

Combat Change *with* CHANGE



Editor | JOHAN C. PAUW

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Translating:

Observations on Environmental Change in South Africa

into Long-Term Policy Considerations for Sustainable Development

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FOREWORD

Reliable knowledge is necessary for effective policy making but both knowledge generation and policy making are continuous processes and neither can ever be complete. This is the understanding that underpins the current contribution to the national policy and development debates relating to the management and use of South Africa's natural environment.

With this booklet we aim to provide a summarised interpretation of the policy implications that may be drawn from the authoritative book *Observations on Environmental Change in South Africa* by L. Zietsman (editor) and published by the South African Environmental Observation Network (SAEON). SAEON is mandated to be a broad network "that delivers long-term reliable data for scientific research and informs decision making; for a knowledge society and improved quality of life". The combined publication of the said book and this publication are therefore tangible outputs created in terms of the SAEON mandate.

Irrespective of the proven technological, scientific, economic and governance performance of the day, the pressure to balance the national economy on sound societal and environmental foundations is rising rapidly and has recently led to new environmental laws, a National Framework for Sustainable Development and a National Planning Commission. These and many more initiatives represent a never-ending work-in-progress across various domains of government and for which we trust this booklet will be a source of inspiration.

JOHAN C. PAUW

EXECUTIVE SUMMARY

South Africa is blessed with a wealth of biodiversity and unique and diverse natural ecosystems upon which many of its citizens depend for their livelihood, well-being and economic opportunity. Effective management of the natural environment and assets is essential for a healthy and prosperous life for all South Africans and for sustainable socio-economic development of the country. Adverse environmental changes present a rapidly mounting challenge to South Africa and to the world as a whole. Understanding how ecosystems work, providing reliable evidence of current changes, and predicting future changes and how essential goods and services from ecosystems might be affected, is critical for developing appropriate adaptation response strategies. This booklet has as its point of departure, the seminal publication *Observations on Environmental Change in South Africa*. It introduces selected environmental changes that have been observed and emphasises the important role of ongoing scientific observation and research in understanding and tackling some of the most pressing environmental change threats. The booklet concludes by advocating both reactive and proactive change through a series of key policy considerations for the prevention and mitigation of the impacts of environmental change, including: i) strengthening the policy framework for environmental change and sustainable development; ii) reviewing and aligning key policies related to environmental change; iii) strengthening institutional structures and capacities to address environmental change; iv) promoting cooperative governance; v) implementing existing legislation; vi) developing and implementing priority actions and programmes; and vii) improving long-term environmental observation and research.

1. ENVIRONMENTAL CHANGE IN SOUTH AFRICA AND SIGNIFICANT FINDINGS

1.1 The context of environmental change in South Africa

Earth and ecosystems are dynamic. These systems support all life on Earth but are increasingly affected by human activity in an interactive cyclical pattern. Human activity can drive changes in these systems to transformed states which may then cause reciprocal adaptive changes in human activity. **Global Environmental Change** refers to directional changes in the Earth's physical and biogeochemical environment, resulting directly or indirectly from natural processes and/or socio-economic stressors, and having world-wide repercussions.

Environmental conditions on Earth are changing fast. The consequences of the changing conditions are particularly severe in southern Africa. The global-scale Earth systems (i.e. biogeochemical cycles of the atmosphere, ocean and land), interact in a complex and integrated way and are affected by natural and human forces acting at multiple scales. The resulting environmental change is experienced as a gradual or a drastic directional trend, which may become irreversible and affect humans' social conditions, economic security and general well-being.

South Africa is relatively well-resourced compared to the rest of southern Africa in terms of its energy and transport infrastructure, as well as its financial services, telecommunications and legal services, food production and waste management (Department of Environmental Affairs and Tourism, 2008). The country's economy has historically relied on its rich natural resources, particularly minerals, but these are

finite and the economy is already dominated by the service sector. South Africa is the third most biologically diverse country in the world. This biodiversity provides some alternative opportunities for economic growth and job creation, if wisely implemented. All South Africans depend on the natural capital and the healthy functioning of our ecosystems for life-supporting services and resources as well as for resilience against natural variability. Environmental change, therefore, has very real and potentially dire consequences for the future of the nation. Understanding and adapting to environmental change is critical, as is the need to help citizens to access resources, services, education and infrastructure. Ongoing observation and informed responses are required from the government who, in collaboration with all sectors of society, can promote sustainable development and environmental justice and equality by fostering a "green economy".

