





POLICY BRIEF

TOWARDS A POLICY ON INDIGENOUS BUSH ENCROACHMENT IN SOUTH AFRICA

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
of the Federal Republic of Germany

Published by Department of Environmental Affairs

This policy brief must be cited as follows: Towards a policy on indigenous bush encroachment in South Africa (2019), Department of Environmental Affairs, Pretoria, South Africa

Authors:

Jane Turpie, Pieter Botha, Kevin Coldrey, Katherine Forsythe, Tony Knowles, Gwyneth Letley, Jessica Allen and Ruan de Wet

Project Management:

Hlengiwe Mbatha – Project Manager, Department of Environmental Affairs

Barney Kgope – Co-Project Manager – Department of Environmental Affairs

Jane Turpie – Technical Team leader, Anchor Environmental Consultants

Dumisani Nxumalo – Advisor, Climate Support Programme – Deutsche Gesellschaft fűr Internationale Zusammernarbeit (GIZ) GmbH

Mirko Abresch – Technical Advisor, Climate Support Programme – Deutsche Gesellschaft fűr Internationale Zusammernarbeit (GIZ) GmbH

Acknowledgements:

Dr Anthony Mills of C4 EcoSolutions

Andrew Skowno and Wim Hugo

Christo Marais and Michael Braak of DEA – NRM

Published in Pretoria, South Africa – March 2019

Pictures courtesy of Mr Itchell Guiney and Mr Kent Buchanan (unless stated otherwise)

Contact Information:

Department of Environmental Affairs

Environment House, 473 Steve Biko Street

Arcadia, Pretoria, 0001

South Africa

Tel: +2712 399 9146

Email: HMbatha@environment.gov.za

This brief was kindly funded through the GIZ implemented Climate Support Programme, which is part of the International Climate Initiative (IKI). The Federal ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports the IKI on the basis of a decision adopted by the German Bundestag.

CONTENTS

THE NATURE AND EXTENT OF BUSH ENCROACHMENT IN SOUTH AFRICA

Bush encroachment entails increased abundance of indigenous woody vegetation in the grassland and savanna biomes. In South Africa, where these biomes make up 27.9% and 32.5% of the land surface area, respectively, there has been a significant increase in tree cover since national-scale aerial photography was first undertaken in the 1940s.

Estimates of the extent of bush encroachment have been made at various spatial scales using field studies, landscape photography, aerial photography, satellite data and modelling based on statistical analysis of existing information. According to the latest estimate, about 7.3 million ha, or 6% of South Africa's land area, has been affected by bush encroachment.[1] This is mostly in areas with more than 500 mm of rainfall per year.

Determining the extent of bush encroachment that has occurred to date requires defining a baseline or 'natural' condition. This is difficult in dynamic, disturbance-driven ecosystems. Evidence suggests that the problem has been around for over a century, but increasing exponentially, so that most encroachment has only happened in the past 30 years.

Thus, the aerial photographs from the 1940s would make an adequate baseline. The baseline is important for informing a restoration strategy, but management goals should also take other societal values into account.

Over 40 species are listed as part of the bush encroachment problem in South Africa, and new species are being added. Bush encroachment is not caused by particular species, but is rather a change in balance of the types of plants occurring in ecosystems.

7.3 MILLION HECTARES OF ENCROACHED LAND

40+ BUSH ENCROACHER SPECIES

Sicklebush (*Dichrostachys cinerea*)
Photo: Wikimedia Commons

Bankrupt bush (*Seriphium plumosum*)
Photo: Wikimedia Commons

Some species respond to the drivers of bush encroachment more prolifically than others, and may be identified as the 'chief culprits' in a particular area (Table 1). However, the same species are likely to be benign and useful at their natural densities.

