Forest and Climate Change Response in Africa

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Abstract

Africa is facing serious constraints exacerbated by climate change. Several components of its development are now constrained by this global environmental problem. More important is the fact that the poorest who are less contributor of climate change are the most vulnerable. Response to this global threat needs to address both the causes of the problem (*i.e.* mitigation actions) and the consequences (known as adaptation to climate change). The 21st Paris Conference of the Parties (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC) was an important milestone that lead to the development of Intended Nationally Determined Contributions (INDCs) with commitments to mitigate climate change, but also to address vulnerability related to this climate alteration. These efforts in responding to climate change, particularly his mitigation component, are to be done in the context where the continent wants to improve its development. Despite its weakness, Africa is expected to contribute to the global climate change mitigation efforts, while enhancing its resilience. Forest as other natural resources management which are contributing to the development of the continent are also to be at the centre of environment solutions such as climate change mitigation. But, several ecosystems of the continent, including forest ones, are subject to climate modification and thus also need to be taking in consideration in responses related to this global menace. In the current paper, we review: 1) the vulnerability of Africa to climate change, 2) the climate change mitigation responses, and 3) the place of Forest in responding to climate change (both mitigation and adaptation) on the continent.

Key Words

climate change, vulnerability to climate change, climate change mitigation, INDC/NDC, Africa, development of Africa, forest and climate change.

Introduction

Of the 3 conventions related to Rio 1992, the one on climate change have been of great attention in the continent during the last decade. The trajectory of the continent has not been put in parallel with climate dynamics as it has been the case, this last decade. The African Union (AU), the African Development Bank (AfDB), and the World Bank (WB) developed a climate strategy/agenda for the continent. United Nations Economic Commission for Africa (UNECA) had created an African Climate Policy Center (ACPC) to deal with the issues and response to climate change. All the strategies build generally on the chapter developed by Inter-governmental Panel on Climate Change (IPCC) focusing on the continent (Niang *et al*. 2014). The African Progress Panel chaired by Koffi Annan and which included some respected leaders of the continent are regularly calling for actions on climate change.

The continent is known to be among the worse places in the world in terms of poverty and environmental degradation (Sachs and Warner 1997, Sudo 2014). It is not surprised to see that countries of the continent fail to achieve the Millennium Development Goals (MDG) (UNECA *et al.* 2015). The recent growth of the continent had not been sufficient to give opportunities to reduce the vulnerability of Africans. Though Africa is being gradually perceived as a continent that will be driving the world economy in the nearest future. But this potential need to be turned to realities for the benefit of Africa and the world (Sudo 2014, Rodrik 2016, Bhorat and Tarp 2017). Recent finding from McKinsey Research Institute reveals that, to renew his dynamism, governments of the continent need to focus on six priorities: more mobilisation of domestic resources, aggressive diversification of economies, acceleration of infrastructure development, deepening of regional integration, creation of tomorrow talents, and insurance of healthy urbanisation (Bughin *et al.* 2016). The transformation of this potential will really depend on the socio-economic and ecological context of the continent (Sudo 2014, Brahmbhatt *et al*. 2016, Bhorat and Tarp 2017). Climate change is among the factors that are affecting and will continue to affect the trajectories of the continent in the nearest future (Davidson *et al*. 2003, Niang *et al*. 2014, Sudo 2014). The continent cannot ignore the will of the global community to move to a green growth economy. The 2015 milestone with the SDGs and the COP 21 are important signs towards a sustainable world.

Among the sectors that affect and are also affected by climate change, forest is one of the important one by its coverage and importance in the continent (Lewis *et al*. 2009, Leal 2009, Thompson *et al*. 2009, AMCEN 2011, Ciais *et al.* 2013, Sengul *et al*. 2007). On the continent, other sectors (mainly agriculture and energy) are associated to forest to sustain the livelihoods of smallholders in rural and urban areas (AMCEN 2011, CIFOR 2005). Land use management particularly forest landscape management can thus be seen as an opportunity to mitigate climate change (Sengul *et al.* 2007, Gizachew *et al*. 2017). On the other hand, such landscapes that support livelihoods are under the influence of changing climate and thus need to be subject to adaptation to climate change (Nabuurs 2007). Mitigate and adapt to climate change can thus be done through the management of land cover/use, including forest landscape management (Bele *et al*. 2015).