Despite South Africa's natural wealth, scientific observations reveal the increasing **disruptive threat of human-caused changes to ecological processes** which support our future livelihood, security and prosperity. Environmental changes are particularly grave for poverty-ridden sectors of society who either depend directly on natural resources and/or have little protection against environmental hazards.

The Preamble of South Africa's first democratic Constitution commences with the words: "We, the people of South Africa recognise the injustices of the past" (The South African Government, 1996), thus calling for environmental change to be seen against the backdrop of massive social change and expectations resulting from the political transformation following 1994. The advent of a governance system based on equality, the rule of law and subscription to a Bill of Rights embedded in Chapter 2 of the Constitution, has generated a set of new and complex social challenges. Section 24 of the Bill of Rights includes

an environmental right that is of specific relevance to environmental change. It states that "Everyone has the right ... to have the environment protected for present and future generations ..." (own italics). The Constitution, therefore, obliges the nation to maintain the environment at least in the same good state for future generations by responding appropriately to environmental change. This environmental right further obliges the state to "secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development" (Section 24(b)(iii)).

South Africa's democratic dispensation, coupled with a high immigration rate from the rest of Africa, has led to burgeoning urban societies where consumerism is rife, and to the sprawl of poverty-ridden informal settlements. Whether by choice, ignorance or simply survival, South Africans are collectively and rapidly transforming their environments for short-term gains in their standards of living. Understanding how ecosystems work, providing reliable evidence of current changes, and predicting future changes and how goods and services from ecosystems might be affected is essential for the future sustainable development of the country and the broader southern African region.

1.2 The importance of environmental observation and research

While environmental change is not new, scientific observation reveals that the rate, extent and intensity of changes caused by anthropogenic drivers are increasing rapidly. Understanding the difference and extent of directional environmental change driven by socio-economic activities versus normal environmental variability is, therefore, critical to developing effective mitigation measures and prioritising adaptation responses on an ongoing basis.

Anthropogenic drivers are socio-economic decisions or actions leading to environmental change. Those include demographic, economic, technological, institutional and political patterns and systems, for example, civil infrastructure development, energy generation, settlement, harvesting, fishing, pollution, agriculture, mining and forestry.

Observation also highlights the threat and potential costs of damage control arising from fossil-fuel burning, mining, freshwater extraction, pollution, nutrient loading, invasive alien species, loss of biodiversity, climate change and sea-level rise. Identifying and understanding the relative contribution of different driving forces relies on comprehensive and integrated environmental observation and monitoring systems.

1.3 Environmental observation tools

SAEON works in collaboration with government, science institutions and civil society to answer questions about environmental change and the implications for South Africa's life-support systems. SAEON contributes reliable data and information to scientific understanding and management information for the path towards sustainable development through six operational nodes and a network of collaborators performing long-term observations of the national landscape and surrounding oceans.

To be effective, environmental observation systems need to unravel the complexities of natural variability, anthropogenic drivers and environmental change (O'Connor, 2010). According to the Plan of Implementation (United Nations, 2011) following from the World Summit on Sustainable Development in 2002, long-term and multiple spatial scale observation infrastructure and programmes backed-up by sound

data management systems are globally required. Aligned thereto, the government-sponsored South African Environmental Observation Network (SAEON) focuses on long-term *in situ* observation that provides ground-based data and information on South Africa's natural and transformed landscapes and marine systems for scientific research and policy making.

Increasing efforts towards building a comprehensive national environmental observation framework are essential for a deeper understanding of socio-economic, politico-cultural and physical drivers forcing change in South Africa's major ecosystems and for the development of appropriate responses. Key challenges include: i) unravelling the complexities of environmental change; ii) translating scientific findings into accessible information and then into action using appropriate governance systems, mechanisms and tools; and iii) integrating local and indigenous knowledge in adaptation and mitigation strategies.

2. KEY ENVIRONMENTAL CHANGE ISSUES IN SOUTH AFRICA

2.1 People and environmental change

Interactions between people and the environment are complex and non-linear. On the one hand, global environmental change impacts on people and their livelihoods. On the other hand, people react to environmental change in a complex interaction of feedback processes. **Population growth and human migration** are key drivers of the population-environment interface. South Africa's population, currently estimated at 50,5 million, is expected to reach 56,8 million in 2050. Population increase inevitably leads to greater consumer demand for basic goods and services as well as for the trappings of a western-type consumer lifestyle. This results in the depletion

of natural resources and environmental degradation as ecosystems are exploited for development, energy needs or food security. Urban migration results in the growth of informal settlements where inadequate planning and services exacerbate environmental pollution and threaten key ecosystems, such as rivers and wetlands. This may, in turn, increase the risk of disease for people using water from these ecosystems. Environmental change can also impact social well-being and environmental health. Climate change or natural disasters may force migration as people search for livelihood opportunities elsewhere. Accurate observation of population and migration trends and their complex relationships with environmental change is essential for developing appropriate responses. It is important to note that environmental degradation may be caused more by unsustainable land-use activities or inadequate management policies than by simple population or migration drivers.

