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Advancing knowledge for Long-term Benefits and Climate Adaptation through Holistic Climate Services and Nature-based Solutions

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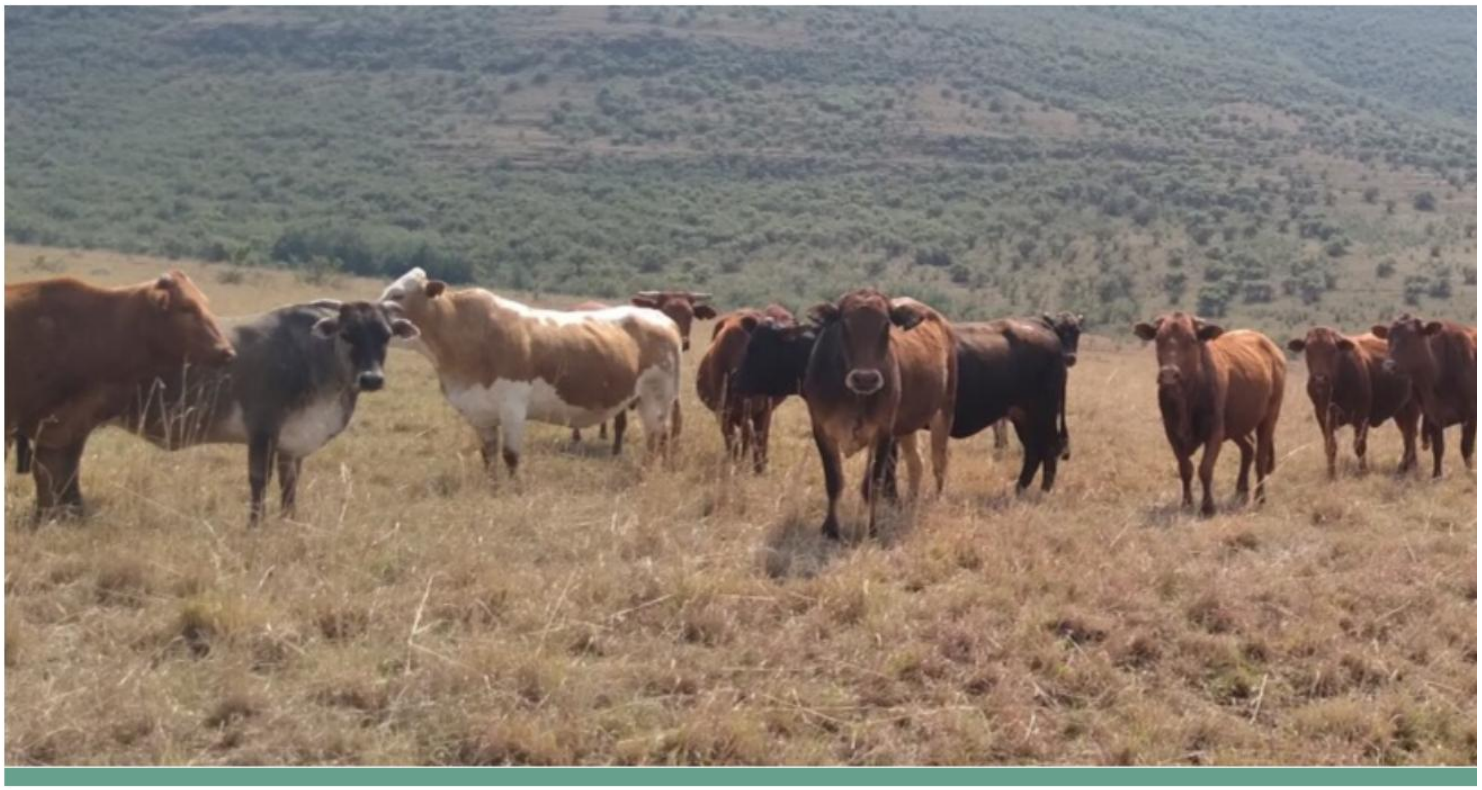
Strengthening Climate-Resilient Development in South Africa: Integrating Nature-Based Solutions, Climate Services, Gender & Social Inclusion, and Indigenous Knowledge.

Country Synthesis Report



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Source: This synthesis report is based on ALBATROSS Horizon Europe Deliverable D6.1: *Multi-level policy analysis* (Nyasimi, Almassy, Muhwanga, et al., 2025). For more detailed information and supporting evidence, readers are referred to the full report.

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List of Abbreviations

DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
EbA	Ecosystem-based Adaptation
EIA	Environmental Impact Assessment
GFCS	Global Framework for Climate Services
IKLK	Indigenous Knowledge and Local Knowledge
IWRM	Integrated Water Resources Management
MDTP	Medium Term Development Policy Framework
NAP	National Adaptation Plan
NbS	Nature-based Solutions
NDC	Nationally Determined Contribution
SDG	Sustainable Development Goal
UN	United Nations
UNEA	United Nations Environment Assembly
WMO	World Meteorological Organization

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1. Objectives

This country synthesis presents key findings from a detailed analysis of South Africa's environmental and climate change policies, focusing on integrating Nature-based Solutions (NbS), climate services, Indigenous knowledge and local knowledge, gender inclusion and related cross-cutting themes.

