming?**
404 Notwithstanding the substantial that have been made by Cameroun to mainstream climate
405 adaptation into sectoral policies, majority of the stakeholders interviewed recognised that there are still
406 numerous challenges that impede the mainstreaming initiative in the country. Generally, information
407 about the impacts of climate change is not easily accessible from the general public. Analysis revealed
408 also that collaboration among government institutions, NGOs and the local communities is very limited
409 (UNDP, 2010).
410 In the area of communication, the government recognizes that despite many communication
411 channels put in place, climate information is generally insufficient especially at the regional and local
412 levels and not well coordinated given that local authorities are not well informed (MINEPDED, 2015).
413 Brown and Sonwa (2015) also reported that, there is lack of information on climate change adaptation
414 among government officials working at the regional and sub-regional level thus limiting their capacity
415 to help the local communities to gain access to climate information. This lack of information by the
416 general public has been attributed to a lack of government policy to enhance the dissemination of climate
417 information to the general public (Egan, 2013). For example one stakeholder lamented that many
418 websites created to provide information to the general public are not regularly updated and access to
419 internet is still very low and costly. Furthermore, lack of logistical support, insufficient information and
420 training among journalists discourage private media organs from reporting issues related to climate
421 change (Tiani *et al*., 2015).
422 Even with the existence of relevant academic departments in some universities in the country,
423 during the interviews, many stakeholders were frustrated that most climate impact research is conducted

in foreign institutions. They lamented that although such research may be recognized globally because it is published in peer reviewed journals, it may lack policy uptake because it may fail to address priority areas pertinent to policy makers in Cameroun. Stakeholders in the academia also expressed frustration on the lack of resources and relevant climate data needed to carryout impact studies. They also decried the absence of collaboration between scientists and policy makers.

Even though the government has elaborated a national strategy to integrate courses/modules and training programmes on climate change into formal educational systems, environmental education is absent in the curriculum of teachers training colleges in Cameroun (MINEPDED, 2012). Consequently, teachers lack the capabilities to train pupils/students in the area of climate change. A similar situation has been observed in journalism training schools which limits the capacity of journalists to report relevant climate issues (Tiani *et al*., 2015).

Although the country is well placed to harness available adaptation funding, a co-ordinated climate change adaptation strategy is needed to ensure that sovereign development projects and climate adaptation projects are not conflated and therefore render ineligible for their separate respective funding streams (Egan, 2013).

Some stakeholders were of the opinion that, the fragmented nature of institutions involve in climate issues sometimes creates instances of overlap and misinterpretation of rules by different institutions resulting to conflict and power struggle among stakeholders. According to them, such situations could lead to a delay in the execution of pilot projects put in place to facilitate climate adaptation mainstreaming into sectoral policies.

Most stakeholders in government ministries decried the absence of resources including basic working materials such as computers, absence of sufficiently trained personnel and financial resources.

4.3 What steps have been put in place to address inherent constraints aimed at facilitating climate adaptation mainstreaming across different sectors?

4.3.1 Institutional Reforms

Generally, institutions and their configurations play an important role in mainstreaming government policies (Koetz *et al*., 2012). In the area of climate adaptation, previous research has shown that institutional arrangement can significantly facilitate the mainstreaming of climate adaptation into sectoral policies (Mubaya and Mafonguya, 2017). Considering this, efforts by the government of Cameroun to include climate change into major policy agendas began in 1994 after ratifying the UNFCCC by creating the Ministry of Environment and Forestry. This ministry was later split into two to create the Ministry of Forestry (MINFOF) and the Ministry of Environment and Nature Protection

(MINEP) in 2005, later renamed Ministry of Environment, Nature Conservation and Sustainable Development (MINEPDED) in 2011. This ministry is responsible for multi-sectoral policy development and implementation in the areas of climate change and environmental protection. Presidential decree N° 2009/410 created and organized the National Observatory on Climate Change. The observatory is responsible for directing climate change impact studies, adaptation research, policy advice, information sharing, and to support national capacity development in this area.

