

Earth System Governance in Africa: knowledge and capacity needs

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Traditional approaches for understanding environmental governance — such as environmental policy analysis or natural resources management — do not adequately address the gamut of human–natural system interactions within the context of the complex biogeophysical cycles and processes of the planet. This is perhaps more so in the African regional context where the complex relationships between modern and traditional governance systems and global change dynamics are arguably more pronounced. The Earth System Governance (ESG) Analytical Framework encompasses diverse systems and actors involved in the regulation of societal activities and behaviors vis-à-vis earth system dynamics. The concept encompasses a myriad of public and private actors and actor networks at all levels of policy and decision-making. The existence of, and interaction among, these diverse actors and systems, however, is under-researched in the African context. Various research approaches taken to address crucial global environmental change (GEC) challenges in Africa have proven to be inadequate because they tend to overlook the complex interactions among the various local actors, players, and indigenous conditions and practices vis-à-vis GEC system drivers and teleconnections. Similarly, the regional peculiarities in terms of governance typologies and socio-cultural diversity highlight the need for nuanced understanding of the complex interactions and nexuses among multiple actors and interests and Earth system processes. However, this diversity and complexity has often been lost in generalized enquiries. We argue that examination of the governance-GEC nexus through the aid of the ESG Framework would provide a much broader and more helpful insight.

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Introduction

The impacts of global environmental change (GEC) vary regionally, and Africa is exceptionally prone to the more adverse impacts. Governance deficits, heavy dependence on natural resources and climate sensitive economies, high levels of population growth and urbanization, poverty, conflicts, a hefty disease burden and similar stressors weaken the capacity of many African countries to adapt to these impacts [1,2].

While there has been significant amount of research on governance in Africa (including governance aspects of development), understanding of the complex relationships among the different typologies, agents, scales and/or attributes of governance in the context of GEC dynamics is deficient [3••]. Such gap in knowledge, among other things, has the effect of limiting the utility of adaptive interventions in the region and may as well limit the value of ongoing investigations and assessments of ‘climatic and other global change processes, teleconnections and feedbacks that occur across regions’ [4]. This paper identifies the governance implications of GEC in Africa as a crucial area of research and makes the case for systematic examination of existing knowledge by employing the analytical framework advanced by the Earth System Governance (ESG) Project, and by fostering research capacity and a transdisciplinary pan-African research network in the area of earth system governance.

An analytical framework for ESG research in Africa

Traditional approaches for understanding environmental governance — such as environmental policy analysis or natural resources management — do not adequately address the gamut of human–natural system interactions within the context of the complex biogeophysical cycles and processes of the planet [5**]. In this context, the analytical framework advanced by the Earth System Governance (ESG) Project enables integrated understanding of ‘global transformations of social and natural systems, including accelerating economic integration, globalization in all its forms, internationalization of policy processes, and multi-scale consequences of ecological transformation’ [5**]. It prioritizes five interdependent analytical problems (Figure 1). These are the problems of the overall architecture of earth system governance, of agency beyond the state and of the state, of the adaptiveness of governance mechanisms and processes, of their accountability and legitimacy and of modes of allocation and access in earth system governance [5**].

The ESG Framework encompasses diverse systems and actors involved in the regulation of societal activities and behaviors vis-à-vis earth system dynamics. The concept encompasses a myriad of public and private actors and actor networks at all levels of policy and decision-making [5**]. The existence of, and interaction among, these diverse actors and systems, however, is under-researched in the African context. Various research approaches taken to address crucial GEC challenges in Africa have proven to be inadequate because they tend to overlook the complex interactions among the various local actors, players, and indigenous conditions and practices vis-à-vis GEC system

drivers and teleconnections [6]. Similarly, the regional peculiarities in terms of governance typologies and socio-cultural diversity highlight the need for nuanced understanding of the complex interactions and nexuses among multiple actors and interests and Earth system processes. However, this diversity and complexity has often been lost in generalized enquiries. We argue that examination of the governance-GEC nexus through the aid of the ESG Framework would provide a much broader and more helpful insight.

Architecture

The first conceptual pillar of the ESG Analytical Framework is Architecture — it refers to the institutional framework for sustainable development across scales and sectors and encompasses the interlocking web of widely shared principles, institutions, and practices that shape decisions at all scales [5**].

