

Briefing Note*

Sustainability of Southern African Ecosystems under Global Change: Science for Management and Policy Interventions

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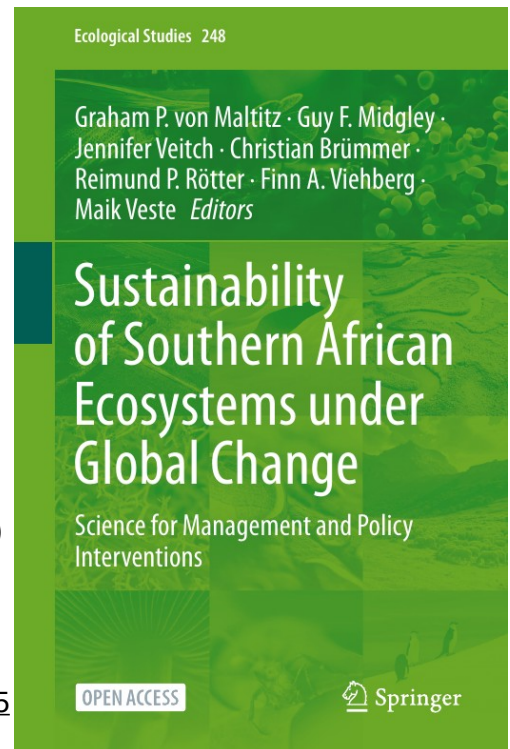
*Objective – A briefing note aims to provide a concise outcome based synopsis of recent research or expert opinion that may inform decision making and activities by authorities, NGOs and NPOs. The briefing note series complements the academic peer reviewed literature published by SAEON

Objective of Briefing Note

In this briefing note, we provide a summary of some key and relevant findings of the recently published, open access, book entitled: 'Sustainability of Southern African Ecosystems under Global Change: Science for Management and Policy Interventions' (von Maltitz et al (2023)). The book is a compilation of chapters that are the outcome of German – African collaborations under the auspices of the German Federal Ministry of Education and Research (BMBF)-funded SPACES II project (2018-2022). Jennifer Veitch (Egagasini) was on the editorial committee of this book and co-authored two of the marine chapters, while Gregor Feig (EFTEON) contributed to a chapter on terrestrial CO₂ sequestration and was the lead author on the chapter on research infrastructures.

Reference: von Maltitz, G., G.F. Midgley, J. Veitch, C. Brümmer, R.P. Rötter, F.A. Viehberg and M.Veste (eds) (2024) *Sustainability of Southern African Ecosystems under Global Change: Science for Management and Policy Interventions*, Ecological Studies, Volume 248, Switzerland, Springer.

Link: <https://link.springer.com/book/10.1007/978-3-031-10948-5>



Summary

The book highlights the profound impact of climate change on Southern African ecosystems by examining regional climate trends and extreme weather events and their consequences for biodiversity, agriculture, and water resources. The scientific insights provided support the adaptation and mitigation strategies that are required to address these challenges. The book highlights the urgency of adopting sustainable practices and policies, along with integrated approaches, to mitigate the adverse effects of climate change on the Southern African region.

Key drivers of terrestrial ecosystems are examined, such as land-use changes, biodiversity loss, and climate variability impacting these ecosystems. The contributors discuss current research findings that shed light on the intricate relationships between vegetation, soil, and climate. Marine ecosystem issues addressed include overfishing, habitual degradation, and the impacts of climate change on ocean processes, as well as how they contribute to atmospheric variability. This body of work underscores the fact that the sustainability of both marine and terrestrial ecosystems in the Southern African Region depends strongly on science-based strategies for their management and conservation.