TABLE 1. 'Chief culprit' encroacher species per region

Common name	Scientific name	Main Regions
Blackthorn	*Senegalia mellifera*	Kalahari
Sicklebush	*Dichrostachys cinerea*	Bushveld and Lowveld
Mopane	*Colophospermum mopane*	Mopane
Red bush willow	*Combretum apiculatum*	Lowveld
Silver cluster leaf	*Terminalia sericea*	Lowveld
Sweet thorn	*Vachellia karroo*	Savanna and grasslands
Bankrupt bush	*Seriphium plumosum*	Highveld grasslands
Paperbark thorn	*Vachellia sieberiana*	Grasslands

Recognising that there is considerable spatial variation in bush encroachment across the country, the extent and impacts of bush encroachment and potential remedial interventions were summarised for a set of seven bioregional zones (Figure 1). Results from earlier studies were used to determine the average change in woody cover over the monitoring period for affected areas in each of the bioregional zones, and the total extent of bush encroachment in each zone was estimated from recent mapping of bush encroachment (Figure 2).

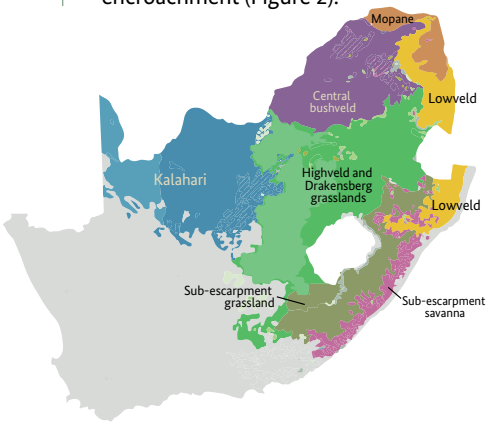


FIGURE 1. Bush encroachment zones defined in this study, in relation to biome and bioregion boundaries.[2]

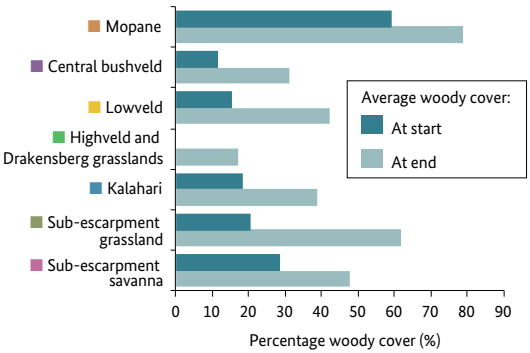


FIGURE 2. The average percentage woody cover at the start and end of periods studied in different zones.

WHAT DRIVES BUSH ENCROACHMENT?

- Poor land management and fire suppression
- Rainfall and soil characteristics
- Increasing carbon dioxide

Savannas are characterised by the coexistence of grasses and trees (or shrubs) and are the transitional biome between grasslands and forests. The degree of woody cover in these systems largely boils down to how variation in rainfall and fire affect the competition between grasses and tree seedlings.[3] Increased rainfall and increased rainfall period move savannas towards closed forest systems, whereas lower rainfall, longer dry seasons and the resulting increase of fire moves them towards grassland systems.

POOR LAND MANAGEMENT AND FIRE SUPPRESSION

Prolonged, high grazing pressure prohibits the growth of the grass layer and reduces fuel loads, thereby suppressing fire. In addition, active suppression of 'runaway' bush fires to protect property is also likely to play an important role. As encroachment progresses, there may be a tipping point as tree canopy cover increases over 45–50%, above which fires rarely occur.

RAINFALL AND SOIL CHARACTERISTICS

The progression of bush encroachment is also influenced by the amount of rainfall in the wet season and the length of the dry season. Rainfall above about 650 mm per year supports closed canopy cover while a longer dry season reduces the rate of canopy closure and increases fire frequency. Soil characteristics may also be an important determinant of the vulnerability of landscapes to encroachment, since these influence the dynamics between grasses and trees, and the combination of low soil nutrients and high rainfall may favour bush encroachment.

INCREASING CARBON DIOXIDE

Elevated atmospheric carbon dioxide is also likely to promote bush encroachment. Since the start of the industrial revolution, atmospheric CO_2 had increased from 278 to 390.5 ppm in 2011.[4] The addition of more CO_2 helps C_3 plants (woody species in savanna ecosystems) to grow faster and outcompete C_4 species (grasses in savanna ecosystems). ■

Photo: Wikimedia Commons

Photo: NASA

BUSH ENCROACHMENT: Land degradation or carbon sink?