Ecosystem goods and services are critical to rural communities in South Africa that depend on **resource harvesting and land-based livelihood strategies**. In the Central Lowveld, over 90% of rural households use locally-harvested indigenous natural resources (fuelwood, wild fruit and wild herbs) for domestic needs, income generation, and as a livelihood "safety net". Examining natural resource use at different scales reveals that landscapes are strongly shaped by complex interactions between natural processes and biodiversity use. These are influenced by interdependencies among drivers ranging from poverty and unemployment to population density, land tenure, access to services, culture, household size, age, gender and health. Long-term observation of both natural and human drivers of environmental change highlights the importance of ecological sustainability to the livelihood and cultural security of poor rural communities. Effective adaptation requires focused integrated land-use planning.

Long-term environmental observation is essential to inform appropriate adaptation measures through socio-economic planning, environmental protection regulations, subsidies, incentives, penalties and taxes, technological development, low-impact life style education, integrated governance systems and structures, land-use and natural resource management systems, water management systems, energy supply systems, civil infrastructure and social security services.

Water is arguably the main resource through which people, ecosystems and economies experience environmental change impacts. South Africa is a relatively dry country with unevenly-distributed water resources. **Drought** events are driven by natural climate variability and place significant pressures on vulnerable populations, such as the rural and peri-urban poor who rely on untreated water extracted directly from rivers, wells and wetlands. Drought also poses a major risk to essential production sectors such as agriculture. Drought impacts can be mitigated by appropriate integrated water resource management policies and adaptation measures, which reduce vulnerability for both natural and human systems.

Climate variability and change may exacerbate periods of extreme weather or climate (floods and droughts) and change the intensity of rainfall, temperatures and storm events. Evidence shows how the biophysical impacts of climate variability and change can magnify other socio-economic and political stresses and increase the vulnerability of people (particularly children, the sick, the elderly and the poor) and the environment. Appropriate adaptation responses will require greater understanding of the range of climate change impacts, such as the causes, costs and consequences of our actions, and how people interact with such changes.

Climate change priorities

- i. Improve understanding of climate change impacts and how they impact on livelihoods.
- ii. Validate climate change models and response strategies through long-term environmental observation and research systems.
- iii. Quantify the costs of climate-related impacts for planning and adaptation measures.
- iv. Foster collaboration among social, biological and physical sciences and recognise the role and opportunities for all sectors of society in mitigation and adaptation.
- v. Improve communication about climate change.
- vi. Strengthen policies and institutions to enable information sharing and use.

2.2 Atmospheric system and climate change

Quick wins for air pollution reduction strategies

- More efficient domestic fuel-burning practices
- Ensure compliance with vehicle exhaust gas regulations
- Emission reduction technology on power production facilities
- Greater control of wild fires and mine dump emissions
- Promote public transport systems

Air pollution, caused by a combination of natural processes and anthropogenic factors, poses a serious risk to human wellbeing and environmental health. Anthropogenic sources of pollution occur at a faster rate than humans or the natural environment can

adapt to. South Africa's meteorological characteristics exacerbate the impacts of air pollution by reducing vertical mixing, recirculating air and increasing seasonal soil acidity through precipitation. Resultant respiratory and cardiovascular diseases escalate health-related economic impacts. Increased soil acidity disrupts biological processes, such as photosynthesis, and reduces agricultural productivity. The implementation of recent air pollution legislation (National Environmental Management: Air Quality Act (No.39 of 2004)) is critical. The South African Air Quality Information System (SAAQIS) is a key mechanism for information production and dissemination.

The impact (either negative or positive) of environmental change on South Africa's **biodiversity and ecosystems** requires more systematic evidence. Ongoing observations of key landscapes and processes suggest considerable change. The aerial extent of the permanent ice cap on Marion Island is estimated to have melted to just over 6% of its original size over the last 50 years. Understanding and predicting potential impacts require a combination of ground-based observations, experiments, remote sensing observations and systems modelling. Coordination is needed among a range of disciplines to develop a comprehensive programme to detect the impacts of environmental change and to bolster the implementation of policies and adaptation measures.