Other institutions that support climate change adaptation/mitigation include the creation, organization and functioning of the Steering Committee to reduce emissions from deforestation, forest degradation, sustainable management and conservation of forest (REDD+) by decree N° 103/CAB/PM. The Committee is responsible for the formulation of proposals for REDD+ strategic action plans, develop selection criteria for REDD+ projects, evaluate REDD+ pilot project proposals, promote REDD+ activities and validate the work of the National Technical Secretariat. In compliance with UNFCCC recommendation, the "Cellule National des Changement Climatiques" (CNCC) was created in the MINEPDED. The goals of CNCC include the creation of a greenhouse gas (GHG) inventory, establishing adaptation measures, implementing an information system and database, designing sectoral projects addressing priority climate actions and evaluating climate change impacts and policies (Nachmany, 2015).

4.3.2 Information dissemination

Under international binding treaties, Cameroun was not expected to prepare a NAPA (UNDP, 2010) as it is not on the list of Least Developed countries (LDCs) but the country opted to do so in partnership with UNDP. Since 2005, the country has prepared and adopted three National Communications (NCs) on Climate Change (MINEPDED 2015).

According to the stakeholders interviewed, the government of Cameroun and her partners acknowledge that the media can influence the perception and attitude of the general public regarding environmental issues especially climate change and as such, many communication channels have been created for this purpose. Dedicated media organs such as Radio Environment was created by the World Conservation Union in Yaoundé in partnership with the government although it does not cover the whole country. Another stakeholder articulated that a network of community radios have been created across the country through the help of UNESCO to facilitate the broadcast of climate information in local languages. Furthermore, UNESCO organizes regular training sessions for local journalists managing these community radio to train them on how to produce and broadcast climate information. Other communication channels that have been put in place to facilitate access to climate information include;

(i) monthly magazine and weekly newsletter of MINFOF; and (ii) many weekly and bi-monthly programs run by Cameroon Radio Television (CRTV) (UNDP, 2010).

4.3.3 Education and Training

The government of Cameroun in partnership with UNDP, has elaborated a national strategy to integrate courses/modules and training programmes on climate adaptation and environmental protection into the formal educational systems (primary, secondary and tertiary) (MINEPDED, 2012). According stakeholders at the Ministry of Environment, the elaboration of this strategic policy document ushered in the inclusion of environmental education into the national education curriculum. Since the adoption of this policy, environmental education has become a regular subject taught in primary and secondary schools across the country (Nchia et al., 2017). Many stakeholders interviewed were unanimous that there was a functional department of Hydrology and Climatology at the University of Maroua, a laboratory of environmental modelling and atmospheric physics hosted by the Physics department in the University of Yaoundé I and a faculty of agronomy and agriculture sciences in the university of Dschang where research on climate change impacts and adaptation are conducted to enhance the mainstreaming initiative.

4.3.4 Adaptation Financing

Scientific analyses have emphasize the significant financial resources and technological support needed to address Africa's current adaptation deficit (Niang et al., 2014). As part of the engagement to fulfil this obligation, multiple climate adaptation projects are currently under execution in Cameroun with most projects aimed at facilitating the mainstreaming of climate adaptation into different sectoral policies (UNDP, 2010). Other projects are in the areas of forest, energy, mangroves, watershed management and developing climate scenarios (Crawford et al., 2011).

Examples of projects that have been executed in Cameroun include; (i) the Africa Adaptation Project and the objective was to strengthen institutional capacities, enhance existing experiences so that climate adaption could easily be mainstreamed into different sectoral policies and was funded by the Japan International Cooperation Agency (JICA); (ii) the Africa Adapt Knowledge Sharing Innovation project which was aimed at strengthening the adaptive capacities of small farming communities jointly funded by the Department for International Development (DFID) and the Natural Environment Research Council (NERC) United Kingdom; and (iii) the Climate Change Adaptation in Africa (CCAA) programme which was aimed at establishing a program on vulnerability and adaptation to climate change in Africa and was co-financed by the International Development Research Centre (IDRC) and