■ Carbon sink (UNFCCC)	✘
■ Land degradation (UNCCD)	✔
■ Biodiversity loss (UNCBD)	✔

Climate change, desertification, and loss of biodiversity were identified as the greatest global challenges to sustainable development during the 1992 Rio Earth Summit. As a result, the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention on Biological Diversity (UNCBD) and the United Nations Convention to Combat Desertification (UNCCD) were established. South Africa is bound to the commitments under these conventions.

The UNCBD and UNCCD, which focus on the conservation of biodiversity and the halt of land degradation, provide a clear mandate to government to address bush encroachment, either by inhibiting further encroachment or by restoring encroached land.

However, the UNFCCC has two primary aims – climate change adaptation and mitigation – which may be contradictory in the context of managing bush encroachment.

Whereas sequestration of carbon in woody biomass following encroachment may be viewed as a form of climate change mitigation, it is likely at the same time to reduce water services and the productive capacity of land, therefore reducing the ability of local residents and downstream economies to adapt to climate change.

To distinguish bush encroachment as either a form of land degradation or as a carbon sink, the value of ecosystem services gained or lost as a result of bush encroachment was estimated for encroached areas for each of the bioregional zones.

A net loss in ecosystem service value as a result of bush encroachment would imply that it is a form of land degradation which negatively impacts the adaptability of communities to climate change, while a net gain would imply that bush encroachment could be considered a carbon sink and therefore a form of climate change mitigation. ■

Photo: Wikimedia Commons

IMPACTS ON ECOSYSTEM SERVICES

Our estimates suggest that bush encroachment has resulted in woody biomass carbon gains in the order of 4.3–28.5 tonnes per ha in the affected areas, worth some R23–154 per ha in terms of climate change costs avoided in South Africa (Table 2).

TABLE 2. Gains in the woody carbon pool (t/ha) and associated ecosystem service gains (R/ha) from bush encroachment for each zone

Zone	Woody carbon gain (t/ha)	Value gain (R/ha)
Mopane	28.5	154
Central bushveld	7.1	38
Lowveld	13.8	75
Highveld grassland	4.3	23
Kalahari	16.4	89
Sub-escarpment grassland	27.7	150
Sub-escarpment savanna	6.7	36

Carbon values were combined with the estimated changes in value of other ecosystem services, such as the provision of natural resources, livestock fodder production, water supply, and tourism value, to generate a net loss or gain in ecosystem service value due to the impacts of bush encroachment for each land tenure type for each zone (Table 3). Estimates were based on GIS layers from a recent national mapping of ecosystem services.[5]

Net impacts of bush encroachment, taking both carbon gains and other ecosystem service gains or losses into account, are highly context-specific. In most cases, our high-level estimates suggest that bush encroachment has led to an overall loss in the value of ecosystem services, despite the carbon gain. In most communal land areas, however, bush encroachment could have yielded net positive effects, as a result of increased fuelwood.

However, in these cases it is likely that bush encroachment would only be positive to the point where the marginal gains from increased fuelwood are exceeded by marginal opportunity costs in terms of losses of grassland benefits such as grazing and thatch.

Given the absence of information on marginal values, it is possible that these thresholds have actually been exceeded.

In the arid Kalahari bioregion, bush encroachment appears to have had a net economic benefit across all land tenure types, a result of ecosystem service gains from the provision of natural resources (fuelwood) and carbon sequestration outweighing the ecosystem service losses from livestock fodder production and water supply. This does not take impacts on biodiversity into account, however.

Again, any positive impacts may only remain positive up to a point.

In general, bush encroachment should be regarded as a form of land degradation, despite its contribution to carbon sequestration. Addressing bush encroachment will lead to positive welfare gains relative to allowing it to proceed.

TABLE 3. Net gain or loss (R/ha) from bush encroachment for each land tenure type within each zone

Zone	Protected areas (R/ha)	Communal (R/ha)	Private (R/ha)
Mopane	70.7	94.7	-129.9
Central bushveld	-65.8	183.7	-25.6
Lowveld	-134.8	347.0	-225.9
Highveld grassland	-62.4	-607.8	-198.5
Kalahari	80.1	110.1	23.4
Sub-escarpment grassland	-472.3	-755.6	-695.1
Sub-escarpment savanna	-4951.2	267.9	-1446.6

