



Addressing Specific Elements of REDD+ in South Africa

Component

Comprehensive Assessment of the Definition and Scope of Implementation of REDD+ in South Africa



environment, forestry
& fisheries

Department:
Environment, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

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FOREWORD

The process towards the National Reduction of emissions from Deforestation and forest Degradation (REDD+) Programme, started in July 2015 with the establishment of an Informal REDD+ Consultative Task Team (IRCTT). During the inaugural meeting the IRCTT proposed that instead of following the conventional stepwise approach (Phase 1-3) of REDD+ (as outlined in UNFCCC Decision 1/CP.16, paragraph 73), South Africa should follow a more innovative approach, by having a Phase 0 (Readiness Phase). This led to the commissioning of the South African REDD+ Readiness Study, which was funded by the GIZ, led by the DAFF in collaboration with the DEA. REDD+ was initially identified as part of the suite of eight principle climate change mitigation options in the Agriculture, Forestry and Other land Use (AFOLU) sector in the National Terrestrial Carbon Sinks Assessment. However, at present, it has been included in South Africa's Land-Based mitigation programme, which is also built into the country's Nationally Determined Contribution under the United Nations Framework Convention on Climate Change and its Paris Agreement.

Since 2015, several pieces of work has been commissioned, which links to the initial set of elements of the REDD+ mechanism. This study built on the Expert Consultation, which was held in 2017, and was aimed to assess the initial South African Forest Scope and Definition for the development and implementation of REDD+ applying the three-tiered approach developed during the REDD+ Readiness Study. Through this study the Department of Environment, Forest and Fisheries (DEFF) managed to identify the biomes/bioregions in which we could potentially pragmatically implement the National REDD+ Programme. However, substantial work will still have to be conducted to quantify the potential or actual scope and extent within those biomes/bioregions. This piece of work will be enhanced in the subsequent phases of the development and implementation of the REDD+ mechanism, as we are taking a stepwise and progressive approach.



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ACRONYMS

BSM	Benefit sharing mechanism
CDM	Clean Development Mechanism
COP	Conference of Parties
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
FAO	Food and Agriculture Organisation of the United Nations
FREL	Forest Reference Emission Levels
FRL	Forest Reference Levels
GHG	Greenhouse Gas Emission
IAP	Invasive alien plant
IPCC	Intergovernmental Panel on Climate Change
IRCTT	Interim National REDD+ Consultative Task Team
Mha	Million hectares
MRV	Monitoring, reporting and verification
NEMBA	National Environmental Management: Biodiversity Act 2004 (Act No 10 of 2004)
NCCRP	National Climate Change Response Strategy
RBP	Results based payment
REDD	Reduced emissions from deforestation and forest degradation (through planning and regulation)
REDD+	Reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
SFM	Sustainable Forest Management
SOC	Soil organic carbon
TOR	Terms of reference
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations REDD Program

I. INTRODUCTION

South Africa has taken a progressive approach in its response to climate change. Following early ratification of the Kyoto Protocol, the country published a National Climate Change Response Strategy (NCCRP) (DEA 2011) and has gradually developed a substantial foundation on which to base future policy and measures. A particular opportunity that has been identified is the implementation of a **national programme aimed at reducing emissions from deforestation and forest degradation (REDD+)**. South Africa's National REDD+ programme is also supported by several United Nations Framework Convention on Climate Change (UNFCCC) decisions, the current Paris Agreement (Article 5), the Katowice Paris Rulebook, and subsequently South Africa's Nationally Determined Contribution.

Based on initial analysis in the National Terrestrial Carbon Sink Assessment (NTCSA), (DEA 2015), an Interim National REDD+ Consultative Task Team (IRCTT) was established between the then Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Environmental Affairs (DEA). The IRCTT commissioned an initial REDD+ Readiness Study (DAFF 2017) and subsequently held a national stakeholder engagement meeting in September 2017 to gain further input into the initial scope of work and next steps. The outcomes of the study and subsequent expert consultative workshop identified the need **to develop a number of key elements in order to create an effective and efficient national programme.**

PROJECT AIM AND OBJECTIVES – AS DESCRIBED IN THE TERMS OF REFERENCE

In order to compile the relevant information for the national context in South Africa in preparation for the REDD+ Strategy, this work addresses several elements

identified within the REDD+ Readiness Study as follows:

- a. To fully assess the South African Forest Scope and Definition for the development and implementation of REDD+ applying the three-tiered short, medium and long-term implementation approach developed during the REDD+ Readiness Study (DAFF 2017, 14).
- b. Explore effective and efficient institutional arrangements for the REDD+ process for South Africa on a national level. This assessment will inter alia look into the appropriate institutional location for the REDD+ process as initially outlined in the REDD+ Readiness Study DAFF 2017, 33).
- c. Assess the drivers of deforestation and forest degradation for three selected sites as outlined



below. The service provider is further expected to identify strategic prevention measures and associated costs. This data will serve as guidance for the development of the overall REDD+ strategy through specific examples (DAFF 2017, 18).

This report focuses on the first component, an assessment of definition thresholds and a scope for REDD+ in South Africa. This is a crucial component for developing a national REDD+ programme, understanding required capacity and resources, and developing national Forest Reference Emission Levels and/or Forest Reference Levels (FREL/FRL). Identifying a forest definition, scope and scale for a national REDD+ programme is required to understand changes in deforestation and forest degradation, and if reforestation has taken place. Furthermore, the

definitions used will have a significant impact on how to estimate emission reductions and carbon sequestration as well as the ability to actually implement a national REDD+ programme in the near, medium and long-term.

There is no single definition of a forest under the UNFCCC for the purposes of developing or monitoring national REDD+ programmes. Rather countries are allowed to choose a forest definition following the Marrakesh Accord guidance as well as a scope and scale that is nationally appropriate. As noted below, parties are permitted to update their forest definition, scope and scale over time, allowing nations with limited data or particular concerns to start with an initial programme and either to improve it or increase its scope and scale over time.



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2. RATIONALE AND APPROACH

The development of a national REDD+ definition, associated thresholds and scope need to be considered within the context in which they will be used namely, within the context of developing, implementing and reporting on a national REDD+ programme over time, including the development of reference and activity scenarios.