523 the DFID-UK. As a member of the Lake Chad Basin Commission (LCBC), Cameroun has also
524 benefitted from another project entitled "Lake Chad Sustainable Development and Support Program"
525 financed by the Africa Development Bank. Since the approval of Cameroun's REDD+ Readiness Plan
526 (RPP) in 2013, it has benefitted from a readiness grant of USD3.6 million since 2013 (Nachmany *et al*.,
527 2015).
528
529 ## 4.4 Stakeholders' recommendations
530 Despite the difficulties expressed by stakeholders that hinder the mainstreaming of climate
531 adaptation into the water, agriculture, energy and forestry sectoral policies, proposals were made that
532 according them can fast-track the mainstreaming process.
533 In the area of research more than half of the stakeholders interviewed were of the opinion that;
534 while searching for ways to facilitate the mainstreaming of climate adaptation into different sectoral
535 policies, the government should consider the allocation of financial resources to country-based
536 institutions. They argued that such initiatives have the potential to increase the research output from
537 country-based institutions, directly address the needs of the policy makers, increase collaboration
538 between researchers, policy makers, and local communities and could help to upgrade research facilities
539 in the beneficiary institutions and enhance capacity building in those institutions.
540 Other stakeholders cautioned that policy makers should encourage researchers to carry out long-
541 term climate impact studies which are useful for mainstreaming policies aimed at long-term climate
542 resilient development instead of concentrating on short time frames guided by politics and immediate
543 development priorities; considering that the most severe impacts of climate change may become visible
544 only in the long-term.
545 Considering the significant deficit in the number of climate scientists in Cameroun, many
546 stakeholders interviewed proposed that; to raise awareness among pupils and students and encourage
547 them to develop interest in climate science, the government in partnership with development partners
548 could put in place a strategy to install simple weather stations in schools across the country. According
549 to them, installing such weather equipment in schools have the potential to arouse curiosity among pupils
550 and students thereby encouraging them to develop interest in climate science which could reduce the
551 deficit in climate scientists in the long term.
552 To reduce the communication gap and make climate information more accessible to the general
553 public, some stakeholders interviewed proposed that the government and other partners could put in
554 place different categories of monthly/annual prizes to compensate local media organizations and
555 journalists that run regular programmes or report issues on climate change and environmental protection.

Stakeholders also proposed that training workshops should be organized with local stakeholders such as parliamentarians, mayors, women group leaders, village leaders and faith leaders who have the capacity to mobilise and influence the local population to train them on climate issues given that this group of people can easily disseminate climate information to the local communities if there are sufficiently informed.

In the area of adaptation financing, stakeholders articulated that since most government ministries/institutions directly involved with climate issues have less financial autonomy to directly mainstream climate adaptation into long-term development plans at different sectoral levels; specialized units could be created in influential ministries responsible for finance and economic planning. They argued that the creation of such units in those influential ministries may fast-track the mainstreaming of climate adaptation into the country's long term development plans. However, it was cautioned that for such plans to be successful, there is need to train more climate scientists to take up such roles in public administration.

5 Conclusions

The main objective of this paper was to examine to what extent climate adaptation has been mainstreamed into the water, agriculture, forestry and energy sectors in the Central Africa sub-region with particular focus on Cameroun. To answer the over-arching research question, the strategy adopted was an in-depth qualitative method involving a systematic review of strategic policy documents published by the Government of Cameroun. This technique was complemented by semi-structured interviews with key stakeholders in relevant government ministries/institutions and organizations working in partnership with Cameroun to enhance the mainstreaming of climate adaptation into sectoral policies.

Results reveal that significant progress has been made in mainstreaming climate adaptation in the forestry and energy sectors facilitated through different national policies, legislation and strategic action plans put in place by the government. In addition, relevant policies have also been complemented by other policy incentives elaborated in the National Adaptation Plan of Action. In the absence of strategic policy documents that mainstream climate adaptation in the water and agricultural sectors, progress has been registered in these sectors through the National Adaptation Plan of Action. However, it is thought that putting in place national policies that take into account climate change impacts in these sectors will facilitate the mainstreaming initiative in these sectors.