This brief forms part of a broader multi-level policy analysis under the ALBATROSS Horizon Europe research project. The analysis aims to assess the extent to which, and key challenges and options of integrating Nature-based Solutions (NbS), climate services, Indigenous knowledge and local knowledge, gender inclusion into environmental and climate change policies across five African countries: **Ghana, Kenya, Madagascar, South Africa, and Tanzania.**

Drawing on national and sub-national policy documents, as well as relevant regional frameworks, the analysis mapped the extent and depth of policy integration across the following thematic areas:

- NbS approaches
- Climate services
- Gender-sensitive approaches and
- Indigenous Knowledge and Local Knowledge (IKLK).

The analysis also identified policy gaps, critical needs, and opportunities to scale up NbS and the integration of climate services, gender-sensitive approaches, and IKLK.

This **South Africa country brief** provides an overview of national findings and presents a set of recommendations for advancing the integration of NbS, climate services, gender considerations and IKLK in national and sub-national policy documents.

2. Overview of the studied policy documents

The broader multi-level policy analysis included transnational, national and subnational environmental and climate policy documents. Some additional thematic documents were also included to cover additional thematic areas, such as meteorology services, gender mainstreaming, and IKLK. In total, 252 policies were included in the analysis from the five target countries. For South Africa, 53 documents were analysed, consisting of multi-sectoral and sectoral policy frameworks, regulations, strategies, and plans.

2.1. SDG themes addressed by the documents

SDG 15: Life on Land is covered by 87% of the documents, SDG 13: Climate Action is covered by 77% of the documents, followed by SDG 6: Clean Water and Sanitation (51%).

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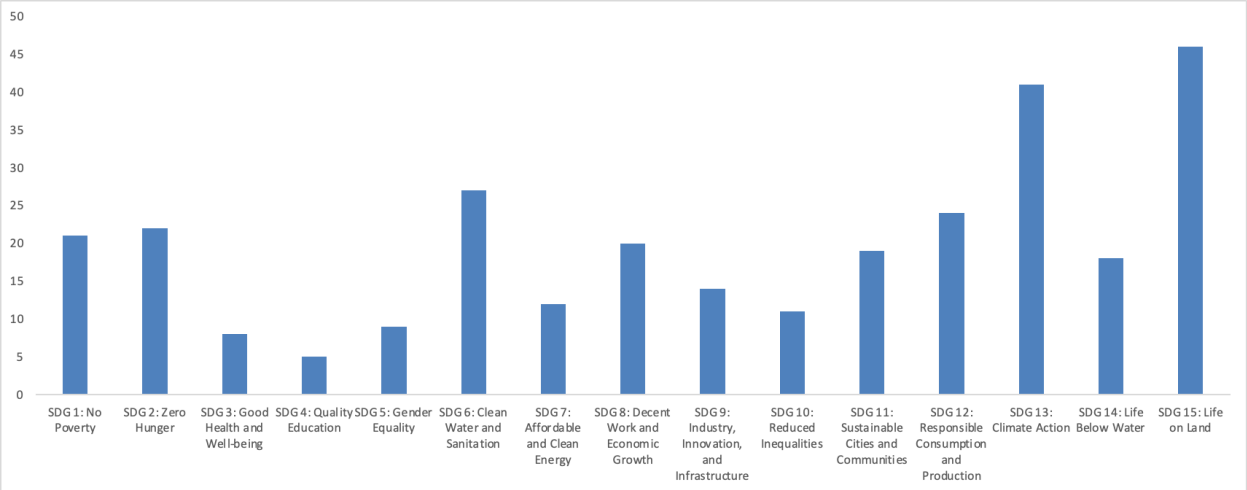
Additionally, SDG 14: Life Below Water is addressed by 34% of the documents (18 policy documents), focusing on marine and coastal ecosystem conservation. SDG 11: Sustainable Cities and Communities and SDG 7: Affordable and Clean Energy are covered in 36% and 23% of the documents, respectively. Given the central importance of sustainable urban development and low-carbon energy production in Sub-Saharan Africa, this indicates a potential policy gap. Socio-economic objectives such as SDG 2: Zero Hunger, SDG 1: No Poverty, and SDG 8: Decent Work and Economic Growth are featured in 42%, 40%, and 38% of the reviewed policy documents, respectively. Fewer policy documents integrated themes relevant to SDG 5: Gender Equality (17%) and SDG 4: Quality Education (9%).

