HEINRICH BÖLL STIFTUNG
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شمال إفريقيا الرباط

Social and ecological transformation
in Morocco and across Africa

Country Analysis Paper
South Africa

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Social and Ecological Transformation in South Africa

Country Analysis Paper

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We hope that this paper will contribute to processes leading to the resilience of not only South Africa, but other countries in Africa and the rest of the world.

ABSTRACT

This paper provides an analysis of social and ecological changes in South Africa with the aim to contribute to the understanding of the various perspectives, perceptions and insights of issues related to the social and ecological transitions processes in the country. The paper examines some of the relevant social-ecological transitions in the country identifies the main climate-induced ecological challenges in South Africa, and explores their social implications. The paper concludes that the societal debates around climate change in South Africa are more closely interlinked with the socioeconomic realities than with the future threats. It notes that whereas there is will expressed in policies and plans, actual action to transform the social and ecological systems for the enhancement of resilience is slow or intangible. The paper attributes this to socio-political dispensation and governance environment of the country. The apartheid history and legacy also continue to drag the country behind in terms of making meaningful progress in socio-ecological transformations. It also draws a conclusion that there is inadequate involvement of critical actors such as the local civil society and indigenous groups, which is related to their inadequate capacity to engage with the technical aspects of climate change. It recommends multi-level, adaptive approaches to understanding and responding to the challenges of climate change, and increased targeted support to spark necessary pathways to the desired social and ecological developments.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immuno-Deficiency Syndrome
ANC	African National Congress
CIA	Central Intelligence Agency
COP	Conference of Parties
DEA	Department of Environmental Affairs
DIRCO	Department of International Relations and Cooperation
DRR	Disaster Risk Reduction
DST	Department of Science and Technology
DWS	Department of Water and Sanitation
EMG	Environmental Monitoring Group
EPWP	Expanded Public Works Programmes
FBE	Free Basic Electricity
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GIZ	Gesellschaft für Internationale Zusammenarbeit
HBS	Heinrich Böll Foundation
HIV	Human Immunodeficiency Virus
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Provider
LTAS	Long-Term Adaptation Scenarios
MFMA	Municipal Finance Management Act
MRV	Monitoring, Reporting and Verification
NDP	National Development Plan

NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organisation
NPC	National Planning Commission
NRM	Natural Resource Management
OMCJC	One Million Climate Jobs Campaign
PEA	Political Economy Analysis
PPP	Purchasing Power Parity
RDP	Reconstruction and Development Plan
RSA	Republic of South Africa
SANBI	South African National Biodiversity Institute
SDGs	Sustainable Development Goals
SES	Social-Ecological Systems
SET	Social-Ecological Transitions
SFDRR	Sendai Framework for Disaster Risk Reduction
SSA	Sub-Saharan Africa
Stats SA	Statistics South Africa
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WDI	World Development Indicators
WWF	World Wildlife Fund

1. INTRODUCTION

1.1. About Heinrich Böll Stiftung (hbs) Afrique du Nord Rabat

The Heinrich Böll Stiftung (hbs) is a think tank for policy reform, a catalyst for green visions and projects, and an international network of about 160 project partners working in over 60 countries. With 30 international offices, hbs provides a space for critical and informative political debates, creating evidence for policy advice, enabling national, regional and global networking and building capacities for political advocacy. Affiliated with, but intellectually independent from, the German Green Party, hbs shares the same ideas as the green political movement, and works in the core areas of ecology, sustainable development, democracy, human rights and justice. The hbs Afrique du Nord-Rabat office commenced its operations in 2014, and is working to promote the same non-violent, proactive and sustainable policies as the parent organisation. Its mandate is in the promotion of civic and political education, and is working on ecology and sustainability, democracy and human rights, with a predominant focus on "gender equality" for social emancipation and equal rights for all.

1.2. Background

In 2015, three important global policy agreements were adopted in an unprecedented coincidence. The Sendai Framework for Disaster Risk Reduction (SFDRR), the Sustainable Development Goals (SDGs), and the Paris Climate Accord (Paris Agreement) were adopted that year in March, September and December respectively. They correspondingly ushered in a new era for global policy on disaster risk reduction (DRR), sustainable development, and climate action. They all recognise the interconnection between the social, ecological, and the economic. South Africa is a party to all these conventions, and has committed to their overall objective of securing socioeconomic development and building resilience. It ratified the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement on 1 November 2016.

Climate change is one of the most formidable challenges facing humanity in the contemporary times, and has weighty implications for both development and disaster risk. It has fuelled social and ecological transitions all over the world, and endangers economic growth and social coherence. The phenomenon has in the last few decades brought to the fore sustainability questions and dilemmas, especially regarding the pursuit of socioeconomic development while ensuring environmental health and integrity. More recently, the debate has included more dimensions that have a bearing on poverty, gender equity (and "equality"), social justice, human rights, peace and security. For instance, it is estimated that without a good, climate-smart development, climate change impacts could push over 100 million additional people into poverty by 2030 (Hallegatte et al., 2015). Africa already experiences these impacts including increasing desertification; water shortages, droughts and famines, crop failures, insect infestations, floods, and even species extinctions (Carpenter et al., 2008; Field et al., 2014; Lobell et al., 2008; Thomas et al., 2004; Urban, 2015).

South Africa is exposed to a wide range of these environmental and climate hazards, particularly droughts – the country is currently dealing with the impacts of the worst drought in almost a century – veld fires, floods (especially in the low-lying coastal zones, and aggravated by sea-level rise) and severe thunderstorms. Agriculture, considered as a key driver of African economies (Jones and Sue, 2017; Kalibata, 2015; NEPAD, 2013), is one of the most affected sectors (Collier et al., 2008). Thus, it will be one of the main influencers of any increases or decreases in poverty under climate change in the continent (Jones and Sue, 2017; Kalibata, 2015). In the FY2016, agriculture contributed US$9.2 billion (about 12%) of South Africa's total export earnings. Partly because of the ongoing drought, South

Africa's agricultural sector lost about 110,000 jobs in the first three quarters in 2017, with about 84% of the losses in the last quarter observed in the Western Cape (Agri SA, 2017; Statistics South Africa, 2017a).