587 Analysis complemented by stakeholder interviews indicate that there are still many obstacles such as
588 the lack of human and financial resources that need to be addressed to enhance climate adaptation
589 mainstreaming especially in the agriculture and water resources sectors.
590 Although institutions such as the Ministry of Environment, Sustainable Development and Protection of
591 Nature and the National Observatory for Climate Change that have been put in place to facilitate the
592 mainstreaming of climate adaptation into sectoral policies, cross-sectoral coordination is still lacking.
593 However, it is hoped that projects funded by development partners such as REDD+ initiatives will
594 allocate part of their funding for capacity building so that experts can take up leadership roles aimed at
595 enhancing cross-sectoral climate adaptation mainstreaming in the country.
596 Considering that our document analysis showed that most climate adaptation mainstreaming are taking
597 place mostly at the national level, Cameroun needs to implement effective "cross-sectoral"
598 decentralization strategies so that personnel from regional and local institutions can benefit from training
599 and resources from different climate adaptation initiatives.
600 Many initiatives such as; (i) the putting in place of a national policy for sustainable forest management,
601 (ii) creation of many protected areas, (iii) signing the VPA, FLEGT and AFLEG cooperative agreements
602 and (iv) joining several multilateral initiatives such as REDD+ in the forest sector; and (i) promoting
603 the use of renewable energy and the putting in place of a national policy to enhance energy efficiency,
604 (ii) the construction of many dams for hydro-power generation in the energy sector and other sectoral
605 policies elaborated in the National Adaptation Plan of Action; indicate that mainstreaming climate
606 adaptation into sectoral policies is effective in Cameroun. Such initiatives are relevant to other countries
607 in the Central Africa sub-region especially those pursuing sectoral climate adaptation mainstreaming
608 initiatives.
609 Overall, this paper presents valuable insights on important policy and institutions advances that have
610 been put in place by Cameroun to facilitate and sustain climate adaptation mainstreaming into sectoral
611 policies as a response to climate impacts and also in compliance with international bilateral agreements
612 signed under the United Nations Framework Convention on Climate Change.
613

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620

621 ## References

622 Adger ZN. (2003) Social Capital, Collective Action, and Adaptation to Climate Change. Economic
623 Geography. 79(4): 387–404.
624 Alemagi D, Minang PA, Feudjio M, Duguma L. (2014) REDD+ readiness process in Cameroon: an
625 analysis of multi-stakeholder perspectives. Climate Policy, 14(6): 709-733
626 Alhassan S, Hadwen WL. (2017) Challenges and opportunities for mainstreaming climate change
627 adaptation into WaSH development planning in Ghana. International Journal of Environmental
628 Research and Public Health. 14(7).
629 Ampaire EL, Jassogne L, Providence H, Acosta M, Twyman J et al. (2017) Institutional challenges to
630 climate change adaptation: A case study on policy action gaps in Uganda. Environmental Science
631 & Policy. 75: 81-90.
632 Atkinson R. and Flint J. (2001) Accessing hidden and hard-to-reach populations: Snowball Research
633 Strategies. Social Research Update. *33*(1): 1-4.
634 Atyi RE, Assembe-Mvondo S, Lescuyer G, Cerutti P. (2013) Impacts of international timber
635 procurement policies on Central Africa's forestry sector: The case of Cameroon. Forest Policy
636 and Economics. 32: 40-48.
637 Ayers J, Huq S, Wright H, Faisal AM, Hussain ST. (2014) Mainstreaming climate change adaptation
638 into development in Bangladesh, Climate and Development. 6(4): 293-305
639 Ayonghe SN. (2001) A quantitative evaluation of global warming and precipitation in Cameroon from
640 1930 to 1995 and projections to 2060: Effects on environment and water resources. In Lambi,
641 C.M. (ed.), Environmental Issues: Problems and Prospects. Bamenda, Unique Printers: 142-155.
642 Bele MY, Tiani AM, Somorin OA, Sonwa DJ. et al. (2011) Forests and climate change adaptation
643 policies in Cameroon. Mitigation and Adaptation Strategies to Global Change. 16: 369–385
644 Berga L. (2016) The Role of Hydropower in Climate Change Mitigation and Adaptation: A Review.
645 Engineering. 2(3): 313-318
646 Berrang-Ford L, James D, Ford JD, Paterson J. (2011) Are we adapting to climate change? Global
647 Environmental Change. 21: 25-33.
648 Brown HCP, Sonwa DJ. (2015) Rural local institutions and climate change adaptation in forest
649 communities in Cameroon. Ecology and Society 20(2).