2.3 States and trends in the terrestrial environment

Government options for improving rangelands

- Improve agricultural extension services
- Restore soil erosion and veld condition
- Increase size of land management units
- Maintain and increase below-ground carbon stocks using indigenous plants
- Remove invasive alien vegetation

South Africa's rangelands, or natural veld, comprise 30% of the country's land surface. Rangelands support a complex set of biophysical processes that provide much of the natural capital sustaining the nation's ability to produce food and provide shelter (i.e. water, forage for livestock, medicinal plants, fuelwood and timber, productive soil, pollination, compost production and nutrient cycling). Changing land-use practices including cultivation, afforestation and livestock introduction, as well as extractive industries (mining) and shifting demographic patterns, are key drivers of **rangeland degradation** in South Africa. Pressures from climate variability and change, such as rainfall variability driven by El Niño Southern Oscillation (ENSO) events, can further impact vulnerable rangeland areas. The change in priorities of government's agricultural extension service towards supporting small-scale emerging farmers resulted in neglect of commercial farming, which may also add to rangeland degradation. Key priorities for improved rangeland management include stronger governance through effective implementation of existing legislation, a wider presence of government extension services and quantification of the value of rangeland services to highlight their role as a vehicle for sustainable development.

Invasive alien species are plants or animals that are relocated outside their normal distribution range and that spread in their new environments by out-competing native species. Biological invasions are one of the most damaging anthropogenic drivers of ecosystem change. Invasive plants choke indigenous vegetation and disrupt freshwater systems. Biodiversity and economic livelihoods are also threatened by introduced diseases and pathogens. Costs associated with the loss of agricultural productivity and control of invasive alien species are estimated at tens of billions of rand per year. A number of uncertainties still exist, including the potential impacts of global environmental changes, which may increase the vulnerability of sensitive ecosystems and spread of alien species. Improved

monitoring and prediction of trends is critical for early identification and mitigation of impacts of invasive alien species. Effective implementation of relevant legislation, such as the National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004), would help to prevent or mitigate emerging threats from these alien species. Additional strategies include identification, classification and mapping of invasive species, ongoing research and the rehabilitation of priority conservation areas.

Mining and other extractive industries exert extensive pressures on natural and socio-economic landscapes. South Africa has extensive mineral wealth. It holds 80% of the world's reserves of manganese, 88% of its platinum group metals, 73% of its chromium and 45% of its gold. While the economy of the nation developed on the back of mining, the industry's environmental and social record is less rosy. As a driver of socio-economic and environmental change, the short-term economic gains from mining often result in long-term problems, which prove difficult to mitigate, ranging from sinkholes and water pollution to irreversibly transformed landscapes, ghost towns, cancers and unemployment. The impacts of mining vary with the type of operation and the size of the ore body.

Environmental impacts of mining

- Surface and underground water pollution
- Loss of biological diversity
- Changes in water tables
- Alteration of the landscapes and scenery
- Human health deterioration

Development and effective implementation of robust environmental management procedures that avoid sensitive ecosystems and include management and long-term monitoring of cumulative impacts of mining and stringent environmental compliance measures, are critical. As an arid land with diminishing resources and a rapidly-growing human population, South Africa

must ensure that both ecological restoration and social considerations inform decisions around mining opportunities.

2.4 States and trends in the aquatic environment

Change is integral to aquatic environments, such as rivers, wetlands and estuaries, and aquatic fauna and flora have adapted to the natural seasonal and annual fluctuations and variable flow regimes of South African rivers. An increase in anthropogenic pressures, however, introduces additional stressors to these systems. These include pollution, soil erosion, extraction of water, afforestation, large dams and inter-basin transfer and the introduction of invasive alien species. Widespread and rapid deterioration of South Africa's freshwater ecosystems is evidenced by a contraction of the distribution ranges of most of South Africa's freshwater indigenous fish and the expansion of alien species' distribution ranges. Progressive initiatives are underway to develop information to improve management and sustainable use of aquatic ecosystems and resources. An example is the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP) under which the River Health Programme (RHP) monitors 639 sites across the country and fosters co-operative governance. Greater understanding of aquatic biodiversity at the organisms, species and community levels is the key to sound decision making regarding the use of these ecosystems.