Figure 1: Distribution of SDG themes in the studied policy documents of South Africa



Source: Calculation based on the multi-level policy analysis for Deliverable 6.1

2.2. *Climate hazards identified and addressed in environmental and climate policies*

The policy documents reviewed in South Africa identified a broad range of these climate hazards:

- **Drought**: A key climate concern addressed in **60%** of the reviewed policies is drought. Concerning water scarcity, 21% of the policy documents addressed agricultural drought, resulting in insufficient soil moisture to sustain crop growth and reduced yields.
- **Flooding**: Among the most frequently addressed hazards, flooding is also a predominant concern, with **49%** of the reviewed policies incorporating relevant considerations. Specific types of flooding mentioned include flash floods (**11%**), coastal flooding (**19%**), urban (pluvial) floods (**4%**), and riverine floods (**4%**).
- **Soil erosion and land degradation**: The third most frequently recognised climate risk is soil erosion, referenced in **45%** of the policies. Many policies linked these problems to unsustainable land-use practices and deforestation.
- **Coastal erosion**: Several reviewed policies (**28%**) highlighted coastal erosion as a significant risk, often linked to sea-level rise and human-induced shoreline changes.

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- **Other notable hazards** include wildfires (**21%**), forest fires (**13%**), storm surges (**11%**) and extreme weather events, such as heat waves (**17%**) and strong wind (**11%**).

3. Integration of Nature-based Solutions (NbS) in environmental and climate policies

The following section provides an overview of identified NbS implementation trends, gaps, needs, and integration opportunities across the policy documents studied in South Africa.

According to **internationally accepted definitions**,[1] NbS integrates various approaches such as ecosystem-based management, sustainable forest and water management, agroecology and agrobiodiversity, sustainable agriculture, urban ecosystem regeneration and green and blue infrastructure development. These approaches are implemented through various actions, such as reforestation and forest conservation, coastal and marine protection, freshwater and wetland conservation and restoration, ecosystem-based river basin and floodplain management, erosion control measures, regenerative and climate-resilient agriculture and rangeland management, as well as urban greening measures and hybrid of blue/green/grey infrastructures solutions.

Among the **reviewed policy documents for South Africa**, around **75% contained NbS measures and actions**. The level of NbS integration across these documents was evaluated according to the following categorisation:

- **High:** NbS approaches are prominently embedded throughout the document, with straightforward integration into strategic objectives and implementation mechanisms. The document may also explicitly position NbS as a core component of climate adaptation and environmental management.
- **Medium-high:** NbS approaches are well-integrated into the policy document and supported by specific policy measures, but they have limited cross-sectoral coordination and alignment with broader policy objectives, such as health, education, or economic resilience.
- **Medium:** NbS approaches are referenced in multiple sections of the document. However, these remain fragmented or limited to general principles without detailed implementation actions.
- **Limited:** The policy document includes a few NbS measures, but these are limited in scope and lacking detail.

[1] United Nations Environment Assembly of the United Nations Environment Programme (2022). Resolution adopted by the United Nations Environment Assembly on 2 March 2022: 5/5. Nature-based solutions for supporting sustainable development. UNEP/EA.5/Res.5. Nairobi, 22 and 23 February 2021, and 28 February – 2 March 2022. United Nations Environment Programme. https://wedocs.unep.org/handle/20.500.11822/39864

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3.1. High-level, multi-sectoral policies, strategies and plans

NbS approaches were included in the broader national development strategies of all five studied African countries. Most reviewed high-level or multi-sectoral policy documents, such as national development plans, spatial planning frameworks, and other long-term strategic documents guiding sustainable development, included some relevant NbS aspects. An overview of the identified high-level, cross-sectoral policy documents that integrate NbS approaches in South Africa is presented below.

Table 1: High-level and cross-sectoral policy documents in South Africa, including NbS approaches and considerations

Name of the policy document	NbS integration	Specific references
National Framework for Sustainable Development, 2008, South Africa	Medium	Investing in protecting and enhancing ecosystem services. Improving aquatic ecosystems, water availability, and water quality. Promoting urban agriculture and soil conservation
National Development Plan (NDP) 2015-2030	Medium	Africa's ecosystem services are recognised as key to achieving social and economic development, and the biodiversity and ecosystems in conservation areas are national assets.

3.2. Climate regulations, strategies and plans

The reviewed African countries also explicitly integrated NbS into their **international climate commitment**s under the Paris Agreement. However, **South Africa's updated first NDC** (2021) considers NbS approaches only to a limited extent but highlighted the potential application of climate-smart agricultural practices and the need to monitor climate change impacts on biodiversity and ecological infrastructures.[2]

Specific NbS considerations were also identified in national climate change strategies and plans. The policies that integrate NbS more comprehensively are presented below.

Table 2: Climate change policies, strategies and plans in South Africa, including NbS approaches and considerations

Name of the policy document	NbS integration	Specific references
National Climate Change Response Policy White Paper (2011), South Africa	Medium-high	Catchment and water management for water security; Conserve and restore natural systems for climate resilience (e.g., mangroves, wetlands); Expand protected areas for resilience and threatened ecosystems management; Water-sensitive urban design; On-farm adaptation strategies with conservation agriculture, indigenous knowledge; Coastal protection (mangroves, reefs, dunes)

[2] https://unfccc.int/sites/default/files/NDC/2022-06/South%20Africa%20updated%20first%20NDC%20September%202021.pdf

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National Climate Change Adaptation Strategy (2019), South Africa	Medium	Climate-resilient rural livelihoods capacity building; Climate-resilient natural resource management for ecosystem services restoration; Vulnerable ecosystems, landscapes, wildlife protection; Invasive species control; Tree cover, forest, and plantation expansion to reduce urban temperatures.