650 Brown HCP, Smit B, Sonwa DJ, Somorin OA, Nkem J. (2011) Institutional perceptions of opportunities
651 and challenges of REDD+ in the Congo Basin. The Journal of Environment & Development.
652 20(4): 381-404.
653 Chow J, Doria G, Kramer R, Schneider T, Stoike J. (2013) Tropical forests under a changing climate
654 and innovations in tropical forest management. Tropical Conservation Science. Special Issue
655 6(3): 315-324
656 Crawford A, Hove H, Parry J-E. (2011) Review of current and planned adaptation action: Middle Africa.
657 International Institute of Sustainable Development: www.adaptationpartnership.org accessed
658 28/09/ 2017.
659 Cuevas SC. (2018) Institutional dimensions of climate change adaptation: insights from the Philippines,
660 Climate Policy. 18(4): 499-511.
661 Dargie GC, Lawson IT, Rayden TJ, Miles L, Mitchard ETA, Page SE, Bocko YE, Ifo SA, Lewis SL.
662 (2018). Congo Basin peatlands: threats and conservation priorities. Mitigation and Adaptation
663 Strategies for Global Change. DOI:10.1007/s11027-017-9774-8.
664 Dargie G, Lewis S, Lawson I, Mitchard E, Page S, Bocko Y, Ifo S. (2017) Age, extent and carbon
665 storage of the central Congo Basin peatland complex. Nature. 542: 86–90.
666 Dessai S, Browne A, Harou JJ. (2013) Introduction to the Special Issue on "Adaptation and Resilience
667 of Water Systems to an Uncertain Changing Climate". Water Resources Management. 27: 943-
668 948.
669 Egan A. (2013) Knowledge Management Strategy on Climate Change Adaptation for Cameroon.
670 Ministry of Environment, Nature Conservation and Sustainable Development, Yaoundé
671 Cameroon.
672 England ME. Stringer LC, Dougill AJ, Afionis S. (2018). How do sectoral policies support climate
673 compatible development? An empirical analysis focusing on southern Africa. Environmental
674 Science & Policy. 79: 9–15
675 Epule TE., Ford JD, Lwasa S, Lepage L. (2017) Climate change adaptation in the Sahel. Environmental
676 Science & Policy. 75: 121-137.
677 Ford JD, Keskitalo ECH, Smith T, Pearce T. et al. (2010) Case study and analogue methodologies in
678 climate change vulnerability research. Wiley Interdisciplinary Reviews: Climate Change. 1(3):
679 374-392.
680 Grant MJ, Booth A. (2009) A typology of reviews: an analysis of 14 review types and associated
681 methodologies. Health Information & Libraries Journal. 26(2): 91-108.

682 He X, (2013) Mainstreaming adaptation in integrated water resources management in China: from
683 challenge to change. Water Policy. 15(6): 895-921.
684 Heazle M, Tangney P, Burton P, Howes M, Grant-Smith D, Reis K, Bosomworth K. (2013)
685 Mainstreaming climate change adaptation: An incremental approach to disaster risk management
686 in Australia. Environmental Science & Policy. 33: 162-70.
687 Intergovernmental Panel on Climate Change. (2007). Appendix I: Glossary. In M.L. Parry, O.F.
688 Canziani, J.P. Palutikof, P.J. van der Linden, & C.E. Hanson (Eds.), Climate change 2007:
689 Impacts, adaptation and vulnerability, IPCC Working Group II (pp. 869–883). Cambridge:
690 Cambridge University Press.
691 Jones H, Jones N, Walker D, Walsh C. (2009) Strengthening science–policy dialogue in developing
692 countries: a priority for climate change adaptation. Overseas Development Institute. Available
693 from www.odi.org.uk
694 Kabeer N. (2003) Gender Mainstreaming in Poverty Eradication and the Millennium Development
695 Goals. London, Commonwealth Secretariat
696 Kenfack J, Lewetchou KJ, Bossou OV, Tchaptchet E. (2017) How can we promote renewable energy
697 and energy efficiency in Central Africa? A Cameroon case study. Renewable Sustainable Energy
698 Review. 75: 1217-1224
699 Kenfack J, Bossou O, Voufo J, Djom S, Crettenand N. (2016) New Renewable Energy Promotion
700 Approach for Rural Electrification in Cameroon. In: Sayigh A. (eds) Renewable Energy in the
701 Service of Mankind Vol II. Springer, Cham
702 Koetz T, Farrell KN, Bridgewater P. (2012) Building better science-policy interfaces for international
703 environmental governance: assessing potential within the Intergovernmental Platform for
704 Biodiversity and Ecosystem Services. International Environmental Agreements: politics, law and
705 economics. 12: 1-21.
706 Lambi CM, Kimengsi JN, Kometa CG, Tata ES (2012) The management and challenges of protected
707 areas and the sustenance of local livelihoods in Cameroon. Environment and Natural Resources
708 Research. 2(3): 10-18
709 Lauer H, Eguavoen I. (2016) Mainstreaming Climate Change Adaptation into Development in the
710 Gambia: A Window of Opportunity for Transformative Processes? In: Leal WF. (ed) Innovation
711 in Climate Change Adaptation. Springer Climate Change Management Series 8740: 87-98.