Human drivers of coastal and marine environmental change

- Fishing and harvesting of marine species
- Introduction of alien invasive species
- Habitat modification through coastal development, extractive industries and destructive fishing practices
- Climate change
- Pollution
- Interruption of sediment transport to the coast

Estuaries are unique environments where freshwater from rivers meets seawater. These dynamic ecosystems perform numerous essential ecological functions and support important subsistence, commercial and recreational activities. Estuaries are amongst the most threatened habitats in South Africa. This is a result of a combination of factors, including reduced freshwater inflow, coastal development and over-exploitation of living resources. Climate change modifies temperature and rainfall patterns and also impacts aquatic environments. For instance, sea surface temperatures off Port Elizabeth, which have increased by 0,250C over the past forty years, has led to an increase in tropical fish species in some eastern Cape estuaries. Shifting distribution patterns of aquatic plants and animals, altered flow regimes, increased erosion or deposition of sediment, sea level rise and loss of genetic variability, all pose a threat to aquatic environments. Management strategies that involve multidisciplinary teams are needed. These strategies should address the broader catchment and coastal zone issues and be aimed at ensuring the maintenance of the physical and biological processes. The implementation of supporting legislation, such as the National Water Act (No. 36 of 1998), is vital to ensure that the current deterioration process is reversed.

South Africa's coastal and marine inshore environments are highly complex and dynamic areas. They range from a warm sub-tropical east coast hosting extensive biodiversity to the cooler arid, yet highly productive, west coast. The marine inshore environment extends offshore from the 3 000km long coastline to the 200 nautical mile Exclusive Economic Zone (EEZ) and generates significant benefits for the country. Some activities supported in these areas include subsistence and commercial fisheries, marine transportation, security, mineral and gas exploitation, conservation, and recreation and tourism. Such contributions to the economy of the country and well-being of its citizens underscore the importance of maintaining the health of the inshore environment.

Some coastal consequences of climate variability and change

- Increase in wind velocity causing higher waves, more rapid sediment transport rates, changes in the nutrient-rich coastal upwellings and fish populations
- Increase in storm frequency and severity
- Structural damage to coastal infrastructure
- Reduction of coastal ecosystem goods and services from altered freshwater inflows and sea conditions
- Erosion and modification of shorelines

Climate variability and change is one of the biggest threats to South Africa's coastal regions. Sea level rise and its interaction with increasing storm frequencies, intensities, wind velocities and local conditions presents a significant threat to the coastline. Over 80% of South Africa's coast consists of sandy shores and is highly susceptible to erosion. A combination of large storm events along the KwaZulu-Natal coast in 2006-2007 and the resultant coastal erosion provides evidence of the need for prediction and adaptation measures.

South Africa's most vulnerable coastal areas to predicted climate change impacts

- Northern False Bay
- Table Bay
- Saldanha Bay
- The Southern Cape coast extending from Mossel Bay to Nature's Valley
- Port Elizabeth
- The developed areas of the KwaZulu-Natal.

Initial observations of the combined impacts of climate change, over-fishing and alien invasions show alterations in the productivity and spatial distribution of important marine species. This threatens both local livelihoods and commercial industries alike. While long-term monitoring of changes in marine environment can be logistically and financially challenging, monitoring of both species and natural and anthropogenic processes show the value of pre-emptive and alternative marine management strategies. For example, marine protected areas (MPAs) and the monitoring of seabird populations can provide important baseline and indicator data and facilitate more systematic observation that recognises the connectivity of ocean and coastal environments.

Since it is impossible to halt the large-scale coastal impacts of climate change, there is an urgent need for implementing adaptation measure. Decision-support tools are needed to identify coastal vulnerability and support adaptive management. Both eThekweni Municipality and the City of Cape Town have embarked on planning for adaptation efforts based on predictive Geographic Information System (GIS) modeling scenarios. Such pre-emptive measures help to prioritise key actions and possible responses and could significantly reduce the economic and social impact from sea level rise. Additional long-term research is needed on the waters of the east and south coasts to be able to separate natural variability from

anthropogenic influence and to improve predictive capacity and decision making for adaptation.