A national REDD+ programme under the United Nations Framework Convention on Climate Change (UNFCCC) requires the development of a set of elements (Sandker et al. 2014, 3):

(Decision CP.16/1/Add. 1/par. 71)):

- a. **A national strategy or action plan;**
- b. **A national forest reference emission level and/or forest reference level** or, if appropriate, as an interim measure, subnational forest reference emission levels and/or forest reference levels, in accordance with national circumstances, and with provisions contained in decision 4/CP.15 [methodological guidance for activities relating to REDD+], and with any further elaboration of those provisions adopted by the Conference of the Parties (COP);
- c. **A robust and transparent national forest monitoring system** for the monitoring and reporting of the [REDD+] activities.
- d. **A system for providing information on how the safeguards** are being addressed and respected throughout the implementation of the [REDD+] activities.

2.1 DEVELOPING FOREST REFERENCE LEVELS

The UNFCCC has defined forest reference emission levels and / or forest reference levels (FREL/FRLs) as ‘*benchmarks for assessing each country’s performance in implementing [REDD+] activities*’ (FAO 2014, 4; 2018,

21). Whereas the UNFCCC has not explicitly defined the difference between a FREL and FRL, the common working understanding adopted in UN-REDD Programme guidance documentation (e.g. Sandker et al. 2014; FAO 2015, 2018) is that a FREL includes only emissions from deforestation and degradation, whereas a FRL includes both emissions by sources and enhancement of forest carbon stocks.

The COP decision provides further guidance on the development of FREL/FRLs (Sandker et al. 2014, 4). They should:

- **Be expressed in tonnes of carbon dioxide equivalent per year** (tCO₂e).
- **Maintain consistency with national GHG inventories.** If the forest definition used for the FREL/FRL construction is different than the one used in the national GHG inventory, an explanation should be provided of why and how it differs.
- **Be established transparently**, providing information and rationale on FREL/FRL
- **Allow for a stepwise approach.** Enabling developing countries to improve FREL/FRLs over time by incorporating additional pools and modifying the scope and methodologies.
- **Allow for the use of subnational FREL/FRLs as an interim measure.**

The development of FREL/FRLs generally requires the magnitude of a country’s REDD+ programme to be defined through three elements:

1. Forest definition
2. Scale
3. Scope

Each element is initially introduced here and then considered in a South African context, taking into consideration risk, maladaptation, efficiency, practicality and prioritisation.

2.2 FOREST DEFINITION AND ASSOCIATED THRESHOLDS

Each country is required to initially identify a forest definition in accordance with the Marrakesh Accords, that defines forest using three threshold parameters (i) minimum canopy cover, (ii) minimum tree height, and (iii) minimum area (described in detail in the section that follows).

In addition to the threshold parameters, countries often include particular land-cover, land-use or vegetation class exclusions. As noted in a review of forest definitions adopted by countries in FREL/FRLs on the Group on Earth Observation (GEO) Global Forest Observations Initiative (GFOI) website (reddcompass.org), countries may exclude land-use, land-cover and vegetation classes within the area covered by their adopted Marrakesh Accord forest definition thresholds based on risk, efficiencies and practicality (Table 1). Such exceptions are considered in a South African context in the discussion that follows.

Table 1: Examples of exclusions in forest definitions adopted by countries in submitted FREL/FRLs

Country	Exclusions
Brazil	Land predominantly under agriculture or urban use.
Colombia	Commercial plantations, palm crops and planted trees for agricultural production.
Malaysia	Oil palm and rubber plantations
Mexico	Land predominantly under agriculture or urban use.
Paraguay	Urban areas, plantations predominantly agricultural, agroforestry and silvopastoral systems,* whose primary purpose is agriculture.

* Silvopasture is the practice of integrating trees, forage, and the grazing of domesticated animals in a mutually beneficial way.

2.3 SCALE

Countries may wish to develop a national scale FREL/FRL immediately or develop a subnational FREL/FRL for a particular jurisdiction as an interim measure and then increase the scale over time. Based on efficiencies and the practicality of immediately implementing a full national programme such an approach is considered in the discussion that follows.

2.4 SCOPE

The definition of the scope of REDD+ activities within a country includes an indication of included activities, carbon pools and greenhouse gases (GHGs) (Table 2). Again, each is considered in a South African context based on opportunity, risk, efficiency and practicality, with further consideration of the appropriateness of starting at subnational level and progressing to a national scale programme over time.

For example, in a review of elected activities listed in FREL/FRLs submitted to date (FAO 2018), it was noted that whereas most countries elect reducing emissions from deforestation and forest degradation as well as the enhancement of carbon stocks (both non-forest to forest – *afforestation* – and forest to forest – *forestland remaining forestland*), few have included sustainable forest management (SFM) or conservation of forest carbon stocks alone. This may be due to the importance of activities in terms of reducing atmospheric carbon and generating carbon-based revenues as well as avoiding double accounting. Practically, there is considerable overlap between firstly, reducing deforestation and forest degradation (reducing emissions) and enhancing forest carbon stocks (carbon sequestration), and then secondly, addressing SFM and the conservation of forest carbon stocks.



Table 2: The components defining the scope of a national REDD+ programme

Activities	Carbon Pools	Greenhouse Gases
<ul style="list-style-type: none"> Reducing emissions from deforestation Reducing emissions from forest degradation Enhancement of forest carbon stocks Conservation of forest carbon stocks Sustainable management of forests 	<ul style="list-style-type: none"> Aboveground biomass Belowground biomass Soil organic carbon Dead wood Litter 	<ul style="list-style-type: none"> Carbon dioxide Methane Nitrous oxide

2.5 METHODOLOGY

A stepwise decision process is followed to allow the identification of a forest definition, scope and scale for a national REDD+ programme in South Africa in a clear and robust manner. Starting with consideration of the Marrakesh Accord definition of forest, the nature

and extent of a national programme is further refined through consideration in a stepwise manner of (i) South African forest and woodland definitions and the use of bioregions, (ii) maladaptation and risk, and (iii) practicality and efficiency, before identifying a forest definition, scope and scale (Figure 1).