At the sub-national level, the Climate Change Adaptation Strategy for the Eastern Cape (2019) promotes biome-specific adaptation municipal development plans, climate strategies and spatial plans as well as nature-based coastal management and protection measures, and ecosystem-based agriculture and rangeland farming approaches.

3.3. Environmental regulations, strategies and plans

The policy review also assessed sectoral policy documents focusing on biodiversity protection, forest management, water and coastal resource management and agriculture. Focusing on different ecosystems, such as forests, freshwater and coastal areas, rangelands, and agricultural and urban areas, various types of management, conservation and restoration actions were identified across the reviewed documents.

The table below highlights key environmental policy documents with a higher level of NbS integration in South Africa.

Table 3: Environmental policy documents in South Africa, including NbS approaches and considerations

Name of the policy document	NbS integration	Specific references
Strategic Plan for the Environmental Sector (2019-2024), South Africa	Medium-high	Oceans and coastal conservation; Climate resilience and air quality management; Ecosystem conservation and rehabilitation; Control of invasive species; Wetland and estuary restoration; Community parks creation or rehabilitation; Forestry management.
National Environmental Management: Protected Areas Act (2003, amended in 2014 and 2022), South Africa	Medium	Protected areas system including reserves, heritage sites, and forests; Conservation of biodiversity and natural landscapes; Sustainable use of biological resources; Nature-based tourism development; Management of biodiversity, settlements, and economic development.
National Forests Act (1998, amended in 2001, 2005, 2022), South Africa	Medium	Community forestry promotion; Soil, biodiversity and water conservation; Sustainable forest resource use.
Forestry 2030 Roadmap, South Africa	Medium	Sustainable use, Conservation of forest biological diversity, ecosystems, and habitats; fair and equitable distribution of benefits
National Water Act, 1998 (amended in 1999 and 2014), South Africa	Medium	Protect aquatic ecosystems and biodiversity; Manage catchment strategies for water allocation.
National Water Resource Strategy Third Edition (2023), South Africa	Medium-high	Invest in ecological infrastructure for climate resilience; Protect and restore water source areas; Mainstream climate considerations in water planning; Promote NbS for water security.

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Working for Wetlands Program (ongoing since 2002), South Africa	Medium-high	Restore degraded wetlands; Prevent erosion and sedimentation; Manage invasive species; Community involvement in wetland conservation.
Working for Water Program (ongoing since 1995), South Africa	Medium-high	Reduce the density of established, terrestrial, invasive alien plants; Manage water resources by controlling alien plants.
White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (2023)	Medium-high	Restore degraded ecosystems; Strengthen threatened species recovery; Promote conservation agriculture and ecological connectivity; Prevent wetland and groundwater degradation; Expand biodiversity economy.
National Protected Area Expansion Strategy (2016), South Africa	Medium	Expand terrestrial and marine protected areas; Implement biodiversity stewardship programs; Research ecosystem-based adaptation to climate change.
National Biodiversity Strategy and Action Plan (2015-2025), South Africa	Medium-high	Develop a network of protected and conservation areas; Expand the biodiversity economy; Support the land reform agenda through biodiversity conservation; Restore, maintain and secure important ecological infrastructure; Develop implementation plan for EbA
Preservation and Development of Agricultural Land Act (2024), South Africa	Medium-high	Promotes the integration of the principle of agro-ecosystem management in agricultural practices.
Strategic Plan for South African Agriculture, (2020-2025), South Africa[3]	Medium	Innovative sustainable agriculture encouraging ecologically sustainably food systems; Foster cooperation between conservation, agricultural production and enhancement of rural livelihoods.
2nd National Action Programme to Combat Desertification, Land Degradation, and the Effects of Drought (2018–2030)	Medium-high	Combat desertification and restore degraded land to achieve Land Degradation Neutrality by 2030; Promote sustainable agriculture and critical habitat restoration; Identify high-risk landscapes; Strengthen community adaptation to desertification, land degradation, and drought; Enhance ecosystem-based climate adaptation.
South African Land Degradation Neutrality Target Setting Programme (2017)	High	Soil carbon enhancement on cropland; Management of degraded ecosystems (forests, grasslands, savannas, fynbos, thicket, Karoo, wetlands, artificial areas); Sustainable land practices (grazing, erosion control, afforestation, conservation agriculture, post-clearing rehabilitation); Stewardship programmes; Stormwater and fire management.
The South African Land Care Program (ongoing since 1997)	Medium-high	Provide a framework to optimise productivity and sustainability of the natural resources through management, protection and rehabilitation; Sustainability-focused land use; Rehabilitation of degraded land; Control invasive species; Floodplain management; Support soil conservation and biodiversity.