But climate change is a complex, multidimensional phenomenon which also poses a risk to many other sectors and aspects of the society through intricate interactions and feedback loops (Hallegatte et al., 2015). The impacts of climate change on ecological systems affect the social systems as well (Adger, 2003). Its impacts on ecological systems such as wetlands, forests, rivers, lakes and oceans adversely affect agricultural productivity and food security, and health. It threatens progress on poverty eradication, while climate-related risks and disasters often affect poor people the most. Furthermore, climate change will increasingly worsen hazards (such as droughts, floods and storms) in most regions of the world. Many of these hazards and disasters also contribute to poverty and magnify the health risks posed by climate change to the already poor people. For example, South Africa's '2016 drought' is considered the worst since 1926, and has had negative implications not only of food security, water shortages (notably in areas such as Cape Town and Western Cape), but also jobs and employment (especially in the agricultural sector). Climate change is also a real "new" security threat with dire implications for Africa (Brown et al., 2007) and the rest of the world. Climate-induced resource scarcity, people displacement and migration fan tension and (even violent) conflicts. From this perspective, some analysts have at different times termed climate change as the "mother of all security problems", "the 'mother of all risks' to national security" (Powers, 2015), and the "mother of all conflicts" (Gilding, 2011) with an increasing risk of civil wars in Africa (Burke et al., 2009). Some of these have already been documented in Southern Africa (Mcdonald, 1999; Reuveny, 2007).

Evidently, as a minimum, climate change has geographic/spatial, ecological, political, sociocultural, and economic dimensions (Sakai and Umetsu, 2014). These dimensions are critical in understanding the threats and opportunities for adapting to the impacts, but also in the mitigation, of climate change. For instance, besides the "economic sense" of sustainable energy transitions, deliberate considerations of sociocultural and ecological aspects within defined geographic scales are crucial in climate action. The spatial scales may traverse political and administrative boundaries, as some resource (ecological) systems such as river and lake basins are shared between or among countries, and affect the welfare of the people in the respective countries and at different scales of governance (i.e. national and subnational). Besides, "global commons" problem due to the global mixing of GHGs in the atmosphere (Cash et al., 2006). Thus, dialogue between these countries (and scales) are critical to their social-ecological sustainability, bring about considerations of international cooperation and relations. An example of such intra-state inter-scale cooperation has been observed in South Africa between the national government and the City (government) of Cape Town, where the latter was allowed deviation from the Municipal Finance Management Act (MFMA) in its attempt to deal with the impacts of the 2016 drought (News24Wire, 2017)"URL":"http://www.news24.com/SouthAfrica/News/cape-town-gets-gigabas-go-ahead-to-deal-with-drought-20171030","author":[{"family":"News24Wire","given":""}],"issued":{"date-parts":[["2017",10,30]]},"accessed":{"date-parts":[["2017",11,1]]}}],"schema":"https://github.com/citation-style-language/schema/raw/master/csl-citation.json"} .

The impacts of climate change are highly discriminatory. They affect people and communities differently owing to their unique socioeconomic, political, cultural and spatial positioning. Often, it is the politically – and economically – marginalised groups that are the most adversely-affected. Women and men experience and are affected by climate change differently. This is mainly due to their gendered roles, activities, and resources (including social capital) to combat climate change. Therefore, it is important that climate change adaptation policies and practices are deliberately *gender-sensitive, equitable, and inclusive* enough to meet the varied needs of especially the vulnerable at the different scales. Because the *political processes* that determine climate response priorities could reinforce marginalisation of some social groups in a community, it is critical to include all the important groups in the decision-making platforms and processes. South Africa's apartheid legacy and history have an impact in these dimensions. For example, the ownership of land by the Whites has had negative implications to the non-whites' resilience and wellbeing, considering that land is a critical asset and capital. Land tenure and access affect one's capacity to cope with or respond to the challenges of climate change. Land in the country could be a measure of a household's economic power, especially because of its agricultural value. South Africa has had a land reforms policy aimed at redistributing this resource for over 20 years now, although its progress is a contested topic.

The adaptation efforts, therefore, ought to be somewhat 'discriminatory' (or differentiated) in this sense, by deliberate targeting and prioritising the *most vulnerable communities and ecosystems*. Mitigation efforts too (e.g. sustainable energy transitions) also need to be inclusive and considerate of all interest groups. Interventions (including policies) to facilitate transition to sustainable, just, social and ecological development need to be developed through participatory processes – including the civil society and marginalised groups too – to ensure the above-mentioned considerations. For instance, designing and implementing a renewable energy transition strategy would require considering the ownership of coal mines – an important component of the country's extractive industry – and the dependants on the mining industry. Despite the widely-held belief that "all adaptation is local", there is also increasing recognition that there are impacts that require a much wider reach to the national, regional and even continental levels. Thus, dialogue with actors at these scales needs to be encouraged and facilitated.

The formidable challenges posed by climate change notwithstanding, fast-tracked, just, inclusive and climate-smart development can reduce their impacts. Tackling climate change challenges requires a novel, sustainable, just and inclusive approaches. This means finding opportunities and solutions within socioeconomic, ecological, and political systems that affect these aspects. Identifying socio-ecological solutions and development alternatives towards a sustainable, equitable and just economy is one of the initial steps towards the transformative agenda for climate change mitigation and adaptation. But doing so will require navigating the complex, uncertain, multilevel nature of social-ecological systems. In most instances, incremental modifications to the socio-political, environmental stewardship and economic processes are pursued. However, in other cases, these incremental steps may be inadequate, thus necessitating fundamental changes in the social and ecological spheres. This is what is referred to herein as "social-ecological transformations" (see section 3.1 for more details about this concept). This study will contribute towards this, by providing a succinct country analysis of socio-ecological transformations for the Republic of South Africa (officially known as South Africa (RSA)).

2. METHODOLOGY

2.1. Study objective and questions

The overall goal of this study is to provide an analysis of the situation of social and ecological change in South Africa. It seeks to contribute to the understanding of the various perspectives, perceptions and insights of issues related to the social and ecological transition processes in the country. In so doing, the paper asks how social-ecological change could be defined in the context of South Africa and examines some of the relevant social-ecological transitions in the country. It identifies the main climate-induced ecological challenges in South Africa and explores their social implications. The study also explores the societal debates around climate change and related responses, who are the most involved in the debate, the extent to which human rights are considered in the debate and whether the public

debates attract enough attention and action from policy makers. In this last regard, we examine the current climate-related policy environment in South Africa, and how it positively or negatively affects citizen-centred social-ecological transformations. The study also interrogates how structural transformations in the governance processes link with the scales of ecological changes in the country. The methods used to interrogate these questions are outlined in Table 1 under subsection 2.2.

2.2. Methods and procedures

This study adopted a qualitative research design grounded on the Social-Ecological Systems (SESs) framework. It involved literature review, and semi-structured interviews with a diverse set of interviewees who were identified by the research team in consultation with the hbs Afrique du Nord Team. Purposive sampling (Tongco, 2007) and snowballing (Biernacki and Waldorf, 1981; Noy, 2008) techniques were employed, whereby persons believed to possess the desired knowledge (due to their positions, training and occupations) were targeted for interviewing, and referrals for other would-be interviews were sought from willing respondents, who included subject matter experts and opinion leaders such as researchers, activists, and political actors. Some of the interviews were conducted via Skype, while other respondents preferred to write their responses to certain study questions. Five (5) in-depth key informant interviews were conducted, and three (3) written responses were provided through emails.