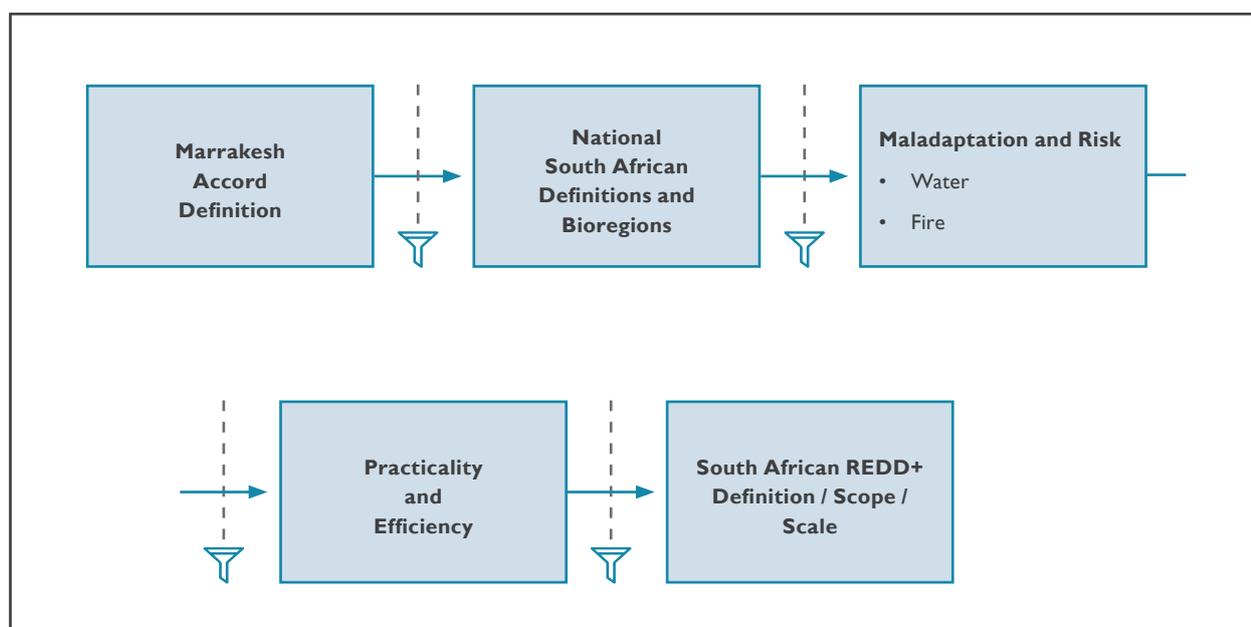


Figure 1: The process of deciding on an initial forest definition, scope and scale of a national REDD+ programme in South Africa through a series of decision filters. The considerations and decision process is supported by the mapping of specific areas and further spatial data. The mapping approach is described at length in Appendix A.

3. FOREST DEFINITIONS: INTERNATIONAL AND DOMESTIC

3.1 THE INTERNATIONAL REDD+ DEFINITION CONTEXT

From its infancy (Bali Action Plan, 2007; Cancun Agreements, 2010), REDD+ remains at its core a financial mechanism directing incentives towards countries attempting to reduce deforestation and degradation (Wong et al., 2019). This is reinforced by Article 5 of the Paris Agreement which invites countries to take action to conserve and enhance terrestrial carbon stocks, including those located in forests. Importantly, the Article also encourages actions to implement and support REDD+, through results-based payments (RBP) and benefit sharing mechanisms (BSMs).

In order to ensure the successful implementation of REDD+ at national, subnational and local levels, payments and benefits must filter through multiple governance structures and priorities. Critical to RBP and BSMs is a clear understanding of forest reference emission levels (FRELs). Therefore, the definition of forest used in the construction of forest reference emission levels and/or forest reference levels (FREL/FRL) is critical in leveraging financial mechanisms. In defining a forest, careful consideration must be given to the implementation and transaction costs and the resultant benefits associated with securitising carbon through reducing deforestation or forest degradation.

The definition and scope of REDD+ in South Africa should be consistent with domestic and international definitions, be explicit and provide for real and cost-efficient implementation while promoting sustainable forest management and contributing to the welfare of forest-dependent communities. In this section, we first discuss the definition of 'forest' as adopted by South Africa under the Marrakesh Accord of the Clean Development Mechanism (CDM), the FAO definition of forest as well as the definition according to the South African National Forests Act, 1998 (Act No. 84 of 1998) (NFA 1998).

3.1.1 CLEAN DEVELOPMENT MECHANISM (CDM)

The Marrakech Accords consists of a set of agreements reached in 2001 at the 7th Conference of the Parties (COP7) to the United Nations Framework Convention on Climate Change (UNFCCC). These Agreements include the definitions, modalities, rules and guidelines relating to land use, land-use change and forestry activities (Article 3.3 and 3.4) under the CDM of the Kyoto Protocol. Reducing deforestation or forest degradation was excluded from the decision due to concerns of leakage and permanence over time (UNFCCC 2002, 58).

Marrakech Accord – Definition of a Forest

“**Forest**” is a minimum area of land of 0.05 to 1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10 to 30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity in situ.

A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest;

Note that plantations are included in the Marrakech Accord definition of a forest. From the specified ranges for a 'forest' definition, countries are able to tailor the definition accordingly to their needs. As an example, Table 3 lists African countries which have defined minimum crown cover, area and tree height.

During the course of the initial REDD+ Readiness Study (DAFF 2017), it was suggested that South Africa's forest definition, according to the *Marrakesh Accords*, is used as a starting point. At the expert meeting in September 2017, parties agreed on the following dimensions, which are



consistent with the Marrakesh Accord and the definitions of ‘forest’ and ‘natural forest’ provided in Chapter 1 of the National Forests Act (NFA 1998):

- A minimum height of 2 meters;
- A minimum tree crown cover of more than 10%; and
- A minimum area of 0.05 hectares of land.

Whereas the intention was to maximise the area eligible for REDD+, a more conservative approach may be prudent which will be discussed in this report. For example,

setting a minimum value for area of 0.05 ha (22.4 x 22.4 meters) must be assessed from the practical perspective of preventing deforestation and degradation. What is an appropriate minimum area from a carbon stock, management and feasibility perspective, especially taking into consideration the transactional and implementation costs of REDD+ that make the protection of an area viable? In addition, inclusion of commercial plantations, fynbos and other particular vegetation types within the Marrakesh Definition are considered below.

Table 3: African host parties minimum tree crown cover, area and tree height.