3.4. Identified trends in NbS approaches and actions.

3 The Agricultural Policy Action Plan guiding agricultural policy implementation in the preceeding 2014-2019 in South Africa also included the following actions: afforestation in Eastern Cape and KwaZulu-Natal, integration of natural resource management into farming, implementation of agro-ecological practices and sustainable grazing.

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The quantitative analysis of the NbS integration patterns identified in the policy documents reveals varying priorities across ecosystems and thematic areas. Regarding the policy documents reviewed in South Africa, the following trends can be identified:

- **Ecosystems covered:** The studied policy documents placed a more significant focus on freshwater resources (40%), coastal and marine ecosystems (30%), agricultural areas (32%) and forests (25%). Urban areas and grasslands were considered in fewer documents.
- **Identified trends in NbS approaches and actions:** The policy documents have integrated multiple NbS actions, regenerative agricultural practices (30%), freshwater resource protection (28%), coastal and marine areas conservation (28%) and reforestation and sustainable forest management activities (21%). Urban green and blue infrastructure development (9%) and anti-desertification, land degradation and soil erosion measures were less frequently included (15%).
- **Level of NbS integration**: 25% of policies integrated NbS approaches more comprehensively. Another 50% integrated NbS at a medium level by including some relevant measures but mainly focusing on specific ecosystems and activities.

3.5. Recommendations for NbS integration

Integrate NbS in high-level and multi-sectoral policies: NbS approaches are considered in several South African policy documents but not integrated systematically and often address only selected sectors and ecosystems.These include high-level policy documents, such as the National Development Plan 2030; sectoral strategies, the Climate Change Adaptation Strategy (2019), the National Disaster Management Framework (2023) or the 3rd edition of the National Water Resource Strategy Third Edition (2023) as well as sub-national policies. The Climate Change Adaptation Strategy for the Eastern Cape and the Eastern Cape Biodiversity Conservation Plan both represent high potential for integration.

Strengthen NbS and EbA integration in key environmental sectors: The Strategic Plan for the Environmental Sector (2019-2024) already includes relevant NbS actions, but these are not systematically mainstreamed in all programmes, and not all ecosystem and activity types are considered. Sectoral strategies, focusing on forestry, water and agriculture, should adopt detailed guidelines for integrating EbA and NbS into planning processes. Strategies, such as the National Water Resource Strategy (2023), National Biodiversity Strategy and Action Plan (2015-2025) recognise the importance of ecological infrastructure, but clearer guidelines are needed on integrated water-management approaches for restoring catchments, wetlands and riverine ecosystems. While the Strategic Plan for South African Agriculture (2020-2025) recognise the importance of sustainable land management, climate-smart and conservation agriculture practices could be more strongly integrated. The National Forests Act and Forestry 2030 Roadmap support sustainable forest management, but expanding policies to promote urban forestry, community-based restoration, and tree-planting initiatives as NbS could provide additional benefits.

Strengthening the legislative framework for NbS: Many environmental laws (e.g., National Water Act and National Environmental Management Acts) align with NbS concepts but lack

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direct references to relevant activities. Strengthening regulatory frameworks to include explicit requirements for implementing NbS would improve coherence. Requirements for NbS approaches could also be included in local environmental regulations and in Environmental Impact Assessments of infrastructure projects

Integrate NbS into urban planning: Some policy documents mention urban greening but do not outline specific NbS interventions for cities, such as urban reforestation, green water management solutions, or community food production areas. National guidelines for urban tree planting, green roofs, and stormwater management could be developed.

Introducing financing strategies and mechanisms for NbS: Most policies and strategies, even if they include NbS or EbA as strategic measures, do not allocate specific implementation budgets to such activities and lack clear financial mechanisms to support large-scale implementation. Establishing a dedicated funding stream can mobilise resources for large-scale NbS investments. In addition, introducing green bonds, and utilising blended financing, can mobilize further resources for NbS investments. For example, the Carbon Tax Act (2019) could be leveraged for NbS-based carbon offsets, but currently, it does not include any NbS-specific mechanisms.

Monitoring frameworks: Establishing NbS-specific indicators and reporting mechanisms can help tracking progress, assess multiple co-benefits, support stakeholder involvement and facilitate evidence-based policy adjustments.

4. Climate services provisioned in policy

The Global Framework for Climate Services (GFCS) of the WMO defines climate services as the "*provision and use of climate data, information, and knowledge to assist decision-making,*" with key components including observations and monitoring, research, modelling and prediction, climate services information systems, user-provider engagement, and capacity development. As such, climate services can play a critical role in supporting climate risk management, adaptation planning and evidence-based decision-making in various sectors, including disaster risk management, agriculture and food security, water management, health and energy. [4]

The analysis found that less than half (40%) of the reviewed policy documents in South Africa consider climate services. The level of climate services integration was evaluated according to the following categorisation:

- **High:** Climate services are prominently embedded throughout the document, with clear integration into strategic objectives and implementation frameworks. The document may

[4] **World Meteorological Organization (WMO).** (n.d.). *Components of GFCS*. Global Framework for Climate Services. Retrieved February 25, 2025, from https://gfcs.wmo.int/site/global-framework-climate-services-gfcs/components-of-gfcs

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also explicitly position climate services as central to climate adaptation and risk management.