The literature review was undertaken first, followed by the interviews in which information and data obtained in the former were further interrogated in the latter. The interview data were collected in form of audios, videos, photos and interview notes, and analysed qualitatively. The key research questions and the methods and techniques employed in addressing them are shown in Table 1.

Table 1. Key questions and methods

Category	Questions	Methods
Theoretical foundations	How can social-ecological change be defined in the context of South Africa? What are some of the relevant social-ecological transitions prevalent in South Africa?	Literature review and analysis
Ecological challenges and social impacts	What are the main climate-induced ecological challenges in South Africa, and what are their social implications?	Literature, primary secondary data analyses
Climate policy environment	What is the current climate-related policy environment in South Africa? How does it positively or negatively affect citizen-centred social-ecological transformations?	Literature, policy reviews; interviews
Public debate on climate change	What is the prevailing narrative in the societal debate on climate change and related responses? Who are the most involved in this debate? Does the public debate attract enough attention and action from policy makers? To what extent are human rights aspects considered in the debate?	Literature and media reviews; interviews
Linking governance and ecological scales	How do structural transformations in the governance processes link with the scales of ecological changes South Africa?	Interviews; analysis

2.3. Analytical approach

The SES framework was used for analytical purposes of this study as it explicitly appreciates the interconnections and feedbacks between the human (social) and natural (ecological) systems (Leslie et al., 2015; Young et al., 2006) as we call them, socio-ecological systems (SESs. It also recognises and allows for an integrative, interdisciplinary understanding and management of social and ecological systems, while appreciating the role of individual and/or collective choices in influencing outcomes in SESs (McGinnis and Ostrom, 2014). Furthermore, the SES framework facilitates the identification of trade-offs and opportunities for building and managing resilience and sustainability (Chhatre and Agrawal, 2009; Persha et al., 2011)especially when they incorporate local knowledge and decentralized decision making. However, hypothesized relationships between institutional factors and multiple benefits have never been tested on data from multiple countries. By using original data on 80 forest commons in 10 countries across Asia, Africa, and Latin America, we show that larger forest size and greater rule-making autonomy at the local level are associated with high carbon storage and livelihood benefits; differences in ownership of forest commons are associated with trade-offs between livelihood benefits and carbon storage. We argue that local communities restrict their consumption of forest products when they own forest commons, thereby increasing carbon storage. In showing rule-making autonomy and ownership as distinct and important institutional influences on forest outcomes, our results are directly relevant to international climate change mitigation initiatives such as Reduced Emissions from Deforestation and Forest Degradation (REDD. Moreover, it facilitates a better understanding of how resource systems (e.g. lakes and rivers, forests, grazing lands), the services and products they provide (e.g. water, fruits and firewood, and livestock fodder), and governance systems jointly affect and are in turn affected spatial-temporally. Finally, it enables the analysis of how the larger socioeconomic, ecological and political contexts may affect and be affected by these attributes (Ostrom, 2007)"container-title":"Proceedings of the National Academy of Sciences","page":"15181-15187","volume":"104","issue":"39","source":"www.pnas.org","abstract":"The articles in this special feature challenge the presumption that scholars can make simple, predictive models of social–ecological systems (SESs. Ultimately, the framework helped to achieve the varied objects of this study.

2.4. Study challenges

A few challenges were encountered during the study. The most important related to the availability of the identified persons for interviews due to the short duration and tight deadlines of the study. The deadline to produce this paper was delayed since most of the interviewees were not available.

3. LITERATURE REVIEW

3.1. What is "social-ecological transformation"?

Before we delve deeper into the social-ecological transformations in South Africa, it is important to understand what the term means. We explore the relevant literature in the SES and geography studies to provide this explanation. However, due to the limited space in this paper, we limit our discussion to the definition of the concept, and choose the one we find most suitable.

Climate change is a wicked problem Brand and Wissen (2017, p. 1) consider social-ecological transformation as an "umbrella term" describing the "political, socioeconomic, and cultural shifts resulting from attempts to address the socioecological crisis". In our context, the 'socioecological crisis' is the global environmental change, or simply, climate change, which we consider as linked to social processes. In this regard, the concept encourages the undertaking of "deliberate transformation on the policies, institutions, infrastructure, practices and lifestyles" (Hackman et al., 2012, p. 117) in the effort to combat climate change and improve human wellbeing. Despite the consensus in literature

that addressing the multiple crises resulting from climate change requires profound and fundamental changes (i.e. transformations), different analyses have emerged on how to do this owing to differences in theoretical perspectives and normative interests – some of which might even be considered as contrasting (Brand et al., 2013).

3.2. Geography and climate

Located at the southern tip of Africa, with an area of 1,219,090 Km2, the Republic of South Africa is the world's 26th largest and southern Africa's largest country by area. Only 0.38% (4,620 Km2) of this area is under water. However, South Africa has a long coastline stretching almost 2,800 Km along the Indian and Atlantic Oceans as illustrated by Figure 1. These oceans surround the South Africa to the east, south and west

Figure 1. Map of South Africa (Source: CIA: The World Factbook)

Their currents illustrated in Figure 2 – i.e. the warm Mozambique and Agulhas Currents (southward-flowing in the Indian Ocean) and the cold Benguela Current (north-ward flowing

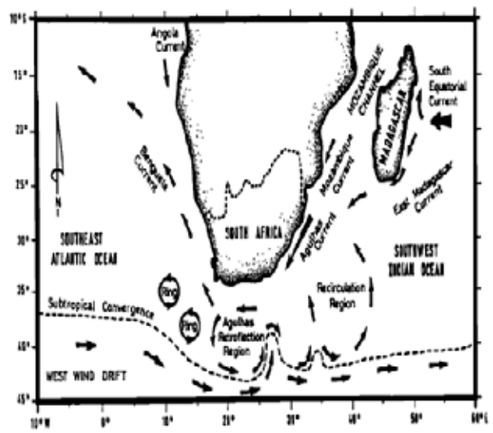

Figure 2. The main ocean current regimes surrounding southern Africa (Source: Walker, 1990).

in the Atlantic Ocean) (Hutchings et al., 2009)- influence the country's weather patterns and climate (Collins et al., 2012; Hermes and Reason, 2009; Matano et al., 2002; Walker, 1990). The warm currents keep the eastern and south-eastern coasts warmer, while the cold current keeps the western coast cooler as well as contributes to the atmospheric stability and dryness in western South Africa.