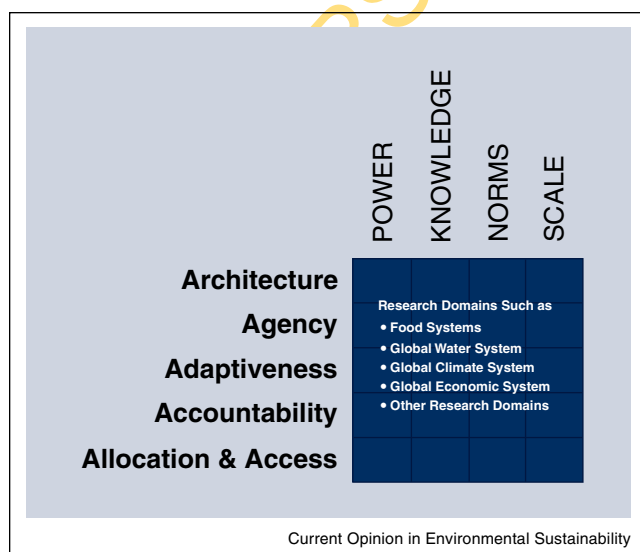
In most parts of Africa, governance architecture is made up of traditional and modern layers of authority and governance structures coexisting simultaneously, often with overlapping jurisdictions. These layers of authority and structures have varying levels of power (and complexity) in GEC governance, depending on the geopolitical, historical and cultural context in which they operate. Informal institutions feature prominently in the landscape of GEC governance in Africa, perhaps more strongly than what obtains elsewhere in the world. In Africa, architecture must thus be understood as a system of multilayer authorities that exist at different levels and exercise controls, sometimes informally.

At the regional level, three structures can be identified: region-based organizations [e.g. Economic Community of West African States (ECOWAS)]; biophysical or ecosystem-based organizations (e.g. Lake Chad, Lake Victoria and Nile Basin Commissions) and, continental organizations (e.g. African Union). While none of these organizations are set up to purposely address GEC, each is mandated with development issues that intersect with GEC. The fact that GEC is not the exclusive remit of regional structures is partly explainable by the existence of other regional priorities such as the high level of poverty in the region.

At the national level, many countries in Africa now have ministries and/or agencies with GEC governance functions. A common feature of such government organs is that they are often handicapped by lack of resources and capacity. Lack of awareness in society-global change connections is also a significant constraint (see Adaptiveness, Capacity needs). The local scale is often more complex than the national and continental scales since this is where the socio-linguistic and ethnic divisions are more acute (see Agency).

The diversity of identities, actors and interests in Africa makes understanding of the role of its institutions

Figure 1



ESG Analytical Framework.

Table 1

Priority research questions

Architecture

- How can existing institutional frameworks be operationalized for the effective governance of earth systems through the use of available traditional knowledge?
- There is a need for scientists to effectively interface with government and the local people through evidence-based research that has direct bearings on the life of local people. How do we, therefore, reform the academia to better integrate research, policy and practice?
- Traditional authority is respected in Africa, including in crucial environmental and natural resource issues such as water, land, and biodiversity. Why do people respect local authority that was not appointed by them through democratic processes? Why are some traditional authority regimes more effective than others? Which model of traditional systems is best suited for GEC governance — more assertive role for traditional authority (e.g. Nigeria and Ghana) or weaker/ceremonial role (e.g. Uganda)?
- How do we integrate government and faith-based organizations for effective GEC governance?

Agency

- What could be done to make national and local governments in Africa more responsive to GEC challenges? How can implementation of existing national policies and frameworks be improved?
- What is the role of traditional authority in responding to GEC? How does this augment or limit action at national and local government scales? What is the relevance of indigenous and traditional knowledge and knowledge systems in GEC response?
- How do we promote the meaningful inclusion of marginalized communities in identifying GEC challenges and response options?
- What are the needs and vulnerabilities of African cities and what can be done to address these vulnerabilities? What is the status of devolved governance in Africa, and how does this affect adaptive, mitigative, and disaster risk reduction and management efforts in the region? How do we empower cities to tackle GEC at their scale?

Adaptiveness

- What is the political context of adaptation to GEC and adaptiveness in Africa? Are there shared trends and tendencies?
- How does the political and institutional context of adaptation contrast with political undercurrents of development in the region and beyond?
- What factors promote or inhibit adaptiveness at the local government and city government scales? How do we leverage funding (e.g. climate finance) to promote devolution in Africa?
- What is the role of traditional authority for adaptation and how does this role vary across state lines?
- What GEC governance schemes have been successful and what factors contributed to their success?