712 Lebel L, Li L, Krittasudthacheewa C. et al., (2012). Mainstreaming climate change adaptation into
713 development planning. Bangkok: Adaptation Knowledge Platform and Stockholm Environment
714 Institute.
715 Levine S, Ludi E, Jones L. (2011) Rethinking Support for Adaptive Capacity to Climate Change.
716 Overseas Development Institute (ODI), London.
717 Ley D. (2017) Sustainable Development, Climate Change, and Renewable Energy in Rural Central
718 America. In: Uitto J., Puri J., van den Berg R. (eds) Evaluating Climate Change Action for
719 Sustainable Development. Springer, Cham
720 Ludwig F, van Slobbe E, Cofino W. (2014) Climate change adaptation and Integrated Water Resource
721 Management in the water sector. Journal of Hydrology. 518: 238-242
722 Melillo J, Lu X, Kicklighter DW, Reilly JM, Cai Y, Sokolov AP. 2015. Protected areas' role in climate-
723 change mitigation. Ambio. 45: 133–145
724 Millennium Ecosystem Assessment (MEA) (2005) Ecosystem and human well-being: Our human
725 planet. Summary for policy makers, Island Press.
726 Mubaya CP, Mafongoya P. (2017) The role of institutions in managing local level climate change
727 adaptation in semi-arid Zimbabwe. Climate Risk Management. 16: 93–105.
728 Nachmany M, Fankhauser F, Davidova J, Kingsmill N, et al. (2015) Climate change legislation in
729 Cameroon: An excerpt from the 2015 global change legislation study. A review of climate
730 change legislature in 99 countries. www.lse.ac.uk/GranthamInstitute/legislation/ access 28/09/
731 2016.
732 Nchia LN, Nditafon PC, Fonkeng GE, Tamesse G, Lebel J. (2017). Primary and Secondary School
733 Teachers' Conception of Environmental Education in the English and French Speaking
734 Subsystems of Education in Cameroon. Conexão Ci. 12(2): 264-270
735 Nelson, DR., Adger, WN, Brown K. (2007) Adaptation to environmental change: contributions of a
736 resilience framework. Annual Review Environmental Resources. 32: 395-419.
737 Niang, I, Ruppel OC, Abdrabo MA, Essel A, et al. (2014) Africa. In: Climate Change: Impacts,
738 Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to
739 the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Eds. Barros
740 VR.and Field CB.). Cambridge University Press, Cambridge, UK and New York, USA.
741 Nkiaka E, Nawaz NR. Lovett JC. (2018) Assessing the reliability and uncertainties of projected changes
742 in precipitation and temperature in CMIP5 models over the Lake Chad basin. International
743 Journal of Climatology. DOI:10.1002/joc.5717