Country	Minimum tree crown cover (%)	Minimum area (ha)	Minimum tree height (m)
Ethiopia	20	0.05	2
Madagascar	30	1	5
South Africa	30	0.05	2
Ghana	15	0.1	2
Morocco	25	1	2
Uganda	30	1	5
Kenya	30	0.1	2
Niger	30	1	4
Mozambique	30	1	5
Tanzania	10	0.05	2
Rwanda	10	0.05	3
Democratic Republic of the Congo	30	0.5	3
Côte d'Ivoire	30	0.1	5
Senegal	30	0.5	2
Mali	30	1	2
Burkina Faso	10	0.05	2
Ghana	15	0.1	5
Togo	10	0.5	5

3.2 THE SOUTH AFRICAN FOREST DEFINITION CONTEXT

3.2.1 SOUTH AFRICAN LEGISLATION

The definition of South African forests as defined in the context of the UNFCCC differs from that defined under the National Forest Act and its subsequent amendments.

In South Africa, the *National Forests Amendment Bill* was tabled in parliament in July 2016. The aim of the bill is to amend the National Forests Act of 1998 and to:

- Provide for clear definitions of natural forests and woodlands.
- Provide for public trusteeship of the nation's forestry resources.
- Increase the promotion and enforcement of sustainable forest management.
- Increase the measures provided for in the Act to control and remedy deforestation.
- Provide for appeals against decisions taken under delegated powers and duties.
- Reinforce offences and penalties.
- Provide for matters connected therewith.

The National Forests Amendment Bill (Amendment of section 2 of Act 84 of 1998, as amended by section 1 of Act 12 of 2001) defines a forest and woodland as follows.

Definition of a Forest

'Natural forest' means a group of predominantly indigenous trees -

- a. whose crowns are largely contiguous in its undisturbed state;
- b. which may represent any successional stage or state of forest degradation, in which case crowns may not be contiguous;
- c. which occur in association with characteristic plants or animals recognised in vegetation science as diagnostic species of a specific natural forest type; or
- d. which have been declared by the Minister to be a natural forest in accordance with section 7(2) of the National Forest Act.

Definition of a Woodland

'Woodland' means a group of indigenous trees which are not a natural forest, but whose crowns cover [more than] at least five per cent of the area [bounded by trees forming the perimeter of the group] they occupy, and which may in a degraded state have a crown cover of less than five per cent.



Note: Although the National Forests Amendment Bill was passed by the National Assembly and sent to the National Council of Provinces for concurrence in August 2018 the Bill in terms of National Assembly Rule 333 (2), has subsequently lapsed and has never become an Act. During the course of an interview with Mr Renny Madula (Deputy-Director DEFF: Directorate: Forestry Regulation and Oversight) during the development of this report, it was noted that the National Forests Amendment Bill will be tabled again in parliament in the near future. However, a potential date for its acceptance is uncertain.

As the Bill has lapsed, legally, the original definitions as defined by the National Forest Act of 1998 is still valid, namely:

‘natural forest’ means a group of indigenous trees –

- whose crowns are largely contiguous; or
- which have been declared by the Minister to be a natural forest under section 7 (2);

‘woodland’ means a group of indigenous trees which are not a natural forest, but whose crowns cover more than five per cent of the area bounded by the trees forming the perimeter of the group.

The definitions of forests in neither the National Forestry Act nor the lapsed Amendments to the Act include minimum thresholds for tree crown cover, area and height. The definition of woodland does, however, include a 5% crown cover threshold.

3.2.2 CONSIDERATION OF SOUTH AFRICAN WOODLANDS TO DATE

Willis (2003) was tasked with developing a classification system for South African woodlands that is useful in understanding the range of forest, woodland and thicket types that fall within the Marrakesh Accord Forest Definition adopted by South Africa (a vegetation

Average height in metres	>20m	Grassland	Wooded Grassland	High Woodlands (Seldom occurs)												High Forest						
	6 - 20m			Open Woodlands (Parkland)	Tall Woodlands (Miombo)						Tall Forest											
	2.5 - 6m				Low Woodlands (Bushveld)						Low Forest (Scrub forest)											
	1 - 2.5m			Open Bushveld	Bushland						Thicket											
	0.1 - 1m	Grassland	Open Shrubland	Shrubland						Closed Shrubland												
			Projected woody plant canopy cover (%)																			
			5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Figure 2: Classification of wooded vegetation types in South Africa (Source: Willis 2003)



type with >10% canopy cover, a height > 2 meters and at least 0.05ha in extent) (Figure 2). Furthermore, the classification assists in understanding vegetation classes and particularly bioregions in South Africa. Readers are encouraged to review the report, which is based on extensive engagement and a consideration of historical classifications, and structural, functional, floristic, phytogeographic and edaphic elements. This classification assists in understanding which biomes and bioregions as defined by Mucina and Rutherford 2006, should be considered within the Marrakesh Accord set of thresholds.

3.3 THE SPATIAL EXTENT OF FOREST, WOODLAND AND SUB-TROPICAL THICKET

A conceptual framework of three tiers was suggested in the initial REDD+ assessment for South Africa. 'Tier A' had the highest priority and focuses on REDD+ in indigenous forest and thicket, which leads to additional non-carbon benefits (landscape production, ecosystem and social outcomes), and aligns well with both international and South African national policies. The realisation of REDD+ in 'Tier B' (Mopane, Acacia and Combretum woodland), may also lead to such outcomes, but it is a concern of many stakeholders whether maintaining closed woodland in such areas is a state that communities and landowners would desire. 'Tier C' principally includes areas covered by bush encroachment and invasive alien plants (IAPs). Due to a suite of potential adverse outcomes and clear policy directives aimed at addressing bush encroachment and infestation by IAPs, the implementation of REDD+ activities to maintain the current status quo in such areas may not be appropriate (DAFF 2017, 16–17).

Building on the initial framework, the structure of three tiers is further expanded in this assessment. A list of considered bioregions within each Tier is presented in Table 4 and Figure 3. The 'bioregion' concept has been adopted from the National Vegetation Map (Mucina and Rutherford, 2011) as means of identifying, aggregating and

communicating different forest types across the country.

Table 4 presents the spatial extent of forest related bioregions and the fraction that has above 75% canopy cover, between 35–75% canopy cover and less than 35%. The intention is to provide an understanding of where opportunities exist and the implications of adopting particular thresholds especially in terms of resource requirements. For example, extending the scope from areas with above 75% canopy cover to areas with greater than 35% canopy cover, increases the area under consideration from 1.2 to 3.1 Mha. To place this in context, during the course of an interview with the Directorate of Woodlands and Indigenous Forest Management, it was noted that the Department is currently actively managing a total area of 18,000 hectares of indigenous forest. This is noted not as a criticism of the Directorate, but to understand that immediate implementation at a full national scale may not be plausible or effective. Practically, a phased approach, starting with a sub-national jurisdiction of strategic importance and then increasing scale over time may be more appropriate.