- **Medium-high:** Climate services are well-integrated and supported by specific policy measures, but with limited cross-sectoral coordination or alignment with broader policy areas such as health, agriculture, or economic planning.
- **Medium:** Climate services are referenced in multiple sections, but treatment is often fragmented or limited to general principles without detailed implementation strategies.
- **Limited:** Climate services are mentioned occasionally, with minimal scope and lacking detail in terms of operationalisation or institutional support.

4.1. High-level, multi-sectoral policies, strategies and plans

In South Africa's high-level and multi-sectoral frameworks, the integration of climate services remains limited or absent. See the table below.

Table 4: High-level and cross-sectoral policy documents in South Africa, including climate services

Name of the policy document	Climate services integration	Specific references
National Development Plan 2030, South Africa	Medium	Use best available climate predictions to inform sectoral development; Promote climate-resilient planning based on detailed regional impact research; Establish and support an independent research body or climate change centre; Prioritise communication tools and early warning systems for rural safety.
National Framework for Sustainable Development, 2008, South Africa	Medium	Support subnational capacities for data collection, processing, planning and monitoring; Support research and monitoring of climate change effects on coastal and marine resources; Monitor atmospheric and oceanographic conditions for early warning systems.

4.2. Climate policies, strategies and plans

South Africa's updated first NDC (2021) contains provisions for strengthening monitoring and surveillance for climate-induced diseases and integrating climate considerations into urban planning, infrastructure development, and building standards. The updated NDC also provisions the establishment of a National Climate Change Information System and a National Framework on Climate Services System, but details are not elaborated on.

The majority of South Africa's climate policy documents also integrate climate services. Identified goals and measures mainly focused on climate data and monitoring, early warning systems and, in some instances, also to improve evidence-based decision-making.

Table 5: Climate policy documents in South Africa incorporating climate services

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Name of the policy document	Climate services integration	Specific references
National Climate Change Response Policy White Paper (2011), South Africa	High	Monitor water adaptation; Strengthen early warning systems; Improve climate-health data and research; Implement Heat-Health plans; Track biodiversity and ecosystem risks; Assess urban resilience; Downscale climate models; Integrate climate risks in coastal and disaster plans; Study climate impacts on coastal livelihoods; Regionalise early warning systems; Support university-based risk centres; Use seasonal forecasts.
National Climate Change Adaptation Strategy (2019), South Africa	High	Assess local climate risks and vulnerabilities; Enhance climate observation, prediction, and modelling; Develop multi-level early warning systems; Plan for climate displacement; Invest in climate impact and adaptation research; Promote adaptation technologies and research dissemination.
Climate Change Act (2024), South Africa	High	Assess local climate risks and vulnerabilities; Map vulnerable areas, ecosystems, and communities; Develop national adaptation scenarios and monitor climate trends; Assess sectoral and geographic vulnerabilities; Identify adaptation options and implementation plans.

In addition to national policy documents, some sub-national climate change policies also included provisions for the application of climate services. In South Africa, the Climate Change Adaptation Strategy for the Eastern Cape (2017) aimed to update risk and vulnerability assessments, strengthen disaster risk reduction awareness, and integrate climate change health risks.

4.3. Environmental policies, strategies and plans

Relevant activities are also included in some of South Africa's sectoral policies, which mainly focus on water resources management, agriculture and DRR/DRM. See the table below.

Table 6: Environmental policy documents in South Africa incorporating climate services

Name of the policy document	Climate services integration	Specific references
Antarctica and Southern Ocean Strategy (2021), South Africa	Medium-high	Improve climate research and monitoring; Enhance climate projection models; Strengthen ecosystem resilience research; Integrate climate data into national decision-making processes.
National Water Resource Strategy Third Edition (2023), South Africa	Medium-high	Conduct climate risk and vulnerability assessments; Develop early warning systems; Support research on climate-resilient infrastructure.
National Water Act (1998, amended in 2014), South Africa	Medium	Ensure availability of data on water quantity, quality, and use to support sustainable management and planning; Establish early warning systems to anticipate events such as floods and drought

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2nd National Action Programme for South Africa to Combat Desertification, Land Degradation, and the Effects of Drought (2018–2030), South Africa	Medium-high	Enhance national climatological, meteorological and hydrological capabilities and the means to provide for early drought warnings; Develop accessible GIS database for spatial distribution of areas severely and moderately affected by desertification, land degradation and drought.
National Disaster Management Framework (2023), South Africa	Medium-high	Develop real-time hazard monitoring capacity; Integrate disaster risk data into a management system for early warning; Conduct risk assessments; Improve risk data storage, mapping, and dissemination. Enhance public access to early warning systems. Strengthen coordination for DRR/DRM.
National Disaster Management Act, (2002 amended in 2015), South Africa	Medium	Collect, analyse, and disseminate disaster information, prioritising vulnerable communities; Promote capacity building, training, and education, including in schools; Require risk assessments, early warning systems, climate-aligned planning, and regular plan updates.