Accountability and legitimacy

- What are the sources of accountability and legitimacy in earth system governance in Africa? To what extent do democratic or non-democratic processes affect accountability and legitimacy? To what extent does public participation improve accountability and legitimacy? What are the roles of traditional authority and local communities in promoting accountability and legitimacy?
- How do we hold CSOs, NGOs and MNCs accountable in earth system governance given the increasing power they exercise in Africa? Are there any workable mechanisms for holding non-state actors (CSOs, NGOs and MNCs) accountable for how their actions influence or impact GEC? How do we make the operations of CSOs, NGOs and MNCs more transparent?
- What are the effects of different models of accountability and legitimacy on the efficiency of the performance of earth system governance?
- How do we ensure that decentralization translates into accountability and efficiency in earth system governance? How do we balance the imperatives of decentralization with appropriate accountability and transparency mechanisms?

Access and allocation

- What policy and regulatory tools would be helpful in ensuring effective and equitable handling or management of resources? How do we best minimize corruption?
- How do we promote equitable sharing of the burdens (and benefits) of GEC in Africa? Given Africa's minimal historical GHG contributions, how do we frame the ethical obligation of developed countries to mitigate adverse effects of GEC that accrue to Africa? What more can Africa do on its part in GEC mitigation?
- How do we provide clarity and tools to identify opportunities for financing for Africa?
- What is the best way to define the rules of access to (human and financial) resources and accompanying capacity and economic limitations facing Africa?

vis-à-vis GEC dynamics complex. One key area for research is the current function and potential role of traditional knowledge systems and authority within the broader milieu of GEC processes and responses that occur in coupled human–natural systems (see Table 1 for a list of questions identified by the authors as priority areas for research on *Architecture* in Africa).

Agency

Agency is the second conceptual pillar of the ESG Analytical Framework — it describes the role of state and non-state actors who prescribe or proscribe behavior that impinges on society and ecosystems across scales [5^{••},7].

Over the past few decades, there has been an increase in national institutions and policies that deal with GEC impacts in Africa. For example, the Fifth Assessment report of the IPCC observes that there are already adaptive and mitigative efforts underway, *albeit* at small scales, to address the impacts of climate change [7]. Such effort is demonstrated by the fact that 34 African least developed countries (LDCs) and Cape Verde have adopted National Adaptation Programmes of Action (NAPAs) under the UNFCCC process. In addition to, or in lieu of, NAPAs, countries like Ghana, Ethiopia, Kenya, Tanzania, Zimbabwe and Uganda, among others, have also initiated or put in place climate change policies. However, while

headways have been made in terms of deliberate policy making for GEC adaptation, more needs to be done to implement what is on paper [8,9]. Besides, awareness, financial and capacity constraints, institutional fragmentation and lack of information limit the efficacy of adaptive policies and efforts.

Africa is characterized by strong central governments; local governments are financially and politically relatively weak. Thus far, devolved approaches to governance (with the possible exception of South Africa) have not succeeded even in countries that have constitutionally mandated federal national political frameworks (e.g. Ethiopia and Nigeria) [10,11] (see also Adaptiveness). Because adaptation takes place primarily at the local level, better understanding of the local-central power dynamics and its relationship to GEC impacts needs to be better understood.

Africa's fractionalization along socio-ethnic, tribal, religious, political, and institutional lines, coupled with weak institutions, could also have adverse effects on GEC response [11,12,13*]. There are numerous examples of policies and programs that failed, in part or in full, due to lack of buy-in from these informal networks (such as religious and traditional groupings).

It is difficult to address agency issues in Africa in generic terms given the evolving nature of current national and subnational policy undertakings. More effort is needed to understand the role of national and subnational organizations in GEC governance in the region (see also knowledge and capacity needs). One key region-specific area of research is the potential role of devolved governance to address GEC impacts in the region (see Table 1 for a list of questions identified by the authors as priority areas for research on *agency* in Africa).

Adaptiveness

Adaptiveness — the third analytical pillar of the ESG Analytical Framework — looks into the issue of responsive adjustment by different actors and responses to global change stimuli at multiple levels [5*,7].