The mapping exercise (Appendix A) provided further insights into the practicalities of certain forest, scope and scale definitions, particularly in terms of implementation and reporting. Firstly, mapping a canopy cover threshold below 35% is possible, but significantly more difficult and costly, especially as it needs to be done repeatedly over time. This is due to the availability and cost of remote sensing, as well as seasonal and interannual fluctuations in canopy cover. Secondly, the area of reported 'bush encroachment' and 'invasive alien plants' should be viewed as only indicative and requires further assessment. The area under invasive alien plants (IAP) only indicates that IAP are present, but not type of species. The 'bush encroached' area is the amount that woody cover has increased in each bioregion over the period 1990 to 2013 (Skowno et al. 2016). This requires further exploration to understand if it is bush encroachment or a desired expansion of forest, woodland or sub-tropical thicket areas.

Table 4: Considered forest-related bioregions within each Tier. The bioregions are identified, described and mapped in Mucina and Rutherford (2011).

Biome / Bioregion	Total extent ha	Woody cover fraction			IAP cover ha	Bush encroach. ha
		'Forest' > 75% ha	35%-75% ha	< 35% ha		
Tier A – 'Scarp and coastal forests, tall woodland and thicket'						
Forests						
Zonal and intrazonal forests						
FOz 1 Southern Afrotropical Forest	77 536	37 842	367	229	20 674	0
FOz 2 Northern Afrotropical Forest	19 383	6 456	468	45	1 116	1 826
FOz 3 Southern Mistbelt Forest	106 197	49 492	638	25	23 389	10 965
FOz 4 Northern Mistbelt Forest	37 910	28 878	522	184	1 600	780
FOz 5 Scarp Forest	83 582	45 982	397	44	17 846	6 066
FOz 6 Southern Coastal Forest	18 511	13 377	52	6	299	0
FOz 7 Northern Coastal Forest	67 879	46 869	135	43	6 275	1 634
FOz 8 Sand Forest	26 547	17 929	350	10	986	258
FOz 9 Ironwood Dry Forest	6 869	247	295	657	184	358
<i>Sub-total</i>	444 414	247 071	3 223	1 242	72 368	21 886
All Azonal Forests						
FOa 1 Lowveld Riverine Forest	13 266	5 591	97	95	614	235
FOa 2 Swamp Forest	10 044	7 483	34	5	508	126
FOa 3 Mangrove Forest	4 294	2 747	10	10	29	32
<i>Sub-total</i>	27 604	15 820	141	110	1 151	393
Indian Ocean Coastal Belt						
All coastal belt bioregions	1 169 280	163 448	22 989	333	43 977	31 238
Albany thicket						
All Albany Thicket Types	3 530 690	176 882	460 841	19 045	135 957	7 333
Tier A – Sub-total	5 171 988	603 221	487 194	20 730	253 453	60 849
Tier B – 'Mopane, Acacia and Combretum woodlands'						
Savanna						
Mopane Bioregion	2 567 260	1 234	120 329	1 535 430	5 860	317 535
Central Bushveld Bioregion	11 856 200	65 787	929 077	4 383 120	74 894	1 431 270
Lowveld Bioregion	5 382 640	334 012	1 027 280	1 257 100	132 216	358 078
Sub-escarpment Savanna Bioregion	2 858 030	205 814	280 958	5 211	140 448	259 642
Eastern Kalahari Bushveld Bioregion	12 453 000	9 289	42 289	1 756 090	0	145 304
New low priority						
Kalahari Dunveld Bioregion	4 294 520	1	41	13 711	0	1 318
Fynbos						
All combined	8 156 450	3 470	308 231	43 359	92 107	39
Tier B - Sub-total	47 568 100	619 605	2 708 206	8 994 021	445 526	2 513 186
TOTAL	52 740 088	1 222 826	3 195 399	9 014 750	698 979	2 574 034