4.4. Identified trends in climate services integration

Our analysis identified the following trends concerning climate services in the reviewed policy documents of South Africa.

- **Types of climate services integrated**: Climate research and modelling (32%), climate observations and monitoring (28%) and climate services information systems (32%) are the most frequently included across the South African policies, but still only moderately referenced.
- **Sectors addressed by climate services:** Climate service provision in the agriculture (19%) and water sectors (19%) receives somewhat more attention, but overall, the sectoral focus is less emphasized. Many documents provide general provisions.
- **Level of integration:** Less than one-fifth of the policies (17%) demonstrate a higher level of integration of climate services. A further 23% exhibit a moderate level of integration. Approximately 60% do not consider climate services.

4.5. Recommendations for CS integration

Strengthen climate services in key environmental sectors: Most policies contain provisions for environmental monitoring, but do not comprehensively link data collection efforts to climate risks. The National Water Act (1998, as amended) and the National Water Resource Strategy (2023) emphasise hydrological monitoring and flood prediction, but fail to integrate climate projections into long-term water resource management. An updated water resource management strategy could link hydrological models with climate projections to anticipate water availability changes and help forecast droughts and floods. The Integrated Coastal Management Act (2008, as amended) and the Marine Spatial Planning Framework (2017) mention environmental monitoring but do not explicitly link coastal erosion and sea-level rise projections to climate services. A national coastal climate risk monitoring system could include ocean temperature and sea level monitoring and expand coastal early warning systems,

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particularly for small-scale fishers vulnerable to climate impacts. Strategic Plan for South African Agriculture (2020-2025) mentions the importance of effective disaster risk reduction, but could establish a direct connection between agricultural monitoring systems and climate forecasting services. An integration framework for climate services could also support the systematic integration of climate data into sectoral policies.

Improve climate data availability and accessibility: Provisions for the collection of climate data and information are fragmented across various sectors and lack detailed plans for downscaling models to local levels. The development of localised climate data and risk maps for municipalities and rural communities, should be prioritised. A centralised national climate data repository could be developed to ensure that all stakeholders (government, businesses, and communities) can access up-to-date climate projections, vulnerability maps and relevant sectoral climate data.

Expand early warning systems: Some policies, such as the Disaster Management Framework (2023), mention real-time hazard monitoring, but policies should aim for the development of a people-centered, multi-hazard early warning system that considers various climate risks (droughts, floods, heatwaves, coastal erosion). The local adoption of early warning systems should also be ensured, especially for small-scale farmers, vulnerable coastal communities, and urban settlements.

Expand climate information networks to increase adaptation capacities: The Climate Change Act (2024) mandates supporting adaptation planning activities, but these should be clearly linked to climate data and risk assessments. To support capacity-building, sub-national climate training hubs for local governments could be established, and support the development of sector-specific climate awareness and capacity-building programs for businesses and communities.

5. Gender-sensitive approaches in policies

Gender-sensitive and equity-based approaches are increasingly recognised as essential to effective climate adaptation strategies. Such approaches can significantly reduce vulnerability across critical African sectors, such as water, health, food systems, and livelihoods. [5]

The majority of the policy documents studied in South Africa incorporate social inclusion considerations, although many of the reviewed documents do not cover all relevant needs.

[5] IPCC, 2023: Annex I: Glossary [Reisinger, A., D. Cammarano, A. Fischlin, J.S. Fuglestvedt, G. Hansen, Y. Jung, C. Ludden, V. Masson-Delmotte, R. Matthews, J.B.K Mintenbeck, D.J. Orendain, A. Pirani, E. Poloczanskaa, and J. Romero (eds.)]. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 119-130, doi: 10.59327/IPCC/AR6-9789291691647.002

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Regarding gender mainstreaming, around 30% of the reviewed policy documents included specific gender-responsive measures. An additional 25% of the documents acknowledged the need to address gender inequality without listing specific actions to address these challenges. The remaining 40% of the reviewed policy documents included limited or no consideration of gender inclusion.
The table below provides an overview of identified environmental and climate policies with more comprehensive gender inclusion measures in South Africa.

Table 7: Gender-responsive approaches in the climate and environmental policy documents of South Africa

Title of Policy	Specific references
Strategic Plan Environmental Sector (2019-2024), South Africa	Transformation of workforce to reflect race and gender demographics.
2nd NAP to Combat Desertification, Land Degradation, and Drought (2018–2030), South Africa	Ensure effective participation of both women and men in policy planning, decision-making, and implementation.
Strategy toward Gender Mainstreaming in the Environment Sector (2016–2025), South Africa	Guidance on gender mainstreaming in the environment sector and sustainable development.
National Water Resource Strategy 3rd Edition (2023), South Africa	Redress past race and gender imbalances in water use. Facilitate HDI-owned enterprises' access to water.
National Biodiversity Strategy and Action Plan (2015-2025), South Africa	Strengthen benefit-sharing from protected areas, including gender considerations.
Strategic Plan for South African Agriculture 2020-2025	Supporting women, youth, and other vulnerable groups in agricultural activities
Climate Change Act (2024), South Africa	Decision-making must consider women, especially poor and rural women, children, the aged, the poor, and the physically challenged.
National Climate Change Adaptation Strategy (2019-2030) ,South Africa	The NCCAS will promote the participation of women and will not exacerbate gender inequalities.
Just Transition Framework for South Africa, 2020	The transition must be fair considering gender, race, and class inequalities. Social protection must reach vulnerable groups, particularly women and young people.