The first major characteristic of adaptiveness in Africa is arguably that response actions are often reactive rather than proactive [12,13*,14]. In most cases, adaptive decisions and actions in the region are donor-driven and not always based on robust knowledge and analysis [4]. Furthermore, adaptation to GEC impacts, including climate change, in most African countries is affected by fragmented, and sometimes inconsistent, policies, local politics (including frictions with traditional authority). Lack of focused or consistent policies and programs to enable adaptiveness is also a major drawback. Many African states lack legislative frameworks for dealing with GEC impacts and, where such frameworks exist; there is insufficient political will for proper implementation

[9,15]. For example, the lack of success in adaptive efforts in Kenya has been linked to the absence of a legal framework on climate change [16]. Further, formal institutions in Africa have weak institutional capacity, often manifested by inadequate financial and human resources.

Lack of political will, corruption, poverty, poor coordination among sector agencies, political instability, and marginalization of vulnerable groups have been highlighted as impediments to adaptiveness in many parts of the region [17–22].

Thus, weak coordination has been shown to have adversely impacted adaptiveness of societies in Ghana [23]. Similarly, weak local-central government relations have resulted in lack of access to needed resources in countries with decentralized governance structures particularly, resulting in diminished adaptive capacities in Cameroon [24] and southern Benin [25*]. A related challenge is abuse of power in electoral politics. For example, following the severe floods in Mozambique in 2000, the flood-affected victims who did not support the ruling party allegedly did not get adequate support from the government [26]; a similar allegation has also been made in connection with the 2010 storms in Ibadan, Nigeria [27] (see also Accountability).

While there are ad-hoc studies across the region that address different dimensions of 'adaptiveness', there is a need for more systematic and robust understanding of this pillar (see also knowledge and capacity needs). One key theme for further enquiry is the socio-political dynamics that influence or are influenced by adaptation to GEC and adaptiveness in the region (see Table 1 for a list of questions identified by the authors as priority areas for research on *Adaptiveness* in Africa).

Accountability and legitimacy

Accountability is the fourth pillar in the five 'As' of the ESG Analytical Framework; it examines the democratic quality of earth system governance across all scales, both in public as well as private domains [28,29]. While accountability and legitimacy are terms that lend themselves to a multitude of meanings, these notions bear conceptual and practical kinship with the notion of democratic governance [30].

'Accountability' research in Africa — as with the other pillars of the ESG framework — must address some peculiar features of the region. First, it must recognize the democracy deficits in Africa. Many African countries still suffer from poor democratic governance. For example, over 85% of countries in the region have witnessed coups or coup attempts [31]. However, there have also been significant improvements in the transition to democratic governance in Africa. South Africa came a long way from Apartheid to multi-party democracy. Countries like Cape Verde, Ghana, Botswana, Senegal, Mauritius, Seychelles,

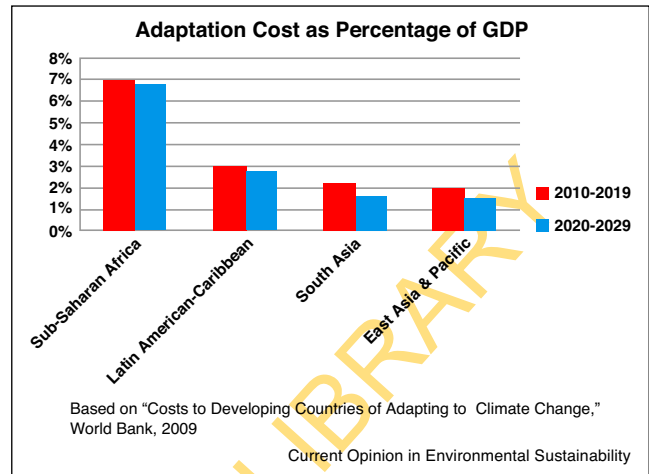
Lesotho and Malawi have fairly functioning democracies. Some are making notable progress (e.g. Rwanda, Sierra Leone). Yet, there have been utter failures (Somalia) and setbacks (e.g. Eritrea, Mali, Chad). Countries like Nigeria, Central African Republic, Kenya, Uganda, and Madagascar are also witnessing set backs on their democracy on account of ethnic and religious strife. Where governance is bad, resilience to GEC impacts is bound to be poor. In many countries across Africa, governance processes are characterized by lack of continuity in government; weak policies and programs and widespread corruption. Deficits in democratic governance have contributed towards conflicts over issues of fair representation and ownership and use of natural resources [32,33].