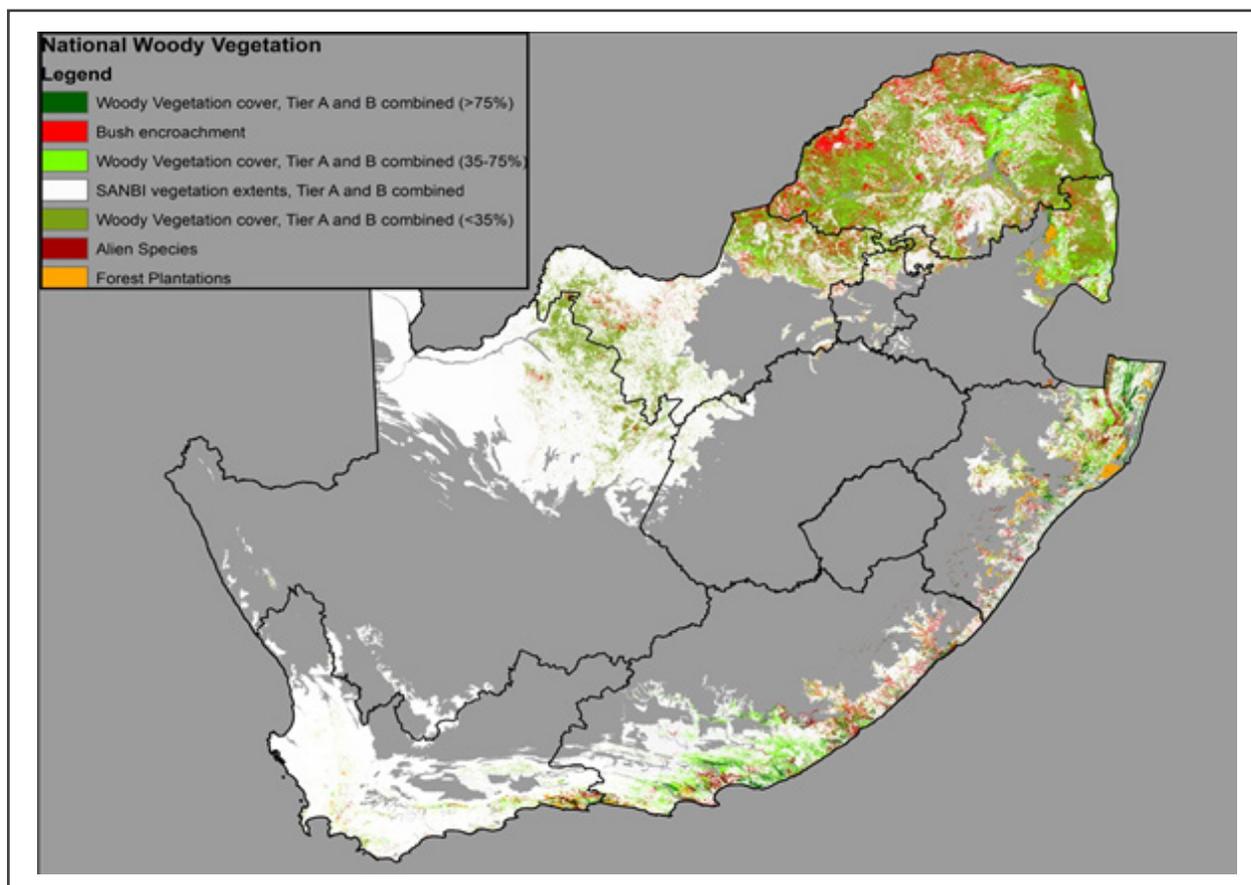


Figure 3: The spatial distribution of each woody cover class with the Tier A and B bioregions under consideration in South Africa (commissioned for this study).

4. CONSIDERATION OF RISK AND MALADAPTATION

Where the outcome of a programme is not fixed, an element of risk exists. In the context of REDD+ activities, risk factors typically include:

- Ecological risk – What is the potential impact of fire and pests on carbon stocks over time?
- Leakage risk - In which forest classes is there a risk of not truly addressing the drivers of deforestation and forest degradation?
- Opportunity cost risk - In which forest types are there alternative land-use options that are far more lucrative and present a threat to forest cover and future REDD+ activities?
- Operational and capacity risk - In which forest types is there a lack of capacity and resources to manage and regulate forests?
- Socio-political and tenure risk - Where can land ownership and resource access inhibit the longevity of project interventions?

In a country with a climate that is naturally conducive to the occurrence of fires (a short-wet season and prolonged dry season), fire can have a significant effect on the distribution of vegetation types and the vegetation structure within a particular biome or bioregion (Geldenhuys 1994; Bond et al. 2003). In

certain vegetation types where fire occurs relatively frequently and combusts a large fraction of the total carbon stock (Table 5), it may be prudent to exclude these vegetation classes from the definition and scope of a national REDD+ programme.

Within South Africa, this includes the fynbos biome where fire occurs relatively frequently and leads to the release of up to 90% of the aboveground woody carbon pool. Until the net impact of fire on terrestrial carbon stocks in the fynbos biome is better understood, it is proposed that the biome is excluded from the scope of REDD+ implementation in South Africa.

A further risk factor that needs to be considered is operational and capacity risk, especially the capacity to implement a full national scale programme in the near term (<5 years). During engagement with the Directorate of Woodlands and Indigenous Forest Management and the Directorate of Forestry Regulation and Oversight, it was noted that there are currently severe resource and capacity constraints limiting the ability of the Department to fulfil management and regulatory functions. Furthermore, the Directorate of Woodlands & Indigenous Forest Management is currently only **managing indigenous forest areas** and not woodland

Table 5: Key attributes of vegetation wildfires in South Africa. Sources: B.J. van Wilgen & R.J. Scholes (1997), & van Leuwen et al. (2014) in Knowles et al. (2016).

Vegetation type	Burned area fraction %/y	Intensity ^a kW/m	Fuel load kgDM/ha	Completeness ^b %
Forest (Afromontane, scarp and coastal)	<1	Low	40000–150000	Low, 25%
Deciduous dry forests	~5	Low unless crown fire	Usually only grass <1000	90% of grass
Moist savannas and woodlands	30–80	Medium-High	1000-5000	>90
Semiarid savannas	10–40	Medium	500-3000	80–90
Winter rainfall shrubland (<i>fynbos</i>)	10–20	High to very high	5000–15000	60–90
Plantation forests	~2–5	Very high if in crown	10000–60000	20–70

a Low <1000; medium 1000-3000; high 3000-8000; very high >8000 kW/m

b Fraction of fuel load exposed to fire which combusts

or sub-tropical thicket. It may therefore be prudent to adopt a phased approach, choosing a subnational jurisdiction initially and then scaling up implementation over time. During the scaling up process, public-private-partnerships could be explored as a mechanism through which to manage areas of woodland and sub-tropical thicket over the medium- to long-term.

Socio-political and land tenure risk is often a concern that needs to be managed in a progressive manner to ensure that REDD+ implementation is inclusive, occurring in all tenure and forest types. To date, a lack of clear land tenure and associated ownership of income streams has often inhibited the roll-out of REDD+ in several countries. For this reason, it is a key development theme in the UN REDD programme (www.unredd.net). The creation of a national scale or at least biome scale programme, following the principles of portfolio theory, could reduce the impact of this source of risk, especially if led by national government.

In addition to risk, are concerns regarding ‘maladaptation’ which is defined by the IPCC AR5-WGII as ‘actions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future’ (IPCC 2014, 1769). In a South African context, a concern is the impact of bush encroachment and woody invasive alien species on biodiversity and ecosystem services, especially the provision of water. It may increase carbon stocks, but lead to a decrease in landscape production and water services in a region that is predicted to become warmer and drier over time (DEA 2019 6 &7).

For these reasons, the South African Government has established a number of policies, regulations and programmes aimed at clearing woody alien invasive plants and bush encroachment. It would therefore not be appropriate to include areas under woody alien invasive plants or bush encroachment within the scope of a national REDD+ programme.

Table 6: Additional outcomes associated with the existence of each forest type within the Marrakesh Accords definition of ‘forest’ (DAFF 2017).

Tier	Vegetation and land-use types	Additional outcomes (Non-carbon Benefits)			
		Landscape production	Water services	Biodiversity	Social
Tier A <i>Highest priority</i>	Scarp and coastal forests Tall woodland and thicket	Y	Y	Y	Y
Tier B	Mopane, Acacia and Combretum woodlands	?	Y	Y	Y
Tier C	Areas under bush encroachment and alien invasive plants	N	N	N	?