5.1. Recommendations for improving the inclusion of gender considerations

Strengthen gender mainstreaming in environmental and climate policies: The National Climate Change Adaptation Strategy (2019) mandates that adaptation actions must ensure equitable benefits for the most vulnerable, including women, and the Strategy Toward Gender Mainstreaming in the Environment Sector (2016–2021, extended to 2025) provides a framework for integrating gender into environmental governance. These requirements should be mainstreamed into sectoral policies, such as the upcoming updates of the National Biodiversity Strategy and Action Plan (2015-2025), Strategic Plan for South African Agriculture (2020-2025) and the Eastern Cape Biodiversity Conservation Plan (2019).

Gender-sensitive climate services and DRR/DRM: While several of the reviewed climate policies aims for the integration of gender-sensitive approaches, the provisions of climate

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services lack gender integration. The Disaster Management Framework (2023) calls for gender integration in DRR/DRM activities but lacks detailed implementation mechanisms The National Climate Change Adaptation Strategy (2019) and the Climate Change Adaptation Strategy for the Eastern Cape mandate the development of climate information and early warning systems, but these could explicitly include gender-sensitive outreach.

Link economic opportunities and livelihoods to NbS approaches: Policies could promote green job opportunities in climate-resilience agriculture and nature conservation. The *Forestry 2030 Roadmap* includes a principle on gender equity, but implementation mechanisms need to be strengthened. The *Just Transition Framework (2020)* calls for social protection measures, including entrepreneurship support for women. This could be extended to NbS-focused activities, such as climate-resilient agriculture and ecotourism.

Expanding the national gender-environment framework with a subnational implementation component: The Strategy for Gender Mainstreaming in the Environment Sector (2016–2025) lacks strong subnational policy integration. Subnational environmental strategies should also be aligned with national gender mainstreaming goals and could develop gender-sensitive implementation plans for climate resilience, biodiversity conservation, and natural resources management.

6. Indigenous knowledge and local knowledge in policies

45% of the reviewed South African policy documents contain concrete provisions for integrating indigenous knowledge and local knowledge (IKLK), either comprehensively or partially. The remaining half of the studied documents include limited considerations or do not mention IKLK systems.

Across policy documents, IKLK is mentioned in connection to natural resource management, climate change adaptation, disaster risk management, and sustainable agriculture. Policies promote IKLK through documentation, integration with scientific knowledge, and, to a lesser extent, capacity-building and formal governance mechanisms.

6.1. Recommendations for IKLK integration

Mainstream IKLK in environmental governance and natural resource management: The Constitution of the Republic of South Africa recognises customary law and traditional leadership, which can provide a basis for integrating IKLK into governance structures. As part of this, it is also important to ensure the representation of IKLK holders in environmental governance bodies. The National Climate Change Response Policy White Paper (2011) and National Climate Change Adaptation Strategy (2019) already reference IKLK, but they could mandate its integration in climate adaptation planning across sectoral and local policies.

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Integrating IKLK in regulatory frameworks: The National Environmental Management Act (1998, amended in 2022) recognises the importance of various knowledge systems but lacks specific, enforceable mechanisms. Amendments could establish legally binding requirements for IKLK integration in biodiversity conservation, climate adaptation, and land management strategies. Similarly, IKLK is not recognised in sectoral legislations, such as the Water Act (1998, as amended) and the Forest Act (1998, amended in 2022). Similarly, the Marine Living Resources Act could integrate indigenous fisheries management techniques into coastal and marine conservation efforts.

Strengthen documentation and practical implementation: Many policies, such as the National Biodiversity Strategy and Action Plan (2015-2025) and the White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (2023) contain more concrete measures concerning IKLK, but mainly regard IKLK as a knowledge resource. These policies could be revised to explicitly promote IKLK-based biodiversity conservation, ecological restoration, and sustainable resource management.

Broaden the application of IKLK beyond current domains: Existing forest and water management strategies offer opportunities to incorporate or expand IKLK integration. The National Water Resource Strategy (2023) mentions IKLK but does not integrate it into water governance practices. Future iterations could consider traditional practices for watershed management and traditional rainwater harvesting practices. Similarly, the Forestry 2030 Roadmap could be updated to consider sustainable forest management, particularly in community forest stewardship, fire management practices, and biodiversity conservation methods rooted in traditional knowledge systems.

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