The **marine offshore** or **oceanic** component is the least explored, monitored and understood of all the different global components of environmental change. Yet the oceanic circulation system plays a central role in climate control and variability with long-range impacts as far as Europe. South Africa is located at the intersection of three unique oceanic bodies, the Atlantic, Indian and Southern Oceans. Each oceanic region has a characteristic circulation system which interacts with the others dynamically to drive local weather and climate. South African science is in a prime location to understand the role of the ocean in environmental change of the subcontinent and of the globe as a whole. Longer-term monitoring of sea surface temperatures at Marion Island show an increase of 1,4°C of the Southern Ocean, which is believed to have anthropogenic origins. Similarly, Agulhas Current surface temperature measurements indicate an increase of 1,5°C since the mid-1980s. Other observed changes include a rise of sea level in South Africa of approximately 2 mm per year. The global oceans have absorbed an estimated 30% of total atmospheric CO₂ over the last few decades. In the Southern Ocean, the resulting ongoing increases in acidity are likely to negatively affect its foodwebs by dissolving the shells of critically important snails living near its surface. In turn, this can reduce the Southern Ocean's ability to regulate atmospheric carbon. Deeper knowledge is also needed of natural oceanic variability, such as the four to seven year El Niño Southern Oscillation (ENSO) and corresponding oceanic events elsewhere. While significant developments have occurred in ocean observation over the last few years, wider networks of observation locations for persistent and long-term monitoring are needed to unravel the complexity of the growing effects of global climate change on natural oceanic and atmospheric systems.

3. KEY POLICY OPPORTUNITIES AND CONSIDERATIONS

The South African Constitution acknowledges the importance of the environment as a basis for human well-being and provides an enabling framework for developing policies and strategies to respond to environmental change. The inherent value of its unique and extensive biodiversity places South Africa in a strong position to address pervasive socio-economic inequities.

The book *Observations on Environmental Change in South Africa* reveals a multitude of unheralded and ongoing environmental changes which place increasing risk on the country. Some changes are gradual, others more drastic, and many may be irreversible if they remain unchecked. It is critical that the causes of human-induced environmental change are understood and addressed to reduce the likely impacts on people. The most urgent need is for the government to develop appropriate policies and strategies to regulate equitable and responsible access to land and natural resources and to address environmental changes – and to ensure the necessary institutional machinery to implement these policies and strategies. Proactive policy responses promoting healthy and productive ecosystems will unlock further opportunities for South Africans and will augment the current natural resource management programmes.

The following policy considerations recognise that South Africa already has a plethora of environment-related legislation and governance structures to implement them. Some of these policy considerations are not entirely new, however, as in all countries, there remain gaps in the policies, and laws and implementation is lacking. Each of the seven broad policy considerations is prefaced by a succinct policy statement, followed by a rationale and a more detailed description of the policy considerations.

1. Strengthen the policy framework for environmental change and sustainable development

Support the ongoing development and implementation of a practical, participatory and comprehensive environmental change and sustainable development policy framework

Rationale: Environmental change affects all sectors of society and may impede the move towards sustainable development. In July 2008, the Cabinet passed the National Framework for Sustainable Development (NFSD). The NFSD incorporates issues of environment and climate change and is designed to serve as a basis for the development of a national strategy and action plan for sustainable development (Department of Environmental Affairs and Tourism, 2008). South Africa has been developing a national Climate Change policy. There is, however, a need for a more comprehensive policy framework that addresses the broad range of environmental change issues. The sectoral nature of many policies presents a fragmented approach that often fails to balance the three main tenets of sustainable development: environmental, economic and social concerns. A fragmented approach works against the principle of an ecosystems approach to ensure long-term benefits over short-term economic gains. It is also important to note that the effectiveness of policies depends a great deal on their implementation.

The following policy considerations are submitted in this regard:

- 1.1. Finalise, adopt and implement the national Climate Change policy.
- 1.2. Develop a holistic national strategy and action plan for a sustainable South Africa which adheres to ecosystem and pre-cautionary conservation principles and seeks to balance the

needs of a growing nation with the imperative of maintaining the healthy environment on which it depends.

- 1.3. Harmonise environmental management policies and legislation to simplify and clarify accountability and authority over environmental management between different sectors and levels of government.
- 1.4. Develop a monitoring and evaluation system for the environmental and social impacts of adaptation strategies which are developed for one sector, on other sectors. Ensure environmental assessments are undertaken for proposed adaptation strategies which may have "downstream" impacts.

2. Review and align key related policies

Undertake a periodic review and promote alignment of South Africa's current and proposed policies to promote response measures to address environmental change risks and opportunities

Rationale: In this time of rapid environmental, political and economic change many of South Africa's environmental policy instruments are relatively new and are in the early stages of implementation. As collective understanding of environmental change improves, periodic revision and integration of policies that have a bearing on the environment become essential for improving response measures for all sectors. A growing focus on the linkages between environmental health and land restitution, settlement development, spatial development planning, water management, waste management, energy supply, transportation, agriculture, fishing, forestry, mining and civil infrastructure will go a long way in reducing

the country's reliance on an economy grounded on the exploitation and export of natural resources and will promote greater equity.