Lockwood [3**] notes that ‘(t)here has been relatively little thinking about the political context of climate adaptation policy in subSaharan Africa, what this means for the quality of governance, and the capacity to plan and deliver what are often quite complex policies and programs. This is all the more surprising given the quantity and depth of what is already known about politics and governance in Africa’. One key theme for future research in the region may be the ‘democracy’ — ESG nexus (see also knowledge and capacity needs) (see Table 1 for a list of questions identified by the authors as priority areas for research on *Accountability and legitimacy*).

Allocation and access

The fifth pillar in the five ‘A’s’ of the ESG Analytical Framework, ‘allocation and access’, looks into the way GEC impacts are distributed and resources are allocated in response to these impacts [34]. Access and allocation is linked to the fourth pillar and is a perennial problem in African politics. The cost associated with GEC response

Figure 2

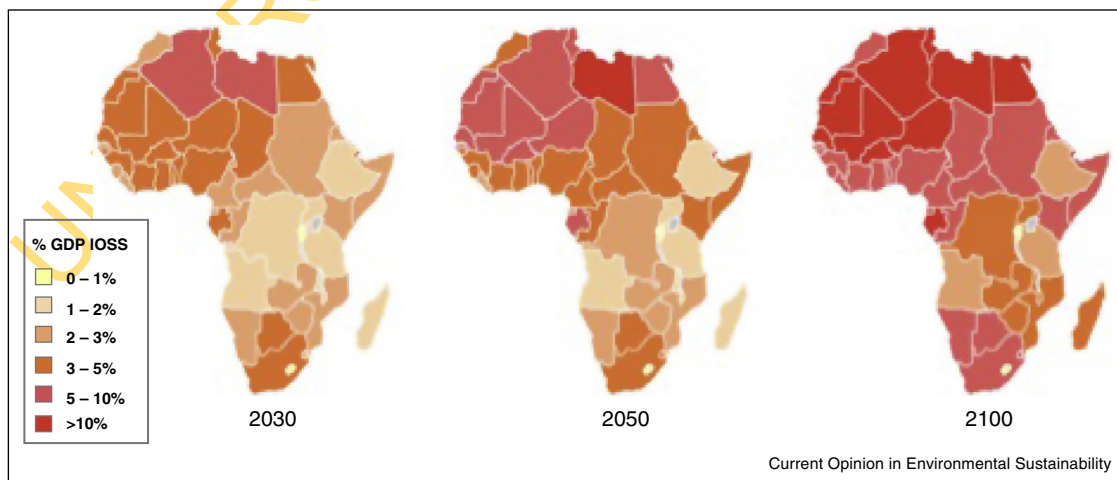


Cost of climate change relative to GDP. <http://blogs.worldbank.org/dmblog/archive/200911>.

provides a good window into the complexities posed by the questions of access and allocation in Africa.

The cost of climate change impacts in the region is significantly high relative to its means (see Figures 2 and 3). Funding in climate change (mostly external) has been steadily increasing over the past few years [35]. But African countries have had difficulties with access as the funds available do not provide direct access, and the procedures and modalities for accessing the funds are cumbersome. Also, the existing climate finance regime has been critiqued as not having mechanisms in

Figure 3



Cost of climate change in Africa expressed as a percentage of GDP loss. United Nations Environment Program (2010). Contribution to the development of a comprehensive framework of African Climate change Program: Economics of climate adaptation in Africa' http://www.unep.org/roa/Amcen/Amcen_Events/3rd_ss/Docs/Presentations/Ministerial-technical/Economics-CC.ppt.

place to allow marginalized groups easy and sufficient access to funds covering weather-related losses or to service adaptation and mitigation technologies [36*].

While it is true that the existing level of funding (both domestic and international) does not meet demand, it is still significant. It is important that these funds be used properly and that the communities whose livelihoods are most affected by climatic stresses be included in benefit sharing. To maximize the effectiveness of available climate finance opportunities, more transparency, accountability, and equity are necessary, since large inflow of resources and the imperative to spend may lead to misuse of resources [37,38] (see Accountability).