Table 7: Alignment between the implementation of REDD+ activities in each forest type and the goals of prominent international and national policies (source DAFF 2017).

Tier	Forest type	International policy				National policy	
		UNFCCC		UNCD	SUNCCD	Water	Biodiversity
		Mitigation	Adaptation				NEMBA
Tier A	Indigenous forest & woodland	Y	Y	Y	Y	Y	Y
Tier B	Mopane, Acacia and Combretum woodlands	Y	Y	Y	Y	Y	Y
Tier C	Bush encroachment & IAP	Y	N	N	N	N	N

5. PRIORITISATION: PRACTICALITY AND EFFICIENCY

An important consideration when deciding on a forest definition, scale and scope for a national REDD+ programme, is balancing a greater vision of halting, reducing and reversing forest degradation at a full national scale, with immediate practicalities, that include knowledge, policy, capacity and resource constraints. As noted, in terms of scale and scope, countries may therefore wish to develop a subnational FREL/FRL for a particular jurisdiction as an interim measure and then increase the scale over time.

As noted in the section on risk, there is a clear concern regarding the ability of existing capacity to immediately implement a full national scale program. This matter was raised by the Directorate of Woodlands & Indigenous Forest Management and the Directorate of Forestry Regulation and Oversight, and is discussed in the 2nd component of this project namely the *Potential Institutional Arrangements for REDD+ in South Africa*.

A second concern is the complexity of South African woodlands, particularly in terms of understanding their extent, drivers of change, the extent of bush

encroachment and the impact of existing and future national and regional programmes aimed at clearing bush encroachment. As an example, Table 8, Figure 4 and Appendix B illustrate the relative level and dynamic nature of forest, woodland and bushland change in each of the REDD+ Pilot Areas considered in this study. Whereas, there has been an average 22 to 26% increase or decrease in indigenous forest cover over a twenty-eight year period from 1990 to 2018 (which is often due to indigenous forest replacing planted forest), the area of woodland and dense bush has on average increased or decreased by 37 to 96%. Whereas some of this change over time may be due to classification methodology used, it still illustrates the relatively high level of change within woodland and dense bush areas in comparison to tall indigenous forest. These are typically landscapes where not only bush encroachment may occur, but also the expansion of commercial agriculture and urban and peri-urban areas. Each driver has a particular impact on woodland cover and integrity at a particular scale.

Whereas it is certainly possible to develop future land-cover scenarios and FREL/FRLs within woodland areas,



Table 8: The average amount of each forest class that has changed over the period 1990–2018. Expressed as the average percentage change between losses and gains. See Appendix B for source tables expressed in hectares of Indigenous Forest, Thicket /dense Bush and Natural Wooded Land.

	Indigenous Forest	Thicket / dense Bush	Natural Wooded Land
Blyde Escarpment	26	90	37
Southern KZN	27	86	96
Pondoland	22	40	86
Mean	25	72	73

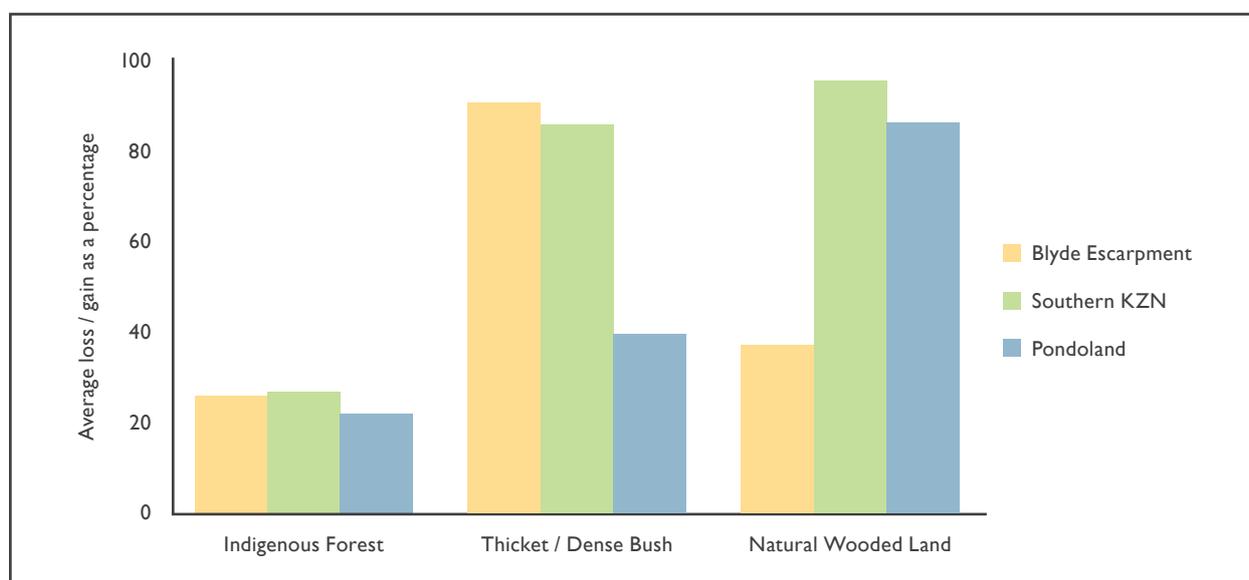


Figure 4: The average amount of each forest class that has changed over the period 1990–2018. Expressed as the average percentage change between losses and gains. See Appendix B for source tables.

it will take a significant amount of time and resources due to the issues raised. It may therefore be practically prudent to develop a South African REDD+ Programme in two stages, starting at a sub-national scale focused solely on **tall indigenous forest areas** and then expanding to a full national scale in due course. This will allow on-the-ground implementation to start, while providing sufficient time to develop future scenarios for South African woodlands that are sufficiently robust for FREL/FRL development and subsequent monitoring, reporting and verification (MRV) purposes.

In a similar manner to the scale of implementation, it may be appropriate to adopt a phased approach to the scope of activities, carbon pools and GHGs included within a national REDD+ programme. In terms of the scope of activities, as noted above, within submitted FREL/FRLs, most countries have elected reducing emissions from deforestation and forest degradation together with the enhancement of carbon stocks (both in the context of transformation from non-forest to forest and forest to forest). However, few have chosen sustainable forest management (SFM) or conservation of



forest carbon stocks alone. This is partly due to double accounting concerns (often clear overlap with the first set of three activities) as well as ability of SFM and the conservation of carbon stocks to generate results-based payments alone. In terms of prioritisation in a South African context, it may be best likewise to first focus on reducing emissions from deforestation and forest degradation as well as enhancing forest carbon stocks and then explore the remaining activities at a later stage.