Although South Africa has a generally temperate climate and, thus, temperature extremes are rare, the country has varied climatic zones owing to the influence of the oceans and its varied

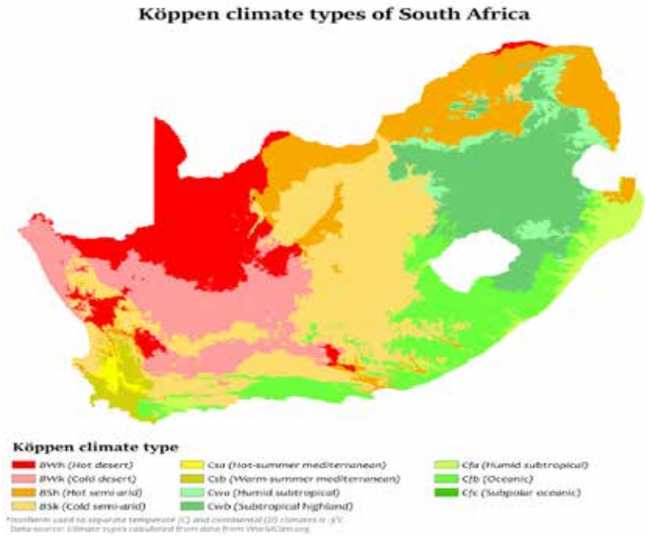

Figure 3. South Africa's Köppen climate regimes (Credit: Adam Peterson, Wikimedia)

topography. These range from the hot desert climate of the southern Namib in the northwest, to the subtropical highland and subpolar oceanic climate in the eastern parts of the country. Figure 3 illustrates these and the rest of the climate regimes using the Köppen climate classification, which is perhaps the most widely-used in climate classification (Alvares et al., 2013; Kottek et al., 2006).

3.3. Poverty, social inequalities and demographics

South Africa has seen a steady population increase over time (see Figure 4.). According to the Stats SA's 2017 mid-year estimates, the population stands at 56,521,900, with the black African population forming an 81% majority of 45.7 million people. The white, coloured and Indian/Asian populations are estimated at 4.5, 5.0, and 1.4 million respectively (Statistics South Africa, 2017b). Slightly over a half (51.13%) of the population is female while the

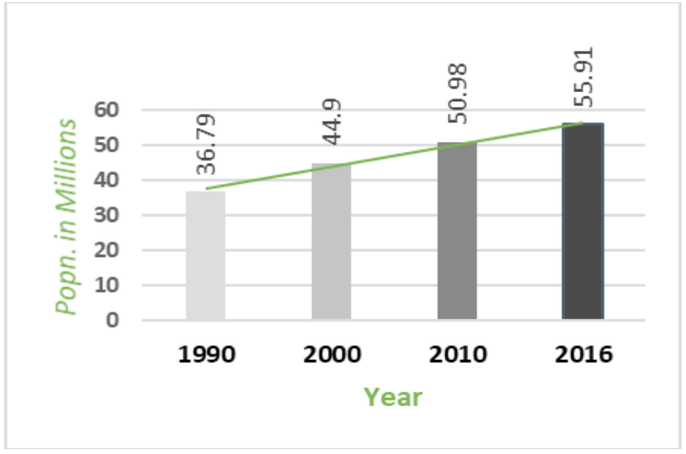

Figure 4. Population change in South Africa since 1990 (Data sources: Statistics South Africa, United Nations World Population Prospects).

males form 48.87% of the population. Despite the steady increase, the annual population growth has been fluctuating in post-apartheid South Africa. For instance, the population growth was estimated at 2.3%, 1.5%, 1.4% in 1990, 2000 and 2010 respectively, although the 2016 estimates put it at 1.6% (WDI, 2017). The impact of HIV/AIDS on the demographic transitions in South Africa is widely appreciated in policy, practice and research communities.

In South Africa, poverty is a pressing development challenge. Combating underdevelopment and poverty has formed a central theme to the South African government. The ANC-led Government in the post-apartheid era is not just concerned with economic development, but also in addressing social ills inherited from the apartheid regime and to ensure the political participation of previously disadvantaged groups in the working of the economy. This was proclaimed in the 1994 Reconstruction and Development Plan (RDP) (RSA, 1994), and reiterated in the 2011 National Development Plan 2030 (NDP) (RSA and NPC, 2011). About 21.5% (about 12 million) of South Africans live below the poverty line (US$ 1.29 per day at Purchasing Power Parity or PPP), even though the country's economy is the third largest in the continent (after Nigeria and Egypt) with an estimated GDP of US$ 294.8 billion in 2016 (Anderson et al., 2017; WB, 2016). This brings forward the question of income inequality, distribution of the national wealth and concerns regarding exclusion as evidenced in the Gini[1] coefficient which places South Africa among the most unequal societies globally with a Gini index between 0.660 and 0.696 in 2014 (WB, 2016). Besides the social inequality, the rate of unemployment in the country is also significantly high (27.3%) and even higher among the youth. The World Bank (2016) estimates that one out of every two young South Africans (or 50%) is unemployed. Looking at the disaggregated data further reveals glaring racial and gender disparities.

3.4. Energy, climatic change and their impacts

The South African economy is highly energy-intensive making the country one of the top emitters of greenhouse gases (GHGs) in Africa. Alone, the country accounts for 18% of the total GHGs in the Sub-Saharan region and 1% of the GHGs emitted globally (Pegels and Stamm, 2011). A large portion of the energy supply comes from non-renewable sources like coal, which alone accounts for 95% of the total energy produced in South Africa, while renewable source of energy represents a meagre share of 2% (Musango and Brent, 2011; SARi, 2011). Although access to electricity has increased steadily since the '90s, energy poverty remains entrenched in South Africa (Joubert, 2016). The percentage of South African

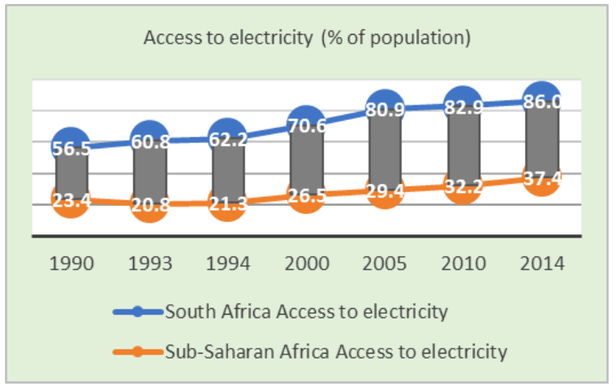

Figure 5. Access to electricity (% of population) in South Africa as compared to the Sub-Saharan Africa (Data Sources: WDI)

population with access to electricity in 2010 and 2014 was 82.9% and 86% respectively, compared to Sub-Saharan Africa's (SSA), 32.2% and 37.4% respectively (see Figure 5.).

In this period, electricity production from coal sources[2] (expressed as a % of total energy produced) stood at 94.3% and 93.0% respectively, while the share of electricity generated by renewable power plants in total electricity generated by all types of plants accounted for 0.9% and 1.4% respectively (as illustrated in Figure 6.).