Questions of allocation and access could be tricky as there is varied understanding of these notions. However, having regulatory tools and mechanisms in place to ensure equity in access is a key principle to consider. Similarly, it is important to ensure that systems of governance that seek to promote equitable allocation and access do not compromise efficiency. In this regard, it is crucial to have a clear and well-enunciated regime, more so in federal and decentralized systems (e.g. Ethiopia, Nigeria, South Africa) or systems that give substantial autonomy to traditional authority (e.g. Ghana, Mali) (see also knowledge and capacity needs): (see Table 1 for a list of questions identified by the authors as priority areas for research on architecture).

Knowledge and capacity needs

Knowledge needs

Global sustainability can only be achieved with robust research that deepens our understanding of the functioning of the Earth system and how it relates to societal and ecological dynamics. There are crucial knowledge gaps in Africa on the connections of GEC dynamics and governance, discussed above using the five pillars of the ESG Analytical Framework as a frame of reference (see also Table 1). In this section, the goal is not to discuss any further specific knowledge needs but to identify two common threads that run through many of them.

First, Africa's diverse and complex socio-economic and governance landscape necessitates integrated research with strong and well-supported scientific knowledge networks in the region (see capacity needs). There is a need to rethink GEC-related research programs, research tools and methods in existence from the vantage point of relevance. Thus, politics and democracy in the region should be seriously factored in the design of relevant tools and methods (e.g. vulnerability assessments).

Second, *how* earth system governance research is carried out, communicated and utilized is just as important, if not more so, as *what* research needs to be done. African universities and research centers are notoriously rigid in their educational systems, which emphasize departments

and disciplinary silos. There is a need to promote interdisciplinarity and transdisciplinarity in ESG research across institutions of higher learning and research. Related to this, Africa lags behind when it comes to data sharing. While a significant barrier in this regard is lack of information sharing infrastructure, attitudes and culture on data sharing also need to change. There is a strong need for promoting open-data policy in Africa

Capacity needs

Earth System governance research in Africa will require building capacity to identify, prioritize and design key research areas (relevance, scale, and scope) and the appropriate research methodologies that foster interdisciplinarity and transdisciplinarity. Capacity is also needed to convert knowledge into usable information.

There is a need to work with universities to promote integrated approaches on earth system governance research and education through curricula revision and creation of research hubs and centers. Training (and retraining) of African researchers in the use of integrated research methodologies is also important.

A missing link in research on the governance implications of global environmental change in Africa is lack of strong knowledge networks that support and nurture robust knowledge and capacity development [4]. There is a need for creation of an overarching pan-African ESG network, which shall act as a clearinghouse for ESG governance research of relevance to Africa.

One of the priorities for fostering research and research capacity of next generation of African researchers in ESG is thus the need for resources, both within and without, to support research in ESG. In this regard, there is a need to also encourage private and multinational corporations and philanthropies to fund ESG research in the region.

It is important to underscore that capacity building is in itself an effective adaptation response to global change impacts in the vulnerable region.

Conclusion

Efficient, accountable and equitable governance systems and processes for GEC response is key to sustainable development in Africa. Robust research and research capacity that underpin such systems and processes is equally important, if not more so. However, the degree to which deficits in Africa's governance systems and processes stress, or perhaps drive, GEC is understudied. The ESG Analytical Framework could provide a broader and more helpful insight for future efforts in knowledge generation in this crucial area of research.

This paper presents context to priority areas for research using the ESG Framework. It presents a series of research

questions for the ESG community and also suggests approaches and capacity as well as network needs for addressing this significant knowledge need. Given the scope of this need, there is a need to foster productive strategic partnerships with the private, public, non-governmental, and research sectors.

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References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- of special interest
- of outstanding interest

1. Boko M, Niang I, Nyong A, Vogel C, Githeko A, Medany M, Osman-Elasha B, Tabo R, Yanda P: **Africa**. In *Climate Change (2007): Impacts, Adaptation and Vulnerability. 31 Contribution of Working Group II to the Fourth Assessment Report of the IPCC*. Edited by Parry ML, Canziani OF, Palutikof JP, Van Der Linden PJ, Hanson CE. Cambridge: Cambridge University Press; 2007:433-467.
2. Toulmin C: *Climate Change in Africa*. London: Zed Books; 2009.
3. Lockwood M: **What can climate-adaptation policy in Sub-Saharan Africa learn from research on governance and politics?** *Dev Policy Rev* 2013, **31**:647-676.