The year 2015 has been an important milestone for the environment and development agenda worldwide including Africa. Beside the SDGs, the Paris Agreement perceives a new direction with climate change response. After the recent discourse of world leaders at the global level, climate change has taken a new landmark on the diplomatic agenda and outputs of the Paris agreement and related elements now need to be translated into concrete actions at the national level. Prior to the Paris agreement, the Intended Nationally Determined Contributions (INDC) development was an occasion for African countries to show their commitments (Mbeva *et al*. 2015, GIZ 2016). International effort

was also brought in to strengthen the national capacity (see Tiani *et al.* 2015 for some details/issues on the mastering of climate change responses) of countries in line with this process. The Paris Agreement that resulted from these efforts generated a new framework that will structure the way countries respond to climate change. The previous technical dynamics around adaptation and mitigation will remain but will probably need to be more rooted in the commitments of sectorial policies at the national level.

The continent through the AU, has been trying to speak with one voice (Ramsamy *et al*. 2014), making appearances with what is known as the African pavilion managed by AfDB, UNECA, and AU. Nevertheless, the realities in the continent is diverse. Not all the regions are affected in the same way and responses are also diverse (Davidson *et al*. 2003, AMCEN 2011). The objective of the current paper is to review the forest and climate responses in Africa in the era of INDC/NDC. This will be done by sharing rapid information on the following: 1) the vulnerability of Africa to climate change, 2) mitigation responses of the continent, and 3) the place of forest in responding to climate change. Information presented here are based on the review of existing literature and expert view of the author base on his experience as a researcher and many years of participation in stakeholder/expert deliberations on climate change in Africa and beyond.

Vulnerability of Africa to Climate Change

The vulnerability of the Africa is as a result of its exposure and sensitivity to climate change and the nature of the activities taking place in the continent.

The 5th Intergovernmental Panel on Climate Change (IPCC) report reveals that the continent has shown some increase trends of warming over the last 50 to 100 years (Niang *et al*. 2014). This tendency will increase by at least 2 degrees by the end of the century. This will be faster than other parts of the world, particularly on the arid lands. The precipitation is reducing and will continue by the end of the 21st century particularly in the northern and southern parts of South Africa, while rainfall is increasing in some complex topographies, such as the Ethiopian Highlands.

The consequences of temperature and precipitation change is negative on African ecosystems, on water availability leading to the modification of agriculture, health and other livelihoods sectors (Davidson *et al*. 2003, Knox *et al*. 2012, Bele *et al*. 2013, Ciais *et al.* 2013, Niang *et al*. 2014). On the continent, agriculture depends mainly on rainfall with very limited development of irrigation systems (Davidson *et al*. 2003, Sonwa *et al*. 2016b). This dependence on rainfall thus make the agricultural system more sensitive to the climate variability (Müller *et al*. 2011, Knox *et al*. 2012). Beside crop production, several agricultural health problems are exacerbated by climate modification (Morton 2007). On the continent, it is common to see health issues associated with seasons. Such seasonality of the health problems is related to the seasonality of parasites and/or vectors. With the high concentration of population in African cities, coupled with poor drainage infrastructure, flooding is so common putting the lives of many citizens to danger (Niang *et al*. 2014). Several parts of the continent are subjected to floods, with negative impacts on farmer's livelihoods. Drinkable water is another sector of the continent that is suffering from climate change/variabilities. The limited access to water is exacerbated by the long and intense drying period. Such drought thus leads to the lack of drinking water but also the increase of some illness problem and reduction of crop productivity (Niang *et al*. 2014). There are thus some linkages between sectors when it comes to climate change vulnerability (Mbeva *et al*. 2015). The continent is known to be the most affected by climate change because of some previous constrains related to its poverty (Davidson *et al*. 2003, APP 2014). In brief,

the vulnerability of African countries to climate change is partly associated with their poor/insufficient institutional and technical capacities, poverty, and lack of appropriate technologies to face climate change. Among the capacities, one of the main constraints is the lack of climate and hydrological observatory systems.