While the coal continues to dominate energy production sources, renewable electricity in South Africa has never gone beyond 1.4% of the total. Energy access is closely linked to economic wellbeing, that is, energy poverty is aggravated by economic poverty. Electricity access is higher in urban than in rural areas. In 2010 and 2014 also, this stood at 63.7% and 71.5% respectively for rural areas, and 94.6% and 94.1% for urban areas. A 0.5% decrease between 2010 and 2014 can be attributed to an increase in urban population without a proportional increase in electricity provision. Available data show that access to clean fuels and technologies for cooking[3] has steadily increased since 2000 and stood at 81.8% in 2014.

1 The GINI coefficient is the measure of unequal distribution of income and wealth, ranging between 0-1, where 0 represents a perfect income distribution and 1 represents a perfect unequal society

2 Sources of electricity refer to the inputs used to generate electricity. Coal refers to all coal and brown coal, both primary (including hard coal and lignite-brown coal) and derived fuels (including patent fuel, coke oven coke, gas coke, coke oven gas, and blast furnace gas). Peat is also included in this category.

3 Access to clean fuels and technologies for cooking is the proportion of total population primarily using clean cooking fuels and technologies for cooking. Under WHO guidelines, kerosene is excluded from clean cooking fuels.

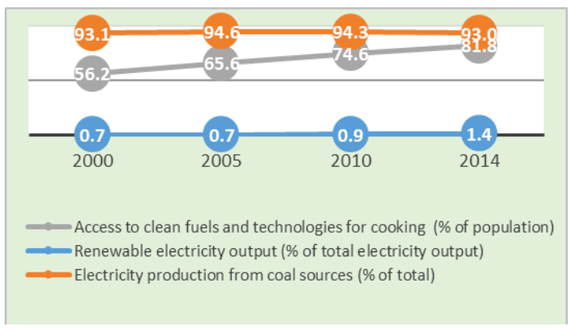

Figure 6. Renewable and coal-sourced energy (Data Source: WDI

The "many laudable and strong pro-poor energy policies" (Sustainable Energy Africa, 2014, p. 1) developed by the RSA Government since the '90s would have been expected to yield better outcomes. In an article in "Energy Transition: The Global Energiewende", Joubert (2016) observes that:

"Meeting South Africa's household energy needs is not just about having access to the grid, or a suite of renewable technologies on hand. It requires tackling the roots of poverty in one of the most unequal societies in the world".

Cullis et al. (2011) forecast a temperature increase of between 1o to 2.2o by 2025 and 2050 respectively, corroborating the recent report of the Intergovernmental Panel on Climate Change (IPCC, 2014) and the findings of Kusangaya et al. (2014) regarding a temperature increase trend in the Southern Africa region in recent years. The increase in temperature in South Africa will significantly alter the hydrological cycle with far-reaching ramifications for sectors such as agriculture, fishery, energy supply, tourism, and forestry, to name but a few (Gleick, 2000; Olmstead, 2014; Yilmaz and Yazicigil, 2011). Hydrological hazards for instance drought and flood are also expected to increase in frequency and magnitude/intensity, resulting into serious socio-economic disruptions and exacerbating other non-climatic issues such as poverty and food insecurity. In the process, this threatens to increase the vulnerability of an already racially-tense society, a common phenomenon debated by Wisner et al. (2004) in their discussion of progression of vulnerability[4] to natural hazards.

3.5. Ecosystem services

It is estimated that the value of ecosystem services in South Africa, based on land cover alone, has dropped by 10% in the last two decades, from the initial US$ 675 billion in 1990 to US$ 610 billion in 2014[5] (Anderson et al., 2017). Considering that South Africa's GDP was US$ 350 billion in 2014 (WB, 2014), it is evident that the ecosystem services are a critical part of the RSA's economy. They offer significant revenue to address social injustice, fight poverty and generate job opportunities at all scales of the social fabric of South Africa, and any negative impact on their productivity is injurious to the country.

4 Wisner et al. (2004) posit that disasters occur when a natural hazard meets a vulnerable community whose vulnerability can only be understood from the socio-economic and political processes that progress from root causes (such as marginalization, exclusion, limited access to resources, etc.) to dynamic pressures (e.g. rapid urbanisation, lack of training, etc.) to unsafe conditions (such as living in slums, coastal areas, etc.)

5 The net loss of the ecosystem and the total value of the ecosystem services would be higher if land degradation such as soil erosion, invasive species, etc. and all the ecosystem services were factored in the valuation respectively

3.6. Government interventions and initiatives

The Government of the RSA has been responsive towards the above issues. It has instituted various initiatives and policy reforms to address the issues surrounding poverty, income inequality, energy poverty, unemployment and environmental among others. These include the establishment of the social welfare programme, income growth programmes, Free Basic Electricity (FBE), Expanded Public Works Programmes (EPWP) and reforms in the formal housing sector. For instance, in line with its vision of "a prosperous and equitable society living in harmony with our natural resources", the Department of Environmental Affairs (DEA) established several programmes, such as the Natural Resources Management (NRM), aimed at enhancing the natural capital while at the same time creating job opportunities in the marginalised communities (Angelstam et al., 2017). The Long-Term Adaptation Scenarios (LTAS) – implemented by DEA with the technical support of the South African National Biodiversity Institute (SANBI) and technical and financial support of GIZ - was also a flagship research programme that responded to the knowledge and research needs of the 2011 National Climate Change Response White Paper.

3.7. Social and ecological transformation (SET) – Analytical Framework

The understanding of the socio-ecological systems has evolved over time. In the context of this study, we position ourselves within the sustainability school of thought and define the social and ecological transformation as "planned or impulsive alterations of the ecological, social or economic systems when prevailing

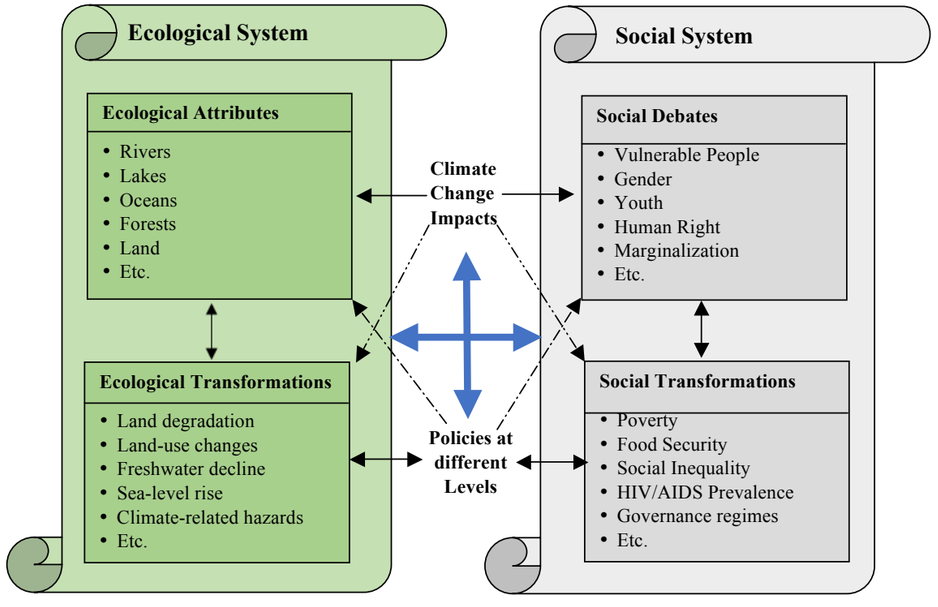

Figure 7. The social-ecological Transformation Framework (Source: Authors)