Providing tools for the development of effective policies for the sustainable management of Southern African ecosystems, as well as to support societal resilience, are overarching objectives of the collection of chapters in this book. To this end, existing policies and

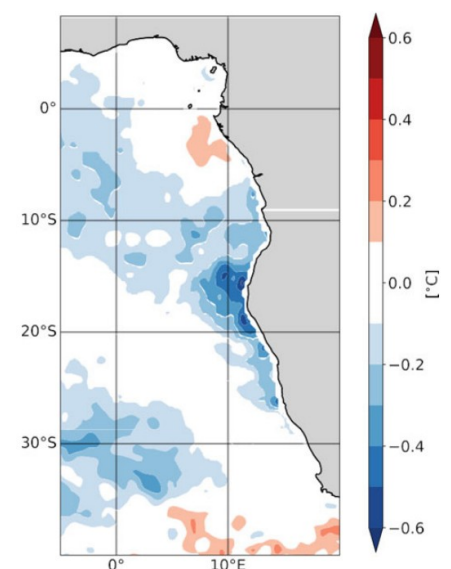


Figure 1: Trends in sea surface temperature variability: blue (red) indicating reduced (increased) variability for the 2000-2017 compared to the 1982-1999 period.

gaps are analyzed and science-based interventions to support more sustainable approaches are proposed. Additionally, it examines how Southern African communities adapt to shifting ecological conditions and emphasizes the need for inclusive and participatory approaches. The role of education, community empowerment, and sustainable development are highlighted as integral in enhancing societal resilience. The book emphasizes the importance of interdisciplinary collaboration, community engagement, and adaptive management approaches in crafting new policies that balance ecological conservation with human needs.

Gaps Identified

Marine Ecosystems and their response to global change

- **Ocean Acidification Impacts:** The book highlights gaps in our understanding of how ocean acidification, driven by increased carbon dioxide absorption, affects Southern African marine ecosystems. The specific consequences for marine species and ecosystem dynamics remain areas that require further research.
- **Integrated Assessment Models:** The book suggests that there is a need for more sophisticated integrated assessment models to predict the complex interactions between climate change, oceanography, and marine biodiversity. Understanding these dynamics is crucial for developing effective management strategies.
- **Inadequate Monitoring of Marine Biodiversity and Environment:** There are gaps in the monitoring of marine biodiversity, with limited data on the distribution, abundance, and health of various species. A comprehensive understanding of the current state of marine ecosystems is crucial for developing targeted conservation and management plans. There is also a lack of long term monitoring of the marine physical environment, which is essential for us to develop an understanding of change.
- **Impacts of Overfishing:** The book points out gaps in our understanding of the cumulative impacts of overfishing on marine ecosystems. This includes the intricate relationships between fisheries, biodiversity, and the overall health of marine ecosystems.
- **Limited Knowledge of Coastal Ecosystem Resilience:** The resilience of coastal ecosystems in the face of climate change remains inadequately understood. The book identifies the need for research into how these ecosystems respond to changing conditions, including sea-level rise, increased storm intensity, and altered sedimentation patterns.

Terrestrial Ecosystems and their response to global change:

- **Land-Use Change Dynamics:** The book emphasizes the need for a more nuanced understanding of the drivers and consequences of land-use changes in Southern African terrestrial ecosystems. Gaps exist in our knowledge regarding how land-use alterations impact biodiversity, soil health, and ecosystem services.
- **Incomplete Understanding of Vegetation Dynamics:** There are gaps in our understanding of the dynamics of vegetation, especially in response to changing climatic conditions. Improved knowledge of species interactions, migration patterns, and adaptation strategies is crucial for predicting and managing ecosystem changes.
- **Limited Research on Soil Health:** The book highlights gaps in research on soil health and its role in terrestrial ecosystem sustainability. This includes understanding the impacts of land management practices on soil fertility, nutrient cycling, and overall ecosystem resilience.

- **Insufficient Data on Climate Adaptation Strategies:** There is a need for more comprehensive data on the effectiveness of various climate adaptation strategies for terrestrial ecosystems. Understanding how different species and ecosystems adapt to changing climatic conditions is crucial for implementing science-based management practices.
- **Inadequate Assessment of Ecosystem Services:** The book identifies gaps in assessing the full range of ecosystem services provided by Southern African terrestrial ecosystems. More research is needed to quantify and understand the contributions of these ecosystems to human well-being, including water purification, pollination, and climate regulation.