Several adaptation measures have been put forward on the continent following the UNFCCC initiatives such as the Nairobi Adaptation framework, National Adaptation Program of Action (NAPA), National Adaptation Plan (NAP) processes etc. (Sonwa *et al*. 2009, 2011b, 2016b, Mbeva *et al*. 2015). Adaptation is perceived as a priority for Africa (Davidson *et al*. 2003, AMCEN 2011, APP 2014). The INDCs of African countries reveals that land use management, agriculture and health are among some of the key importance preoccupations for adaptation. Responding to vulnerability requires a proper examination of climate risks on climate sensitive sectors on the continent. NAPA processes were very good opportunities to address rapid adaptation measures. With this process, many Least Developed Countries (LDCs) in Africa proposed and prioritised adaptation activities that were supported by the NAPA funds (Dazé *et al*. 2016). Several sectors were covered by these set of activities. The NAP process is to identify medium and long-term adaptation needs (Dazé *et al*. 2016). Contrary to the NAPA that were for the short-term response, NAP documents are supposed to be more holistic in responding to climate change for countries. Beside NAPA and NAP processes, other frameworks and mechanisms were put in place to help African countries to adapt to climate change (Sonwa *et al*. 2016b). The Japanese support through United Nation Development Programme (UNDP) falls within this category, in terms of building an enabling environment towards NAP development. Beside institutions within countries, adaptation investment can thus be summarised to the following: finance, technology development and transfer, and capacity building.

Climate Change Mitigation Response in Africa.

Climate change mitigation response over the continent have gradually been build up around the Clean Development Mechanism (CDM), Nationally Appropriate Mitigation Actions (NAMAs) and Reducing Emissions from Deforestation and Forest Degradation and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries (REDD+) initiatives (Walker *et al*. 2008, Gizachew *et al*. 2017, Tsayem Demazu *et al*. 2015). The slowness of the mitigation response of the continent was, partially, due to the insignificant contribution to global emission of Green House Gases (GHG). The developed world with their industrialisation trajectories contributes immensely to GHG emissions. On the continent, few countries are considered among the world top polluters or Organisation for Economic Co-operation and Development (OECD) economies. Some stakeholders think that, since these trajectories taken by the developed countries lead to their development and to the current situation of climate change, the countries of the continent do not need to be prevented to their development by putting response to climate change as priority (Davidson *et al*. 2003). Based on the principle of common but differentiated responsibility, the role of Africa is recognised to be very minor. The polluter pays principle is also highlighted within the UNFCCC arena and Africa is supposed to be part of the world receiving support for climate change mitigation (AMCEN 2011, Baimwera *et al*. 2017). Initiatives falling within this principle of polluter pays were conveyed through CDM and REDD+ processes. Nevertheless, countries still need to have their NAMAs that contain country's effort to mitigate climate change. Some scholars think that it will be strategic to the continent to link his climate response to development. Davidson *et al.* (2003) proposed the 'Development First' approach.

Previous initiatives (CDM, REDD, NAMAs, etc.) were recently repackage in the INDC/NDC processes. The participation of the continent in the GHG market have been very low: in 2016, only 261 projects representing 3.0% of the 8,814 CDM global projects; 1% of voluntary global market (Baimwera *et al*. 2017). The recent years have seen increase in the trends: 54% of the 45.1 Mt CO2 trade by the continent by 2015 were done in the last 3 years (Baimwera *et al*. 2017). Since the continent is not among the big greenhouse gas emitters, the main challenge is how to continue with development taking a pathway that have less negative impacts on the environment. This will include technological transfer and paradigm shift to more clean development initiatives. The continent then sees mitigation as an opportunity to green growth (AMCEN 2011, APP 2014). Transition to this green growth beyond 'Foreign Knowledge' concerns some environmental policies such as: 1) broad cross-cutting that strengthens market incentives to preserve natural capital; 2) expansion of green infrastructure and improvements in infrastructure efficiency; 3) modernisation of agriculture, adoption of climate smart agriculture, and investment in key public goods; 4) adoption of green urban policies (Brahmbhatt *et al*. 2017). These issues thus need to be taken into consideration within the thematic pillars of the AU strategy; a) improving climate change governance, b) mainstream and integrate climate change imperative into national and regional policy, planning, and development processes; c) enhance research, awareness, and education on climate change; and d) promote national, regional, and international cooperation.