The following factors should be considered in any review and adjustment of policies:

- 2.1. Mainstream environmental change mitigation and adaptation measures through all institutions, sectoral policies and legislation.
- 2.2. Harmonise sectoral and environmental management policies and legislation to reduce conflicting provisions.
- 2.3. Mainstream ecosystem integrity objectives to maintain essential ecological processes in harmful industrial sectors.
- 2.4. Promote collaboration between science, government, the private sector and civil society to identify key environmental change adaptation measures. For example, opportunities and practical solutions to reduce carbon emissions through sustainable forms of energy generation and improved public transport systems.
- 2.5. Comprehensive assessment of the long-term environmental costs of harmful activities prior to the approval of applications for resource exploitation.

3. Strengthen institutional structures and capacities to address environmental change

Strengthen and capacitate institutions to address environmental change issues and investigate opportunities for developing new structures or functions to ensure compliance and promote research and education

Rationale: Governance structures and arrangements are evolving entities and require ongoing maintenance and transformation. South Africa's governance

structures responsible for developing and implementing environmental policies and laws need to be rationalised to promote compliance and to foster more informed decision making aimed at sustainable development. There is potential for establishing an Environmental Ombudsman (EO) position, tasked with ensuring that public officials and private sector service providers comply with the correct implementation of relevant environment and natural resources laws, policies and procedures. The office of the EO may work better in collaboration with local and provincial governments, NGOs, conservation agencies and other interested parties to monitor and arbitrate the implementation of environmental impact assessment (EIA) and other environmental management tools and processes.

The development of an independent cross-cutting agency, such as an Environmental Protection Agency (EPA), may also be useful to facilitate improved monitoring of environmental change trends, to enforce compliance and to promote education and research. Consolidating environmental protection, monitoring, research and education under a single agency may help to coordinate environmental and developmental policies among national, provincial and local government levels, and between different sectoral interests at all levels. Establishment of either an EO position or an EPA (or both) would require greater alignment of policies and sufficient power and resources for operationalisation.

These are some possible policy considerations:

- 3.1. Investigate opportunities for strengthening the institutional framework to improve environmental surveillance and law enforcement, research and education, for example, the creation of an Environmental Ombudsman and/or an Environmental Protection Agency.
- 3.2. Strengthen institutional capacity of government to effectively implement existing policies that promote sustainable practices and to enforce their compliance.

- 3.3. Allocate resources and mandate an extension service to educate all citizens about sustainable lifestyles and livelihoods.

4. Promote cooperative governance

Foster collaboration among sectoral government agencies, between different levels of government and between government and other parties to address environmental change issues in a holistic manner

Rationale: South Africa's institutional framework is currently highly sectoral. The "silo" effect inhibits a holistic approach to fulfilling the long-term needs of the country as a whole. The cross-cutting nature of environmental change requires more collaborative governance between different government line agencies (horizontally), and among national, provincial and local spheres of government (vertically) where functions are split. The National Planning Commission (NPC) in the Presidency provides an opportunity to enhance coordination and integration across the various sectors. The role of the NPC is to develop a draft long-term vision and strategic plan for South Africa and to lead investigations into critical long-term trends (The Presidency, 2011). The NPC will advise government on key strategic planning issues such as food security, water security, energy choices, economic development, poverty and inequality, health, and scientific progress, amongst others. The NPC is therefore well positioned to coordinate between the scientific community (where there is a vast body of expertise and data on environmental change) and governance planning and systems.

These are some possible policy considerations:

- 4.1. Build awareness among decision makers and politicians of the implications of environmental

change and the importance of mitigation measures across all sectors.

- 4.2. Increase political will to pursue sustainable development objectives.
- 4.3. Establish mechanisms for collaboration with the private sector, specialists and civil society to develop and implement mitigation and adaptation initiatives. Collaborative mechanisms for implementing sustainable development initiatives with the private sector could be located in the National Business Initiative (NBI), which is the national focal point of the United Nations Global Compact in South Africa.