Based on this, it can be argued that the climate change adaptation benefit of addressing bush encroachment would outweigh the mitigation benefit of allowing it to proceed. While the exact amount of carbon sequestered through bush encroachment in South Africa is unknown, even if it were substantial, the risk of losing biodiversity and further degrading ecosystem services from allowing bush encroachment to continue unheeded is considered unacceptable. Moreover, the potential risk to biodiversity of allowing bush encroachment would contradict the commitments made under the UNCBD. It is clear that **bush encroachment should be considered a form of land degradation** under the UN commitments, and that other, less damaging, emission reduction opportunities should be employed to meet those targets.■

POTENTIAL REMEDIES

Bush encroachment can be avoided or reversed to some extent by better rangeland management (to maintain a healthy grass layer), including fire management. Alternatively, where it has progressed too far for this to be effective on its own, bush encroachment should be cleared or thinned manually or mechanically. Chemical spraying is harmful and should be discouraged.

Best practices for active clearing include determining the appropriate degree of remediation, having a long-term management strategy and undertaking follow-up treatments accordingly. In addition, it is important to introduce sound land management practices to maintain the gains made.

Income generation through wood harvesting could make clearing a viable business option in itself, but its economic viability is unknown and there are potential risks in encouraging this in order to address bush encroachment, such as overharvesting of woody biomass and decreasing long-term soil fertility.

- Rangeland management
- Manual clearing
- Mechanical clearing

POLICY AND LEGISLATION AFFECTING MANAGEMENT

- Conservation of Agricultural Resources Act (CARA)
- National Environmental Management Act (NEMA)
- National Forestry Act (NFA)
- Biodiversity Act (NEMBA)

Current policy and legislation does not deal specifically with bush encroachment. The Conservation of Agricultural Resources Act, 1983 (CARA) encourages maintenance of rangelands, but if agricultural clearing occurs within an important biodiversity area or affects listed species, it can require authorisation under the National Environmental Management Act, 1998 (NEMA), National Forests Act, 1998 (NFA) or the Biodiversity Act, 2004 (NEMBA). There is some level of ambiguity as to the treatment of bush thinning, as opposed to complete clearing, for example, with a bulldozer.

Four potential policy scenarios were evaluated using a high-level estimation of the potential costs and benefits for each of the affected bioregions over 30 years, taking land tenure into account. Clearing costs were taken from the literature and key informants, and included initial and follow-up costs.

The gains and losses of ecosystem services were based on the preceding analysis, with the assumption that demand for ecosystem services would increase at 3% per year. However, the potential benefits from use of the woody biomass in value-adding activities were not included, as these will be estimated in detail in a forthcoming government study.

Karoo National Park *(Photo: Wikimedia Commons)*

AN EVALUATION OF POLICY SCENARIOS

1: Laissez-faire
2: Rangeland management alone
3 and 4: Active clearing in conjunction with rangeland management

1

Laissez faire (no action)

A laissez-faire policy would be expected to lead to further losses in welfare in almost all cases, apart from communal areas in five of the bioregions, as well as all areas in the arid Kalahari region (Figure 2).

2

Incentivise better rangeland management to retard, arrest or reverse bush encroachment

Incentivising better land management as the sole remediation action was assumed to be neutral in this analysis, in that this intervention can already be considered to be an imperative (namely at no extra cost), and because it maintains the current status quo, or achieves slow restoration gains.

3

Fund manual restoration, for example through a Working for Land type of programme, in conjunction with #2 to maintain gains made

The results suggest that while active restoration leads to ecosystem service gains, in the absence of generating any income from the biomass removed, the costs are likely to outweigh these benefits in most cases. There are, however, clear cases where such policies would probably have a positive welfare outcome, regardless of method and without the potential benefits from harvesting biomass, such as the entire sub-escarpment grassland region, as well as the protected areas and private rangelands in the sub-escarpment savanna region.

4

Facilitate mechanical restoration, in conjunction with #2 to maintain the gains made

In most cases, it is more feasible to clear manually than mechanically, owing to the lower per hectare cost and the manageable number of hectares needing to be cleared which limits the time to achieve restoration. However, lessons learnt from the Working for Water programme suggest that the actual cost to clear may be far higher than initial estimates.