The blue arrows represent causal loops between climate change impacts and policies and feedback loops between the social and ecological systems. The solid dash arrows represent the direct impacts while the dotted dashed arrows represent the indirect impacts.

conditions become untenable» (Brown et al., 2013, p. 101). We argue that through transformation, new stable landscapes are formed and new capacities are acquired by the elements of the SES to adapt to the changing environment and circumstances, including to earn a living or just to survive.

Contrary to the notion of transformation is the concept of "trap", which depicts a condition whereby elements of a given system are unable to transform their way of life to adapt to the changing environment. Simply put, transformation is a move towards a stable condition whereas traps may prevent transformation from occurring.

In South Africa, climate change is already affecting the ecological attributes such as rivers, lakes, oceans, forest and land in various ways leading to serious transformations of the ecological system through land degradation, sea level rise, pollution, increase in frequency and magnitude of climate-related hazards, spread of invasive species among others.

From the social vantage point, the legacy of apartheid, food security, poverty eradication, crime and the HIV/AIDS prevalence are among the worth-to-discuss cases of the social transformations in South Africa. It is important to understand the extent to which, the ecological transformations are altering the social fabric of South Africa and vice-versa. This can only be answered when the SES is viewed as a coupled system with various layers of feedback loops occurring at different scales and in constant alterations. More importantly is the need to appreciate the influence of policies on these transformations, and policies themselves as part of the governance transformations on the social systems, as outlined in the social-ecological transformation framework presented below.

4. RESULTS AND DISCUSSION

But changes in the social and ecological systems had been happening before then, and attempts to address them had been contemplated in the 2011 National Climate Change Response White Paper. However, South Africa's climate action for 2017 is rated as "highly insufficient" by «Climate Action Tracker», an independent science-based assessment, which tracks the emission commitments and actions of countries around the globe. In this section, we discuss our findings from literature review and interviews.

4.1. Social and Ecological Transitions in South Africa

4.1.1. Visible transitions

The visible transitions in South Africa are largely ecological in nature. They include sea-level rise which poses flooding risks to low-lying coastal areas, towns and cities; changes in temperature (increase) and precipitation (variable, but generally reduced amount of rainfall); biodiversity shifts (niche changes); water shortages (in an already water-scarce country); and climate-related hazards (such as tropical storms, floods and drought). Landscape changes such as desertification and deforestation are also observable and mostly attributed to land degradation because of land use changes and the influence of human activity on the natural ecosystems. For instance, poorer South African farmers who cannot afford the intensified farming and/or farm inputs clear trees in search for more productive land, or shift to entirely new sources of livelihood.

There are also visible transitions that can be classified as social rather than ecological, since they are largely human responses to changes in the natural ecosystems. These include transitions to, or development of, specialised infrastructures (e.g. green houses, eco-buildings, renewable energy infrastructure, climate-proofed infrastructures), migration and human settlement patterns (rural/urban transitions). Shifting agricultural practices (e.g. rooftop gardening) and intensified farming (digging deeper into the soil and increased application of farm inputs). The latter can be a cause or an impact land degradation.

4.1.2. Invisible transitions

Besides the more obvious visible transitions, there are invisible transitions which are less obvious and more difficult to discern without a deeper analysis. These include sustainable energy transitions; jobs and human labour transformations as some jobs are lost and others (green jobs) created; the financial implications (e.g. due to the human labour transformations, but also due to reduced agricultural productivity and transitions to low-carbon economy); poverty and social inequality; food insecurity (resulting from reduced agricultural productivity); and implications for human health. Climate-induced alteration of the hydrological processes will lead to the increase in temperature and changes in precipitation, evapotranspiration, runoff and stream flow, etc., resulting into significant water stress in an already water-stressed South Africa. This evidence is supported by gloomier facts from World Bank that reveals that the annual freshwater capita in South Africa has dropped by 65% from 2445m3 in 1962 to 857m3 in 2014 (WB, 2014a). Increased discomfort due to temperature and precipitation changes have also been reported, and this will most likely intensify as the impacts of climate change become more tangible in South Africa.

On the other side, the IPCC Technical Paper on climate and water (Bates, 2009) argues that the decrease in precipitation and the increase in evapotranspiration because of climate change will also impact negatively on forest resources, leading to species extinction due to reduction in soil moisture. The paper projects that up to 61% of the South African's Fynbos Biome (considered as IUCN hotspot), will be lost by 2050 whereas a 2.5o -3.0o temperature increase scenario is projected to cause 66% of species extension in the Kruger National Park (Bates, 2009).

The global temperature increase will result into increase in ocean temperatures and subsequently leading to sea-level rise through water expansion (IPCC, 2014). The outcome is the increased vulnerability of South African coastal areas to storms and floods events which are likely to exacerbate further water shortages through salinization of coastal aquifers.

4.2. Social implications of climate change

Societies develop around the resources provided by their natural ecosystems, and as they exploit these resources, they transform and get transformed in turn (Hamilton et al., 2003). As climate change affects South African ecosystems, the society responds by trying to adapt to the changing ecosystem. The adaptation mechanisms entail attempts to either transform the ecosystems or adjust the societal functioning and arrangements in view of the changing landscapes, or both.

South Africa is already water-stressed country, yet water shortage is on the rise. Taking the case of the City of Cape Town, is it evident that major dam levels have consistently reduced over the years. The 'usable levels' are 10% less than the dam level because the last 10% of water in a dam is usually difficult to use.

Table 2. Annual major dam levels in Cape Town as at 30th October each year.