5. Implement existing legislation

Develop greater substance, authority, integration, enforcement and accountability in implementation of the range of "good intentions" present in environment-related legislation

Rationale: South Africa can be justifiably proud of establishing some of the world's most progressive environmental laws. The National Environmental Management Act (No. 107 of 1998) was promulgated in direct response to the constitutional imperative for the state to protect the environment for the benefit of present and future generations. Other more recent progressive environmental laws include the National Environmental Management: Air Quality Act (No. 39 of 2004) and the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008) – the latter being the first piece of legislation dedicated to managing the country's coastline in an integrated fashion and ensuring the sustainable use of the coast's natural resources. While all aspects of the environment are legally protected, including land, air, water, biodiversity and cultural heritage resources, the practical application and enforcement of these

laws remain a challenge. Other problems include the recent status of environmental legislation, with much of South Africa's environmental statutes established post-1994 and still under development. In addition, the integration of different environmentally-related acts is not consistently applied in South Africa and results in a lack of clarity over environmental jurisdiction matters.

These are some possible policy considerations:

- 5.1. Provide greater resources to effectively implement and enforce the existing comprehensive legislative framework which addresses socio-economic drivers of environmental change.
- 5.2. Incentivise compliance with environmental laws and increase penalties for non-compliance, more especially to prevent irreversible environmental damage from occurring.
- 5.3. Promote awareness of environmental provisions to boost understanding of the potential impacts and opportunities inherent in the law and of the need for informed legal and technical expertise.

6. Develop and implement priority actions and programmes

Review and further develop government programmes, initiatives and incentives that promote environmental health

Rationale: Policies provide broad guidance but often avoid specific provisions detailing practical implementation options. Useful lessons for practical policy implementation often emerge from programmes that seek to address specific issues. South Africa has already initiated an array of innovative programmes including the Working for Water, Working for Wetlands, Working for the Coast and the River Health programmes. The existing initiatives have enjoyed varying levels of success and would benefit from a

review to identify opportunities for improving them and for developing additional programmes, which could further contribute to job creation and skills development. Effective policy responses should seek to replicate lessons from existing poverty reduction programmes and environmental quality successes.

These are some possible policy considerations:

- 6.1. Evaluate existing natural resource management and monitoring initiatives to extract useful lessons and to strengthen their long-term financial and social sustainability.
- 6.2. Facilitate the collaboration of sectors impacted by a particular set of policies to explore the design and implementation of further programmes to help to promote environmental health. The book *Observations on Environmental Change in South Africa* provides some initial guidance and suggests action in the following sectors: i) Health and Social Welfare; ii) Integrated Land-use Planning and Management; iii) Integrated Water Resource Management; iv) Air Pollution; v) Mining and Minerals Exploration; and vi) Integrated Marine and Coastal Management.
- 6.3. Promote the sharing of information and communicate existing knowledge relevant to environmental change using a variety of approaches, from once-off educational programmes, to developing appropriate material for school curricula.
- 6.4. Promote opportunities for individual action to reduce anthropogenic environmental impacts, such as through programmes that promote energy or water saving in households.
- 6.5. Review national progress against the WSSD 2002 Plan of Implementation (United Nations, 2011) and participate in the RIO+20 United Nations Conference on Sustainable Development in 2012.

7. Improve long-term environmental observation and research

Support ongoing development and innovation in environmental observation, monitoring and research

Rationale: South Africa has embarked on a path to develop and operationalise a comprehensive platform for observing and researching environmental change. Experience thus far highlights the value of knowledge generation through long-term environmental observation and research to inform responses to emerging impacts and opportunities. Key to this observation is the need for collaboration and integration among research institutes, government agencies and decision makers. These efforts should be based on integrated observations and open access to environmental data and information systems.

The following policy considerations are suggested to fulfill this goal:

- 7.1. Accelerate the expansion of a comprehensive and permanent environmental observation system to generate greater understanding of the complex processes and meaning of environmental change.
- 7.2. Foster greater collaboration between researchers and mandated authorities for bridging the policy-science divide.
- 7.3. Promote trans-disciplinary and inter-disciplinary collaboration as well as cooperation between government and other sectors.
- 7.4. Promote open access to environmental data and information.
- 7.5. Support the coordination and integration of the various mandate-driven monitoring programmes performed by different government sectors, for economies of scale and scientific power.

- 7.6. Adopt a comprehensive communication strategy to promote public awareness of the essential role that healthy ecosystems play in the economy.
- 7.7. Coordinate international and regional scientific collaboration from a local agenda perspective.
- 7.8. Support programmes by which citizens can participate meaningfully in environmental monitoring.

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