Forest in Climate Change Responses on the Continent.

Forest play an important role in the socio-economic and ecological dynamics of the continent (Pesche *et al*. 2016). Since the colonial time, African forest was subject of exploitation mainly for medicinal plants and later for its timber (Nasi *et al*. 2006). After independence, African forest was subjected to several interests because of the role of timber in the macro-economy of the countries (APP 2014). With the intensive exploitation of timber and activities that were threatening the forest, conservation issues mainly for biodiversity emerged as one of the key considerations (Norris *et al*. 2010). During all this period, forest had been contributing to African livelihoods and played a key role in stabilising the climate. This last function has been gradually recognised. Beside this service, Non-Timber Forest Products (NTFP) were also an important component of the forest that got recognition around three decades ago.

One of the main role of forest in responding to climate change has been underscored in the CDM context. In the forest sector, the CDM was an opportunity to allow developing countries such as the one on the continent to grow forest plantations through afforestation and/or reforestation initiatives and claim for support. Since Bali 2007, REDD+ had been promoted as an effort to avoid deforestation, forest degradation, and/or enhance carbon stocks to be part of a compensation process (Sonwa *et al*. 2011a, 2016a). Such dynamic was captured in the NAMAs process putting forest close to other processes of climate change mitigation. But as it can be seen during/after the INDC/NDC process, forest still holds an important role in mitigation response on the continent (Kim *et al*. 2016). During the period 1990 to 2009, net emission from land use land cover change average 320 ± 50 TgCy-1 in sub-Saharan Africa (Valentini *et al*. 2014). Certain parts of the continent as the Congo Basin are contributing to carbon sinks (Fisher *et al*. 2013, Valentini *et al*. 2014). REDD+ has taken an important development on the continent moving from countries dominated by humid forest to semi-arid ones, or moving from countries with high forest cover to the ones with less forest cover, etc. REDD+ is happening thanks to initiatives/structures such as Global Environment Facility (GEF), Central

African Forest Initiative (CAFI), Forest Carbon Partnership Facility (CFPF), etc. including support by institutions such as Japan International Cooperation Agency (JICA). Initially focusing on forest, support is moving beyond the forest sector since the threat to forest resources are coming outside the forest (Tchatchou *et al*. 2015, Ordway *et al*. 2017). Recent studies have highlighted the importance of forest in meeting the target of the Paris (Miles *et al*. 2015, Federici *et al*. 2017). At the local level where REDD+ will be implemented some previous efforts such as biodiversity conservation, activities can help to achieve the objective of reducing deforestation. In the Masito Ugalla Ecosystem REDD+ initiative (Tanzania), activities include for example forest patrols, beekeeping as alternative income sources, and enhancement of capacity and governance mechanisms for local communities and government institutions to administer and benefit from REDD+ (Kweka, 2014). Some of the constraints encountered by this project included lack of sufficient technical skills and financial resources, difficulty in transferring tenure rights, and risk of increase conflict over land and resources with unintended consequences (Kweka 2014).

Forest is threatened not only by logging, agriculture, mining, but also by climate change (AMCEN 2011, Megevand *et al*. 2012, APP 2014). Forest and his vegetal and animal components are exposed to climate change and variability in the continent (Lewis *et al.* 2009). Plant and animals of the forest may face some stress related to the modification of their habitat. This will lead to the re-composition of flora and fauna in the continent (Leal 2009). Some threatened species will face more stress related to climate change. Forest management can also play an important role to resist the effects of climate change (Hannah *et al*. 2008). While mangrove forest is known to be able to protect coastal ecosystems, forest can provide other adaptation measures. Protected areas are known to be good adaptation measures since they can provide space to allow plant and animal migration to a suitable area during climate change (Hannah *et al*. 2002). Outside protected areas, tree planting have been an opportunity to have more shelter in dry areas, providing food during drought periods where crops are suffering from stress, and have been able to prevent erosion and protect against strong wind, etc. In the Congo Basin for example, participatory assessment of communities reveals vulnerabilities of farming systems (mainly crops and livestock) while forest activities were less sensitive to climate change, suggesting that they may be used for climate change adaptation (Bele *et al*. 2015). Diversification of activities and strengthening of local institutions also appeared as ways to reduce vulnerabilities of farmers in forest landscapes (Sonwa *et al.* 2009, 2011b, Brown *et al*. 2010, Brown and Sonwa 2017)