The paper dwells on the political economy of climate change adaptation in Africa and argues that there is a need for improved understanding of governance dynamic and the political context of adaption in the African continent.
4. Virji H, Padgham J, Seipt C: **Capacity building to support knowledge systems for resilient development – approaches, actions, and needs**. *Curr Opin Environ Sustain* 2012, **4**:115-121 <http://dx.doi.org/10.1016/j.cosust.2012.01.005>.
5. Biermann F: *Earth System Governance: World Politics in the Anthropocene*. Cambridge, MA: MIT Press; 2014.

The author provides detailed analysis of global environmental politics in terms of five dimensions of effective governance: agency, particularly agency beyond that of state actors; architecture of governance, from local to global levels; accountability and legitimacy; equitable allocation of resources; and adaptiveness of governance systems.
6. Morgan WB: **Introduction**. In *Sustaining the Future: Economic, Social and Environmental Change in Sub-Saharan Africa*. Edited by Benneh G, Morgan WB, Uitto JI. Tokyo: United Nations University Press; 1996.
7. Biermann F, Betsill MM, Gupta J et al.: *Earth System Governance: People, Places and the Planet. Science and Implementation Plan of the Earth System Governance Project*. 2009, see also Biermann F, Betsill MM, Vieira SC, Gupta J, Kanie N, Lebel L, Liverman D, Schroeder H, Siebenhüner B, Yanda PZ, Zondervan R: **Navigating the Anthropocene: the Earth system governance project strategy paper**. *Curr Opin Environ Sustain* 2010, **2**:202–208 DOI: [10.1016/j.cosust.2010.04.005](http://dx.doi.org/10.1016/j.cosust.2010.04.005).
8. Hepworth N: *Climate Change Vulnerability and Adaptation Preparedness in Uganda*. Heinrich Böll Stiftung; 2010.
9. Madzwamuse M: *Climate Governance in Africa: Adaptation Strategies and Institutions. A synthesis Report by Heinrich Böll Stiftung*. Cape Town; 2010.
10. Burgess M: *Federalism in Africa: An Essay on the Impacts of Cultural Diversity, Development and Democracy*. The Federal Idea; 2012.
11. Mengisteab K: **Ethiopia's ethnic-based federalism: 10 years after**. *African Issues* 2001, **29**:20-25.
12. Fosu AK: **Terms of trade and growth of resource economies; a tale of two countries**. *UNU-WIDER Working Paper No. 2011/28*. 2011.
13. Niang I, Ruppel OC, Abdrabo MA, Essel A, Lennard C, Padgham J, Urquhart P: **Africa**. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Edited by Barros VR, Field CB, Dokken DJ, Mastrandrea MD, Mach KJ, Bilir TE, Chatterjee M, Ebi KL, Estrada YO, Genova RC, Girma B, Kissel ES, Levy AN, MacCracken S, Mastrandrea PR, White LL. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press; 2014:1199-1265.

The IPCC chapter on Africa, among others, shows that national governments in Africa are initiating governance systems for adaptation, responding to climate change, also underscoring that these systems are far from effective when it comes to coordination of the range of adaptation initiatives being implemented.
14. Ziervogel G, Zermoglio F: **Climate change scenarios and the development of adaptation strategies in Africa: challenges and opportunities**. *Clim Res* 2009, **40**:133-146 <http://dx.doi.org/10.3354/2009cr00804>.
15. Habtezion S: **Adaptation Policies in Africa: Challenges and Opportunities in the Application of Tools and Methods on Climate Change**. In *Environmental Governance and Climate Change in Africa: Legal Perspectives*. Edited by Kotze, Mwabaza. Institute for Security Studies; 2009:71-91. ISBN 978-1-920114-91-6-2009.
16. Mutiba S, Mayieko S, Olum P, Wanyama K: *Climate Change Vulnerability and Adaptation Preparedness in Kenya*. Nairobi: Heinrich Böll Stiftung; 2010.
17. Adano R, Daudi F: *Links between Climate Change, Conflict and Governance in Africa. Issue 234*. South Africa: Institute for Security Studies; 2012.
18. Brown O, Hammill A, McLeman R: **Climate change as the 'new' security threat: implications for Africa**. *Int Aff* 2007, **83**:1141-1154.
19. Fitzgibbon J, Mensah KO: *Climate Change as a Wicked Problem: An Evaluation of the Institutional Context for Rural Water Management in Ghana*. SAGE Open; 2012: 1-14 <http://dx.doi.org/10.1177/2158244012448487>.
20. Pasquini L, Ziervogel G, Cowling RM, Shearing C: **What enables local governments to mainstream climate change adaptation? Lessons learned from two municipal case studies in the Western Cape, South Africa**. *Clim Dev* 2015, **7**:60-70 <http://dx.doi.org/10.1080/17565529.2014.886994>.
21. Madzwamuse M: *Climate Governance in Africa-Adaptation Strategies and Institutions*. 2011: 110 pp. <http://www.boell.de/en/ecology/africa-climate-governance-in-africa-adaptation-strategies-and-institutions-10914.html>.
22. Sowers J, Vengosh A, Weinthal E: **Climate change, water resources, and the politics of adaptation in the Middle East and North Africa**. *Clim Change* 2011, **104**:599-627.
23. Yaro JA, Teye J, Bawakyillenuo S: **Local institutions and adaptive capacity to climate change/variability in the northern savannah of Ghana**. *Clim Dev* 2015, **7**:235-245 <http://dx.doi.org/10.1080/17565529.2014.951018>.
24. Brown HCP, Nkem JN, Sonwa DJ, Bele Y: **Institutional adaptive capacity and climate change response in the Congo Basin forests of Cameroon**. *Mitig Adapt Strat Global Change* 2010, **15**:263-282.