Year	% Major Dam Levels	% Usable Levels
2013	99.8	89.8
2014	97.2	87.2
2015	71.3	61.3
2016	60.4	50.4
2017	38.5	28.5

Data Source: City of Cape Town

The major dams of the Western Cape Water Supply System include Berg River, Steenbras Lower, Steenbras Upper, Theewaterskloof, Voëlvlei, and Wemmershoek. The 2016 drought has had significant impacts on the functioning of the South African society, both the rural and the urban. For instance, with dam storage levels at 38.5% (28.5% usable), the City of Cape Town has activated water rationing as part of the disaster management plan. The city's daily consumption has been reduced by 47%, from 1.1 billion to 585 million litres, although the residents have been asked to brace themselves for possible further restrictions. In such instances, the changes in the ecological systems result to changes in the social systems, including how people live, relate with other people and other elements of their lives (including pets whose water is also rationed), and ultimately how they relate with the ecological systems – thus resulting to would be termed as a "new normal".

Climate change has implications for human settlements, and the socioeconomic and political relations developed by these systems. The responses to climate change, such as attempts to transition to low carbon economy, also affect how the society functions. For instance, the coal industry determines where people live – as they work in the coal mines, their earnings etc. Moving to low-carbon economy would mean new settlement patterns and jobs, as they would not be working or necessarily living in the mine areas. In other words, South Africa's climate change mitigation strategy of transitioning to low-carbon economy will lead to loss of the old known jobs and creation of new jobs. It is yet to be seen whether the new (green) jobs will be more and better than the lost jobs.

Climate change also affects the habitats of disease-causing vectors, thus leading to increased prevalence of vector-borne diseases. It exemplifies what have come to be known as "wicked problems" (Head, 2008) or even "super wicked problems" (Levin et al., 2012). These are those challenges that are generally perceived as complex, open-ended, and stubborn. Their implications are not easily summable, and solutions to such problems are not straightforward.

4.3. Societal debates of climate change

4.3.1. What they are

The narrative around climate change causes is usually externalist, with a widespread feeling that climate change has been caused by industrialised countries. However, climate change responses (adaptation and mitigation) revolve around socioeconomic development and environmental integrity, and the South African society seems obliged to deal with the problems at these levels. Thus, the societal debates are more fuelled by current observed than distant/potential socioeconomic impacts of climate change that threaten the people's wellbeing. The climate change debates in the societal realms are thus almost never discussed in isolation from the countries or community's social, economic and political contexts. Many 'ordinary South African' people remain unaware, misinformed and thus detached from the real local and global causes of climate change. This is further fuelled by the prevailing arguments that climate change is caused by the 'developed' (industrialised) countries, and developing countries such as South Africa have little to do with it, and therefore the causers should address it. However, the communities experience and perceive the consequences of climate change in their own, less technical ways.

4.3.2. Who is involved in/shapes the debates

The private sector, media, governmental agencies, local CSOs, national and international NGOs and donor organisations are involved in South Africa's climate change debates in different ways, including campaigns, research, policy/action advocacy and/or lobbying, awareness-creation and promotion of sustainable lifestyles. The extent of involvement differs from case to case, depending on the actor's association with or interest in the issue. Sometimes, a combination of actors come together to engage in an issue, through campaigns such as the One Million Climate Jobs Campaign (OMCJC)[6] , or engage the vulnerable communities to help them understand and build their resilience to climate change impacts -- as noted in Environmental Monitoring Group's (EMG) 'action research' work with small-scale farmer organisations and artisanal fishers. While such organisations have a focused and specialised niche where they seek to shape the discourses, others such as the Alternative Information and Development Centre (AIDC) and Greenpeace focus on a wide range of social-ecological and environmental issues. The expertise and influence of WWF is appreciated among peers in climate change discourses. The DEA is one of the most active governmental departments involved in research and policy formulation processes as well as implementation government supported programmes related to the environment, and works with other line ministries and departments such as the Department of Water and Sanitation (DWS). These organisations, academics and researchers also utilise the media to communicate or discuss their research findings as well as share lessons with peers. One prominent media/platform used in this way in by South African professionals and activists is the Conversation (www.theconversation.com) which combines "Academic rigour and journalistic flair" to discuss critical issues such as climate change. Other online media platforms frequently used to shape climate change debates include All Africa (www. allafrica.com), News24Wire (www.news24.com), Daily Maverick (www.dailymaverick.co.za), Money Web (www.moneyweb.co.za), the Bloomberg (www.bloomberg.com),

4.3.3. Human right considerations

There is little to demonstrate whether human rights are particularly in question when climate response strategies are being developed or in the general societal debate over climate change. There is a strong sense of human rights among the citizens generally. Explicit regard for 'human rights' in the discussions of climate change is not very common except when a climate issue can easily be related to a socioeconomic problem as is the case with the OMCJC and the extractive industry legacy. Whether human rights were explicitly at the centre of the debates was not often clear, and felt as though it was a distant connection. This is most likely due to sampling and sample size for this study, and further research might be required to get more insights on this matter.

6 OMCJC is an alliance of labour, social movements and other civil society organisations in South Africa that are mobilising for real solutions to the threat of climate change, and pushing for a "just transition to a low-carbon economy to combat unemployment and climate change. See more at: http://aidc.org.za/programmes/million-climate-jobs-campaign/about/

4.3.4. Policy responses to these debates

South Africa has some considerable policy framework for climate change. The 2014 White Paper forms a central planning document for climate change response. Although DEA is among the most active governmental agencies and is respected by many stakeholders, the department can only do so much given its institutional size, mandate and budgetary allocations. The climate change debates in South Africa attract some attention from the policymakers. However, the policymakers do not always respond with a 'policy action'. This depends on whether there are existing policies that deal with the core issues of these debates (which is quite often the case). Action by policymakers as a response to the public debates also depends on who is at the frontline. There is an agreement among the interviewed persons that, whereas this differs from case to case, the private sector and the international 'donor' agencies usually get the most attention from the policymakers (i.e. the government). Thus, it is likely that the strategies employed and the identities of those seeking the attention of the policymakers significantly influence the latter's response.

4.4. Climate policy and governance frameworks

The regulatory and governance framework for climate change in South is quite advanced compared to the rest of the Southern Africa and Africa in general. However, there are prevalent arguments that the existing policies are not transformational enough to cause any significant changes. For instance, it is argued that even if the RSA implemented all the existing climate mitigation policies, it would not achieve the UNFCCC commitments in the Paris Agreement because they are 'piecemeal' rather than transformative given the scale of the challenges they seek to confront. The climate policy in South Africa has been cemented by the 2011 National Climate Change Response White Paper, which establishes South Africa's 'vision' for climate action. National, provincial and municipal governments have the responsibility of implementing different aspects of it.

4.4.1. Challenges

Despite the various programmes and policies introduced by the RSA Government to deal with the social and ecological transformations and challenges, their effectiveness has been hampered by several problems. Our analysis agrees with Angelstam et al. (2017) that these problems include poor implementation and coordination of dedicated investments, and limited participation from the private sector and the civil society. The inability to establish an optimal balance between environmental protection and socio-economic priorities (or mechanism for actualising sustainable development) is also a critical concern, whereby the need to create employment overshadows the desire to reduce environmental degradation.