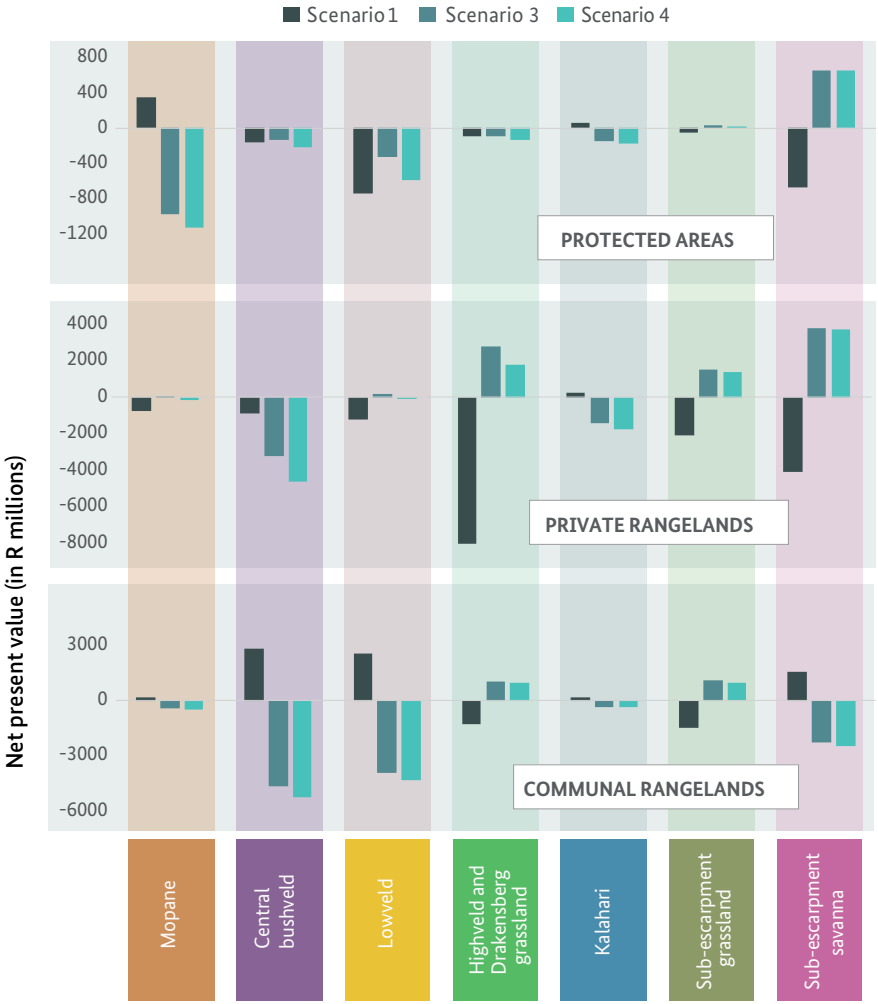


Figure 3. The net present value (in R millions) of different policy scenarios (1: no action; 3: manual clearing and 4: mechanical clearing) for each land-tenure type (protected areas, private rangelands and communal rangelands) for each region. Scenario 2 was assumed to be neutral (maintains status quo at no additional cost).

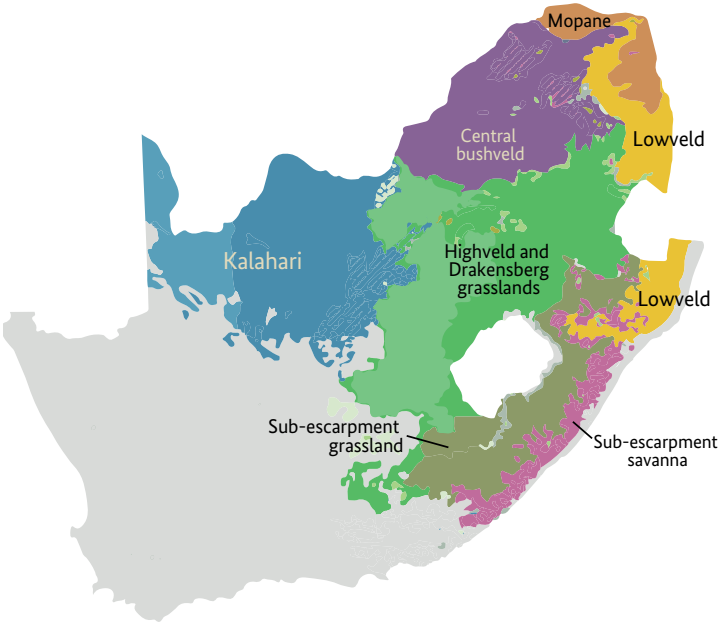
In cases where active clearing without using the biomass harvested is unlikely to yield a positive net outcome for society due to the high costs involved, we estimated how much profit would need to be made from the harvested biomass in order to make active clearing economically viable (Table 4). These figures should be compared with estimates from the forthcoming national study on this potential.