25. Baudoin M: **Enhancing climate change adaptation in Africa**
 • **assessing the role of local institutions in Southern Benin.** *Clim Dev* 2014, **6**:122-131 <http://dx.doi.org/10.1080/17565529.2013.844677>.

On the basis of field researches led among farmers' households in Southern Benin, the author highlights the respect and trust that traditional chiefs and local organizations enjoy (relative to governments) and argues that international support for adaptation should better be geared towards supporting adaptive capacities at the local level.

26. Nyong A, Fiki C, McLeman R: **Drought-related conflicts, management and resolution in the West African Sahel: considerations for climate change research.** *Die Erde* 2006, **137**:223-248.
27. Adelekan IO: **Vulnerability to wind hazards in the traditional city of Ibadan, Nigeria.** *Environ Urban* 2012, **24**:597-617.
28. Biermann F, Gupta A: **Accountability and legitimacy. An analytical challenge for earth system governance.** *Ecol Econ* 2011, **70**:1854-1855 <http://dx.doi.org/10.1016/j.ecolecon.2011.07.017>.
29. Biermann F, Gupta A: **Accountability and legitimacy in earth system governance: a research framework.** *Ecol Econ* 2011, **70**:1856-1864 <http://dx.doi.org/10.1016/j.ecolecon.2011.04.008>.
30. Callamard A: **Accountability, transparency, and freedom of expression in Africa.** *Soc Res* 2010, **77**:1211-1240.

31. Lindemann S: *Working Paper No. 80, Civilian Control of the Military in Tanzania and Zambia: Explaining Persistent Exceptionalism; Crisis States Research Centre, September: 2010.*
32. Collier P, Elliot L, Hegre H, Hoeffler A, Reynal-Querol M, Sambanis N: *Breaking the Conflict Trap: Civil War and Development Policy.* Oxford: Oxford University Press; 2003: <http://econ.worldbank.org/prr/CivilWarPRR/>.
33. Osaghae EE, Osaghae VA: **Rethinking democratic accountability in Africa.** *Forum Dev Stud* 2013, **40**:393-412.
34. Gupta J, Lebel L: **Access and allocation in earth system governance: water and climate change compared.** *Int Environ Agreements* 2010, **10**:377-395.
35. Nakhouda S, Caravani A, Bird N, Schalatek L: *"Climate Finance in Sub-Saharan Africa" November (Climate Finance Policy Brief).* Washington, DC: Heinrich Böll Foundation; 2011.
36. Schalatek L: **Engendering climate finance. Perspectives (Political analysis and commentary from Africa – Mobilising Climate Finance for Africa) No. 4/11.** South Africa: Heinrich Böll Foundation; 2011.
- For example, 'Of the roughly US\$ 10 billion of funding approved by mid-2011, only US\$ 350 million was devoted to climate change adaptation in Africa'
37. Transparency International: *Global Corruption Report: Climate Change.* 2011.
38. United Nations Development Programme: *Staying on Track: Tackling Corruption Risks in Climate Change.* 2011.