744 Nkiaka E, Nawaz NR. Lovett JC. (2017a) Analysis of rainfall variability in the Logone catchment, Lake
745 Chad basin. International Journal of Climatology. 37(9): 3553-3564.
746 Nkiaka E, Nawaz NR. Lovett JC. (2017b) Using standardized indicators to analyse dry/wet conditions and their
747 application for monitoring drought/floods: A study in the Logone catchment, Lake Chad basin.
748 Hydrological Sciences Journal. 62(16): 2720-2736. DOI:10.1080/02626667.2017.1409427
749 Okpara UT, Stringer LC, Dougill AJ. (2018) Integrating climate adaptation, water governance and
750 conflict management policies in lake riparian zones: Insights from African drylands.
751 Environmental Science & Policy. 79: 36-44.
752 Pardoe J, Conway D, Namaganda E, Vincent K, *et al*. (2017) Climate change and the water–energy–
753 food nexus: insights from policy and practice in Tanzania, Climate Policy.
754 DOI:10.1080/14693062.2017.1386082
755 Muthiah R. (2014) Clean cook stoves and fuels: A Catalog of Carbon Offset Projects and Advisory Service
756 Providers. 2nd edition. http://cleancookstoves.org/binary-data/RESOURCE/file/000/000/381-1.pdf.
757 Accessed on the 13/01/2018.
758 Savilaakso S, Cerutti PO, Zumaeta JGM, Mendoula REE, Tsanga R. (2017) Timber certification as a
759 catalyst for change in forest governance in Cameroon, Indonesia, and Peru. International Journal
760 of Biodiversity Science, Ecosystem Services & Management. 13(1): 116-133,
761 Scarano FR. (2017) Ecosystem-based adaptation to climate change: concept, scalability and a role for
762 conservation science. Perspectives in Ecology and Conservation, 15(2): 65-73.
763 Sietz D, Boschütz M, Klein RJ. (2011) Mainstreaming climate adaptation into development assistance:
764 rationale, institutional barriers and opportunities in Mozambique. Environmental Science &
765 Policy. 14(4): 493-502.
766 Sultan B, Gaetani M. (2016) Agriculture in West Africa in the Twenty-First Century: Climate Change
767 and Impacts Scenarios and Potential for Adaptation. Frontiers in Plant Science.7: 1262.
768 Tchakert P, Dietrich KA. (2010) Anticipatory learning for climate change adaptation and resilience.
769 Ecology and Society. 15(2): 11.
770 Tegegne Y, Ramcilovic-Suominen S, Fobissie K, Visseren-Hamakers IJ, Lindner M, Kanninen M.
771 (2017) Synergies Among Social Safeguards in FLEGT and REDD + in Cameroon. Forest Policy
772 and Economics 75: 1–11.
773 Tiani AM, Mekou YM, Sonwa DJ. (2015) What are we talking about? The state of perceptions and
774 knowledge on REDD+ and adaptation to climate change in Central Africa. Climate and
775 Development. 7(4): 310-321.

UNDP (2010) Supporting integrated and comprehensive approaches to climate change adaptation in Africa-Cameroon: https://www.undp-aap.org/sites/undp-aap.org/files/Cameroon.pdf accessed on 28/09/2015.

Vincent K, Colenbrander W. (2018). Developing and applying a five step process for mainstreaming climate change into local development plans: A case study from Zambia. Climate Risk Management. https://doi.org/10.1016/j.crm.2018.04.005

Wang B, Liang XJ, Zhang H, Wang L, Wei YM (2014) Vulnerability of hydropower generation to climate change in China: results based on Grey forecasting model. Energy Policy. 65:701–707

Wilby RL, Orr H, Watts G, Battarbee RW. *et al*. (2010) Evidence needed to manage freshwater ecosystems in a changing climate: Turning adaptation principles into practice. Science of the Total Environment 408(19): 4150-64.

Wise RM, Fazey I, Stafford-Smith M, Park SE. (2014) Reconceptualising adaptation to climate change as part of pathways of change and response. Global Environmental Change 28: 325-336.

World Bank (2009) Powering Up: Costing Power Infrastructure Spending Needs in Sub-Saharan Africa, summary, March 2009, Work Bank, Washington DC.

World Bank. (2007) World Development Indicators Online. Washington, DC, World Bank. http://go.worldbank.org/3JU2HA60D0 accessed 25/10/2014.

World Resources Institute (WRI) (2007) EarthTrends: Environmental Information. Washington, DC, WRI: http://www.earthtrends.wri.org accessed 25/10/2014.