Key Issues or Findings

- The book emphasizes the interconnectedness of terrestrial and marine ecosystems in Southern Africa, highlighting the need for **integrated management approaches** that consider both systems.
- It addresses the **significant impacts of climate change** on Southern African ecosystems, emphasizing changes in temperature, precipitation patterns, and extreme weather events, and their repercussions on biodiversity and ecosystem functions.
- The book identifies **ocean acidification** as a pressing issue affecting marine ecosystems, driven by increased carbon dioxide absorption, with potential adverse effects on marine species and overall ecosystem health.
- The book addresses the challenges of **overfishing** in Southern African waters and its impacts on marine biodiversity, stressing the importance of implementing effective fisheries management strategies.
- It explores the dynamics of **land-use changes** in Southern African terrestrial ecosystems, pointing out the consequences for biodiversity, soil health, and ecosystem services, and highlighting the need for sustainable land management practices.
- It introduces the concept of **societal resilience**, emphasizing the role of communities in adapting to changing environmental conditions and promoting the integration of ecological sustainability with social and economic well-being.
- The book identifies **gaps in existing environmental policies** and provides science-based recommendations for the development and revision of policies that balance ecological conservation with human needs.
- It advocates for **adaptive management strategies** that continuously learn from scientific insights and adjust conservation and management approaches based on evolving knowledge.
- The book highlights challenges in monitoring marine and terrestrial biodiversity, emphasizing the **need for comprehensive data** on species distribution, abundance, and health to inform effective conservation strategies.
- The findings stress the importance of international **collaboration** and research networks to address the complex challenges faced by Southern African ecosystems, encouraging the **sharing of knowledge and best practices** on a global scale.

Key Processes that the Findings May Influence

- **Integrated Ecosystem Management:** the book underscores the importance of integrated approaches to ecosystem management. It may influence processes that prioritize holistic strategies considering the interconnectedness of terrestrial and marine ecosystems, emphasizing a comprehensive understanding of ecological dynamics.
- **Adaptive Management Strategies:** gaps identified in our understanding of ecosystems and their responses to global change may encourage the adoption of adaptive management strategies. This involves continuous learning and adjustment based on scientific insights, fostering resilience in ecosystems facing uncertainties.
- **Policy Development and Revision:** the development and revision of environmental policies, particularly in Southern African countries.
- **Community Engagement and Stakeholder Collaboration:** recognizing the importance of societal resilience, the book may promote community engagement and collaboration with various stakeholders. Involving local communities in decision-making processes and fostering partnerships with NGOs and businesses can enhance the effectiveness of environmental management strategies.
- **Enhanced Monitoring and Research Initiatives:** the gaps highlighted in understanding both marine and terrestrial ecosystems may drive increased investment in monitoring and research initiatives. This includes expanding efforts to collect data on biodiversity, ecosystem health, and climate change impacts to improve our understanding of these complex systems.
- **Climate Adaptation and Mitigation Plans:** the book's insights into climate change impacts on ecosystems may influence the development of climate adaptation and mitigation plans. This could involve incorporating nature-based solutions and sustainable practices to enhance ecosystem resilience and contribute to broader climate action goals.
- **Education and Capacity Building:** recognizing the importance of knowledge dissemination, the book may influence educational programs and capacity-building initiatives. This includes training professionals, policymakers, local communities and learners to better understand and address the challenges posed by global change in Southern African ecosystems.



Figure 2: EFTEONs Benfontein flux tower, emphasizing the need for ongoing and longterm monitoring

- **Conservation and Restoration Initiatives:** the book's emphasis on biodiversity loss and habitat degradation may inspire conservation and restoration initiatives. This could involve targeted efforts to protect endangered species, restore degraded habitats, and implement conservation practices that promote the long-term health of terrestrial and marine ecosystems.
- **International Collaboration and Research Networks:** The book's findings may encourage increased collaboration between Southern African researchers and the global scientific community. International research networks and partnerships can facilitate the sharing of knowledge, methodologies, and best practices in ecosystem management.

List of Entities

- Department of Water and Sanitation
- District and Local Municipalities
- Department of Forestry, Fisheries and the Environment
- Mining interests
- NPOs and NGOs
- Civil Society Organizations
- Other Stakeholders