TABLE 4. The approximate harvesting profit (R/ha) required to make manual/mechanical clearing feasible for the areas where it is not already feasible, for the average level of bush encroachment.

Zone	Land tenure		
	Protected areas (R/ha)	Communal (R/ha)	Private (R/ha)
Mopane	1 330 / 1 540	- / 180	1 490 / 1 700
Central bushveld	440 / 660	670 / 960	2 230 / 2 500
Lowveld	290 / 550	- / 90	2 690 / 2 980
Highveld grassland	240 / 360	-	-
Kalahari	200 / 230	140 / 1704	230 / 260
Sub-escarpment grassland	-	-	-
Sub-escarpment savanna	-	-	1 220 / 1 320

Based on the above, it can be concluded that:

- In protected areas, better land management is the best option for addressing the problem, apart from in the sub-escarpment grasslands and savannas, where active clearing would be worthwhile, especially in the latter.
- In private rangelands, active clearing would be the best option in all but the Mopane, Kalahari and Bushveld regions, where better land management would be the best option.
- In communal rangelands, active clearing would only be worthwhile in the grassland ecoregions, and for the rest, where no action may lead to a positive net gain up to a point, measures to improve land management should be introduced to the expected benefit of poor households.



CONCLUSIONS AND RECOMMENDATIONS

- Interventions to improve rangeland management are highest priority
- Manual clearing is cheaper at current levels of encroachment
- Incentivising private clearing carries risks

1. **Recognise bush encroachment as a form of land degradation.** Continued encroachment could have a significant negative impact on overall supply and value of ecosystem services, biodiversity and livelihoods.

2. **Strengthen extension services and institutions for rangeland management.** Promote sustainable land management practices that reduce bush encroachment, regardless of any other strategy adopted and regardless of region. These include long-term sustainable stocking rates and implementation of rotational grazing practices that provide adequate rest for grazing areas. In communal land areas, this may need to be facilitated by the establishment of defined grazing areas for defined rights holders.

3. **Identify thresholds of potential concern and develop monitoring systems.** Rigorous monitoring systems should be developed to ensure that bush encroachment is managed optimally at the national, provincial and local levels, based on the latest scientific evidence. Thresholds of potential concern for biodiversity and ecosystem services need to be identified for each of the different regions.

4. **Remove legal barriers and develop norms and standards for clearing/thinning encroached areas.** The legal aspects of bush encroachment management should be clarified and (potential) conflicts between the different statutory bodies should be remedied. A set of norms and standards should be developed to reduce bureaucratic delays.

5. **Promote sustainable income-generating bush-clearing activities in private rangelands.** This should be done within a regulatory framework that avoids incentivising unsustainable practices.