Although there have been formidable attempts to link governance to the ecological scales where the transformations occur or are expected, there are still important gaps in actualising action at these levels. Also, the national, provincial and municipal levels are the prevalent scales of policy action, although the impact at the household level is not always immediately evident. At these levels, there exist institutional incoherence and conflicts, some of which are caused or aggravated by the prevailing political climates, and the ruling governments at those levels. Racial and ethnic tensions also impede progressive, cohesive action, although this is mostly covert.

Competition and business interests have also been blamed for stalled action. This is especially prevalent in the energy sector, where transition to sustainable renewable energy has faced peculiar challenges under the 'leadership' of Eskom, the South African electricity public utility. The utility's current investments in the coal-based industry are enormous, and are threatened by 'encroachment' by Independent Power Providers (IPP) and possible growth of off-grid power production. Thus, the agency has been alleged to frustrate licencing of IPPs and establishment of sustainable working models for the promotion of renewable energy. The implementation of carbon tax is believed to have stalled owing to vested interests among powerful sector players for similar reasons.

5. CONCLUSION AND RECOMMENDATIONS

5.1. The research problem restated

This paper sought to explore the climate-induced social and ecological transitions in South Africa. It was mainly concerned with issues of societal debates, policy environment, how governance changes align with the scale of ecological change, and citizen engagement in the relevant debates.

5.2. A summary statement of key findings and their significance

The study reaffirms the significant impacts of climate change on the social and ecological systems in South Africa. It reveals bottlenecks in climate change response including inadequate policy especially on the mitigation side, but also inadequate action to implement adaptation strategies already contemplated in established the policy framework. It ascertains attempts to link governance changes with the scale of ecological changes, although the transformative initiatives are embedded within pre-existing governance structures which makes it tricky to implement deep transformations. The paper also concludes that there are substantial policies to guide the social-ecological transformation agenda, but actual implementation of these policies is not always at per. Many other policies are also underway (see Appendix 1). It further concludes that meaningful citizen engagement in climate change discourse is minimal, only limited to the socially-relevant impacts and possible (pre-determined) responses, without a substantial grounding on causes and the far-reaching consequences of climate change. This is due to capacity issues, but also affected by the costs of public involvement.

5.3. Limitations of the research

Whereas it is recognised that the economic and political environments influence and are influenced by social-ecological aspects, the study goal was less concerned with these aspects, and more concerned with the social-ecological transformations themselves. Thus, a lot of issues were just highlighted without further analysis. The size of the study also limited the scope of the research to the core social and ecological issues. A deeper analysis of these systems would require more space than was provided in the terms of reference for this study.

5.4. Agenda for future research

From the foregoing, it would be extremely useful to undertake a political economy analysis (PEA) of climate change response in South Africa. The PEA would facilitate a better understanding of why certain climate responses (e.g. policies, programmes etc.) do not take off, and recommend ways of navigating the climate action terrain. Further research is also necessary to better understand the extent of the visible and invisible transitions due to climate change. It is necessary to not only understand the present transformations, but also the possible pathways to resilience of South African communities.

5.5. Specific recommendations

5.5.1. Citizen-engagement and climate change

The local civil society and indigenous groups need to be adequately involved in the climate change discourse. For this to happen and to ensure their meaningful participation and involvement, they will require support in not only the technical understanding of the causes and responses to climate change, but also in effective ways of securing the attention and action from the policy makers who are also being sought by other stakeholders with competing interests. They would require support in policy advocacy and lobbying that is tailored to climate change. Relevant, high quality climate information needs to be provided at scale and in a timely fashion to enable the community members to take appropriate action at their levels to respond to the threats of climate change. This way, communities (including indigenous people) would be involved in developing and implementing climate change solutions, thus helping move from considering them as only 'victims'.

5.5.2. Climate change policy making and implementation

Climate change policies are critical to both adaptation and mitigation of climate change impacts. These policies need to be translated from paper to practice/action. South Africa needs to work more on implementing existing climate-relevant policies, and continuously review (improve) them based on lessons derived. Care should be taken to not continue developing unfeasible policies that are not 'fit-to-scale' or context. In addition, the process of making policies need to be made more collaborative and participatory, including the incorporation of the civil society and indigenous groups, the academia and the private sector. Policy alignment for coherence and better coordination of government plans and policies cannot be overemphasised.

5.5.3. Climate change and human rights

It is necessary to amplify the discussion of climate change through the human rights lenses. This would most likely attract more actors that are currently less involved in the climate change discourse. But at the same time, a mention of "human rights" would scare off some actors. Thus, there is a need to develop a robust communication strategy when approaching such actors, if they are critical stakeholders.

5.5.4. Social-ecological and socioeconomic transformations

There is need to understand how the social-ecological and socioeconomic transformations link. We note that some process considered as 'socioeconomic' transformations could have been triggered by social and/or ecological changes and vice versa. Each could also inhibit the other – for instance the case of South Africa's 'cheap coal' apparently preventing quicker transition to renewable energy. This interconnection needs to be understood critically if any progress is to be made.

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APPENDICES

Appendix 1. Ongoing climate-relevant policy processes in South Africa

Thematic area	Projects	Timing	Lead department/s
International climate change negotiations	COP 23 negotiating mandate and feedback	Now to Dec-17 – *DEA has called first consultation*	*DEA* *DIRCO*
Policy and regulatory framework	National climate change response legal/regulatory framework	DEA: "May take 3 years"	*DEA*
	PAMS audit (audit of gaps in policies and measures)	Audit now to Mar-18	*DEA*
	PAMS development (of policies and measures to fill or redesign gaps above)		*Sector Departments*
	Green Transport Strategy		*Department of Transport*
	Carbon tax socio-economic impact assessment		*National Treasury*
Climate change mitigation	Mitigation System (sector targets, company carbon budgets, carbon offsets, trading, tax, compliance, MRV)	To finalise Dec-17	*DEA*
	Emission pathways and climate goals for South Africa		*DEA*
	Refinement of South Africa's Peak Plateau Decline (PPD) Trajectory		*DEA*
	Integrated Resource Plan and Integrated Energy Plan	Due out in Feb-18	*Department of Energy*
	National Employment Vulnerability Assessment and Sector Jobs Resilience Plans		*Economic Development Department*
Climate change adaptation	National adaptation strategy		*DEA*
	National Framework for Climate Services		*DEA*
	Update on sectoral climate change adaptation initiatives implementation by sector departments		*Sector Departments*
Climate change research	Biennial report on the state of climate change in South Africa		*DST*
Climate change MRV (monitoring, review and verification)	3rd Annual Climate Change Monitoring and Evaluation report		*DEA*
Flagship programmes	Climate Change flagship programme		*DEA*

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