While growing forest for adaptation purposes, plants capture and store carbon and by so doing contribute to both mitigation and adaptation to climate change (Guariguata *et al*. 2008). Such double functions of forest is now used to put emphasis on the synergy role than can be played by the forest. With such double functions, the planting of trees and/or forest management provide some good opportunities to synergise adaptation and mitigation goals and additionally contribute to biodiversity conservation and livelihood satisfaction (Bele *et al*. 2015). Forest response to climate change is now implemented in Africa thanks to several organisations (Brown *et al*. 2010). On agricultural land for example, agroforestry practices can thus be useful in synergising climate change responses (adaptation and mitigation) with other rural development purpose (Gockowski and Sonwa 2011).

Using forest to respond to climate change imply bringing research consideration and climate change research agenda together in the perspectives of responding to population needs in a changing climate. The last IPCC report mentioned some research gaps that are important (Niang *et al*. 2014). On adaptation, the following can be mentioned: climate science (observation, modelling, seasonal to sub-seasonal foretasting, impact on hydrology, food security, health infrastructure, etc.); ecosystems (long

term monitoring for long term change, modelling); food systems (vulnerabilities, long term suitable map, etc.); water (observation, linkage between climate and non-climate factors); adaptation (impact, mainstreaming to development, coordination); forest (vulnerability and mainstreaming in adaptation responses). On mitigation, the following gaps need proper attention: Understand the barriers of access to climate finance; map the context that can lead to better internal cooperation between green economy sectors; mapping the skills needed to mainstream REDD+ at the national level and render it concrete at the jurisdictional level; modelling different scenarios for green growth; understand the dynamics around cooperation between the multitudes of stakeholders; lessons learn on the early CDM, REDD+, and green growth activities. Specifically, for university institutions, the recent advices from university presidents in line with sustainability can be a good way forward. They clearly mention that for the global sustainability and the responsibilities of universities, research universities have the following urgent and specific responsibilities: 1) transform education – and not just post-secondary, but the full spectrum of formal and informal education – to educate, engage, empower, and energise the next generation of problem-solvers; 2) drive a robust international and collaborative research agenda designed to identify, invent, test and deploy solutions designed to address the formidable challenges of global sustainability; 3) insist on building both disciplinary in depth and trans-disciplinary breadth of research and education, connecting science, engineering, technology, mathematics, social sciences, arts, and humanities disciplines in service to society; and 4) assess the need for societal action, to transmit authoritative information to stakeholders and then take ownership of the process of transition of knowledge to application, working in new partnerships (Weber and Duderstadt 2012). In the context characterised by the need of research to have more consideration on impact of their work, the theory of change may be an appropriate tool in shaping forest considerations in the climate change response agenda (Thornton *et al*. 2017). This imply multidisciplinary approach that take into consideration, governance and institutional mapping at different scales (internationally, nationally, and locally), livelihood in forest landscapes and its linkages to climate change impacts and climate change response (both mitigation and adaptation), Measurement, Reporting and Verification (MRV), related to adaptation (exposure to climate change, finance and technical responses) and mitigation (GHG emission and all related activities such as technical and financial transfer, as well as institutional reforms). In searching of appropriate solutions, the synthesis science approach may also be useful in complementing classical research activities (Rodrigo *et al*. 2013).

Conclusion

The African continent is not a big greenhouse gas emitter, but is more vulnerable to climate change. Despite this low responsibility in climate change, the continent is gradually putting in place some responses to mitigate climate change. Being the most vulnerable, least developed countries of the continent have developed short term responses to face climate change. The mid and long-term strategies of adaptation have been developed in the continent and need some support for implementation. Forest play an important role in both adaptation and mitigation. Forest resources and trees have important synergy roles for both mitigation and adaptation. They thus offer a good opportunity to tackle climate change in a sustainable manner. With the role of forest in climate response, the new research frontiers are on multidisciplinary approach that take into consideration the forest (its components and stakeholders) with emphasis on its climate services that are not differentiated from other forest functions.

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