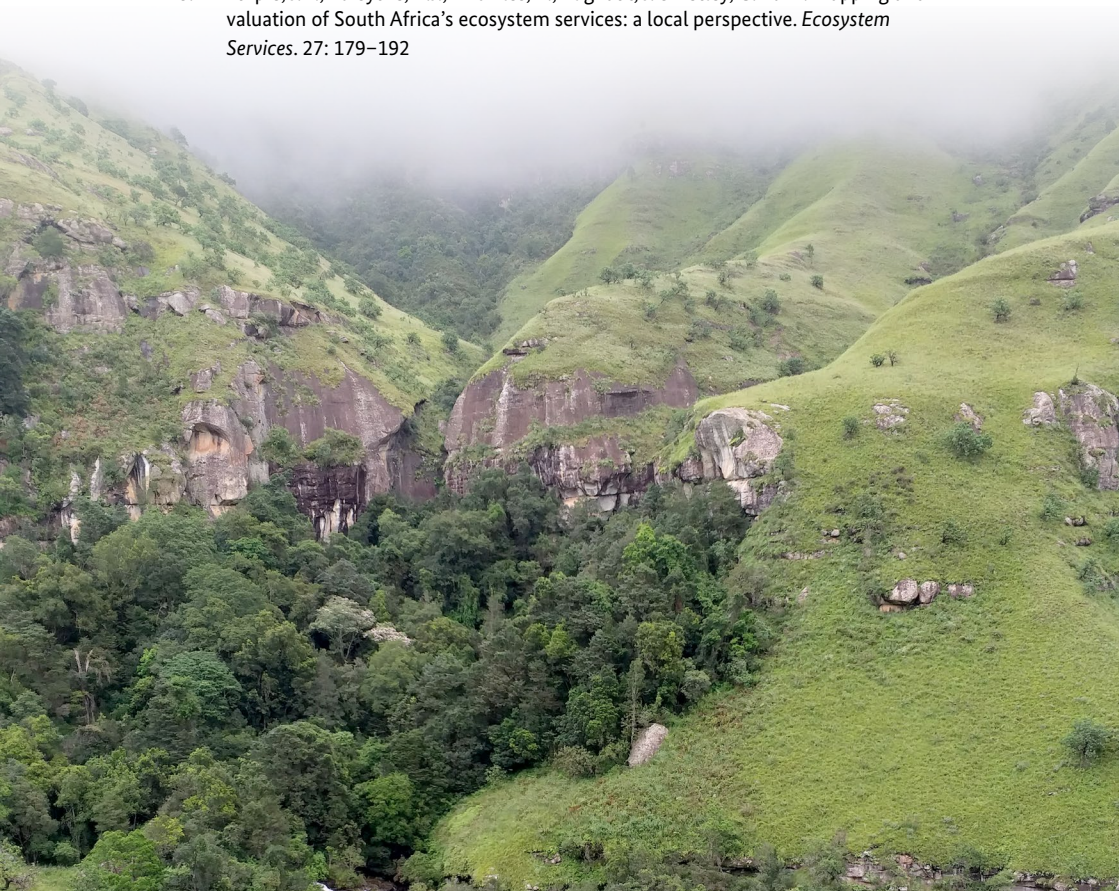
6. **Establish government-funded manual clearing programmes in selected communal areas.** In communal rangelands, manual clearing programmes should be funded in affected areas of the grassland ecoregions and any other localised problem areas.

7. **Set up a bush encroachment information and advisory service.** This advisory unit would ideally develop detailed guidelines for the management of bush encroachment in each of the different regions and land use types identified in this report and provide decision-support systems and tools to land managers for bush encroachment management in South Africa.

8. **Conduct further research.** Further research is needed into the biodiversity impacts of bush encroachment, the potential effects of woody biomass removal on soil fertility and the possible role of woody cover in restoring degraded soils. In addition, a better understanding is needed of the barriers currently preventing active clearing by landowners in areas where the private benefits of clearing appear to outweigh the costs.

REFERENCES

1. Warren, K., Hugo, W. and Wilson, H. 2018. Preliminary report and data on bush encroachment and land cover change, released to DEA, DEA consultants, and selected collaborators. Results are subject to quality assurance and review.
2. Mucina, L. & Rutherford, M.C. 2006. *The vegetation of South Africa, Lesotho and Swaziland*. South African National Biodiversity Institute.
3. Scholes, R.J. & Walker, B.H. 1993. *An African savanna: synthesis of the Nylsvley study*. Cambridge: Cambridge University Press.
4. IPCC. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I. Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. In Stocker, T.F., Qin, D., Plattner, G.K., Tignor, M., Allen, S.K., Boschung, J. & Midgley, P.M. (Eds.). Cambridge: Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, ch. 6 pp. 467.
5. Turpie, J.K., Forsythe, K.J., Knowles, A., Blignaut, J. & Letley, G. 2017. Mapping and valuation of South Africa's ecosystem services: a local perspective. *Ecosystem Services*. 27: 179–192



environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
of the Federal Republic of Germany