808

809 Table 1: List of documents analysed:

Document Title and type	Sector	Source and year
Forest code 94/01/1994 to lay down forestry, wildlife and fisheries regulations (policy document)	Forestry	MINEP (1996)
Plan National de Gestion de l'Environnement (policy document)	Environment	MINEP (1996)
Plan d'Action National de Lutte Contre la Désertification Vol I & II (policy document)	Environment	MINEP (1996)
Cameroon - Forest and Environment Sector Program Project	Forestry	MINEP (2004)
Stratégie national de communication sur l'adapataton aux changements climatiques (policy document)	Communication	MINEP (2005)
Plan du Dévelopment du secteur Électricité (policy document)	Energy	MINEE (2006)
Strategie de developpement du secteur rural (policy document)	Agriculture	MINADER (2006)
Plan d'action national de gestion integree des ressources en eau (PANGIRE) (policy document)	Water	MINEE (2009)
Decree 2009/410 of 10 December 2009 on the Creation, Organization and Operation of the National Observatory on Climate Change (policy document)	Institutional	MINEPDED (2009)
Cameroon civil protection status report (policy document)	Disaster management	MINATD (2009)
NAPA Projects Database (grey literature)	General	UNFCCC (2009)
Planning for Integrated Water Resources Management and Development in Cameroon (grey literature)	Water	GWP (2010)
Cameroon: Growth and Employment Strategy Paper (GESP) (policy document)	General	IMF (2010)
Supporting integrated and comprehensive approaches to climate change adaptation in Africa – Cameroon (grey literature)	General	UNDP (2010)
Review of current and planned adaptation action: Middle Africa (grey literature)	General	Crawford (2011)
Stratégie national de communication sur l'adapataton aux changements climatiques (policy document)	Communication	MINEPDED (2011)
Loi N° 2011/022 portant régime d'electricite (policy document)	Energy	NA (2011)
Climate Change Financing and Aid Effectiveness Cameroun Case Study (grey literature)	Funding	Norrington-Davies (2011)
Elaboration of a strategy to integrate training on adaptation to climate change within the educational system of Cameroun (policy)	Education	MINEPDED (2012)
Decree No. 103/CAB/PM regarding the creation, organisation and operation of the steering committee for activities to reduce emissions from deforestation, degradation, sustainable management and conservation of forests, REDD+ (policy document)	Institutional	PM (2012)
Knowledge Management Strategy on Climate Change Adaptation for Cameroon (grey literature)	General	Egan (2013)
Readiness Preparation Proposal Cameroon (policy document)	Forest (REDD+)	MINEPDED (2013)
National Energy Efficiency Policy, Strategy and Action Plan in the electricity sector in Cameroon (policy document)	Energy	ARSEL (2014)
Understanding the Impact of Climate Change on Hydropower: The Case of Cameroon (grey literature)	Energy	Grijsen (2014)
Economics of Adaptation, Water Security and Climate Resilient Development in Africa	Water	GWP (2014)
Climate change legislation in Cameroon (grey literature)	General	Nachmany (2015)
Second National Communication on climate change (policy)	General	MINEPDED (2015
Plan National d'Adaptation aux Changements Climatiques (policy)	General	MINEPDED (2015)
Republic of Cameroon Energy Sector Development Project	Energy	ARSEL (2017)

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Table 2: Summary of Stakeholder's interviewed by institution and type of organization

Structure	No of participants	Type of organization
Ministry of Environment, Sustainable Development and Protection of Nature	5	Government
Ministry of Energy and Water Resources	2	Government
Ministry of Agriculture and Rural Development	2	Government
Ministry of Forestry and Wildlife	2	Government
Ministry of Public Contracts	1	Government
Ministry of Scientific Research	1	Government
Universities	4	Academia
Commission des Forêts d'Afrique Centrale (COMIFAC)	2	NGO
Media	1	Civil Society
Independent Consultant	1	Civil Society
Centre for International Forestry Research (CIFOR)	2	NGO
German Technical Cooperation (GIZ)	2	IO
International Union for Conservation of Nature (IUCN)	2	IO

ARSEL: Electricity Sector Regulatory Agency

ESDP: Energy Sector Development Project

IO: International Organization

GWP: Global Water Partnership

NGO: Non-Governmental Organization

IMF: International Monetary Fund

MINEPDED: Ministry of Environment, Sustainable Development and Protection of Nature

MINEE: Ministry of Energy and Water Resources

MINADER: Ministry of Agriculture and Rural Development

MINATD: Ministry of Territorial Administration and Decentralization

MINFOF: Ministry of Forestry and Wildlife

NA: National Assembly

PM: Prime Minister

RC: Republic of Cameroun

UNDP: United Nation Development Program

Figure 1: Map of Africa showing the location of Cameroon