In terms of the scope of carbon pools, whereas there is a reasonable understanding of woody biomass carbon stocks (both above- and below- ground) and soil organic carbon (SOC), further research is required to understand the magnitude of dead wood and litter pools and especially the impact of deforestation and forest degradation on all pools. Few countries globally have included the dead wood and litter pools within the FREL/FRL and noted that they will be included in subsequent submissions (FAO 2018). In a South African context, robust national estimates of the dead wood and litter carbon pools will require extensive on-the-ground field work across a range of forest, woodland and thicket types as it is not possible to assess these pools using remote sensing. Such an exercise will however provide opportunity to improve biomass and SOC estimates and especially understand the impact of deforestation and forest degradation on all terrestrial carbon pools.

It is suggested that **only above- and below- ground biomass and SOC pools** are included in a first phase of a national REDD+ programme, while also prioritising a national assessment of all carbon pools in tall forest across the country to ensure there is sufficient data to include the dead wood and litter pools in subsequent phases.

The last component of the scope is consideration of particular GHGs (Table 9). Although CO₂ is the primary GHG under consideration, methane and nitrous oxide emissions need to be reported in due course, especially for woodland and open bushland areas where fire is prevalent and where cattle production is often the principle form of land use – leading to emissions from enteric fermentation as well as manure and urine. In line with the suggested phased approach, it may be practical to start with the net reporting of carbon emissions and sequestration in an initial phase of a national REDD+ programme, especially in tall indigenous forest where emissions from fire and livestock is minimal, and then develop the understanding and reporting systems to include methane and nitrous oxide emissions in a robust manner in a subsequent phase.

Table 9: The initial scope of a national REDD+ programme highlighted in bold.

Activities	Carbon Pools	Greenhouse Gases
<ul style="list-style-type: none"> • Reducing emissions from deforestation • Reducing emissions from forest degradation • Enhancement of forest carbon stocks • Conservation of forest carbon stocks • Sustainable management of forests 	<ul style="list-style-type: none"> • Aboveground biomass • Belowground biomass • Soil organic carbon • Dead wood • Litter 	<ul style="list-style-type: none"> • Carbon dioxide • Methane • Nitrous oxide

6. CONCLUSION: PROPOSED FOREST DEFINITION, SCOPE AND SCALE

South Africa is known for its progressive approach to responding to climate change with early international commitments and targets. In the context of a national REDD+ programme, there is therefore often a will to be progressive and to adopt the most expansive forest definition, scope and scale from the start. Whereas this is certainly the intention over the medium to long-term, it may be prudent and effective to adopt a more constrained definition, scope and scale in the short-term, allowing the development of initial FREL/FRLs and implementation on the ground to proceed, while developing the knowledge and capacity to effect a full national scale program.

We encourage readers to review the FREL/FRL guidance and reviews compiled to date (Sandker et al 2014; FAO 2015, 2018), as well as submitted FREL/FRLs to the UN-REDD programme (<https://redd.unfccc.int/>) and academic publications on the subject to understand the amount of work and engagement required to develop FREL/FRLs, especially in heterogenous multi-use landscapes that are exposed to agricultural, urban and mining development pressures. The development of full national scale FREL/FRLs with required levels of robustness, including the complexities of future scenarios in South African woodland, savanna and urban areas will take a fair amount of time to prepare. While this preparation takes place, an initial phase can still proceed.

6.1 INITIAL FOREST DEFINITION

At the expert meeting in September 2017, parties agreed on the following thresholds, which are consistent with the Marrakesh Accord and the National Forests Act:

- A minimum height of 2 meters
- A minimum tree crown cover of more than 10%
- A minimum area of 0.05 hectares of land.

Due to the practicalities and costs of mapping changes in forest cover over time and required engagement to develop robust FREL/FRLs, it is suggested that a minimum tree crown cover of 30% is adopted in an initial phase of a national REDD+ programme, expanding to a minimum crown cover of 10% in subsequent phases as data availability and remote sensing technologies improve. For the initial phase of a national REDD+ programme, the Forest Definition could be:

- A minimum height of 2 meters
- A minimum tree crown cover of more than 30%
- A minimum area of 0.05 hectares of land.

Exclusions:

As noted, countries often exclude certain land-cover or land-use types that fall within their Forest Definition for reasons of risk, practicality and effectiveness. In the context of a national REDD+ in South Africa, it is proposed that these include:

- The **Fynbos biome** is highly fire disturbance driven and therefore offers little permanence in terms of carbon storage.
- **Commercial Plantations** are unlikely to significantly decrease in spatial extent in the near to medium term. Incentivising the expansion of plantations may better occur through the Article 6 mechanisms being developed under the Paris Agreement, which will replace the Kyoto Protocol Clean Development Mechanism.
- **Horticulture** results in trees being planted, grown and cleared in cycles. It is excluded as it covers a relatively small area of land and comparative studies remain to be undertaken – comparing the average carbon stock and GHG emissions within an orchard over its lifetime, to indigenous fynbos, sub-tropical thicket or woodland.



- Areas of **woody invasive alien species and bush encroachment**. South Africa has clear policies, legislation and national programmes aimed at removing invasive alien species and bush encroachment. However, further assessment is required to understand if the expansion of woody cover in areas in which indigenous forest could occur is detrimental bush encroachment or the expansion of indigenous forest.
- **Urban and peri-urban areas**. Whereas urban greening programmes are appropriate, the inclusion of urban and especially peri-urban areas within a national REDD+ programme and FREL/FRL is questionable in terms of practicality and control. For this reason, many countries have excluded urban and peri-urban areas from their national REDD+ programmes.

6.2 INITIAL SCOPE

Current knowledge and capacity allow for the short-term inclusion of the activities, carbon pools and GHGs highlighted in bold in Table 10. As suggested, during the development and roll-out of initial implementation, it would be prudent to undertake the research and development work required to include all carbon pools and GHGs in subsequent phases of a national REDD+

programme. In addition, further assessment of the double accounting, efficiency and benefit concerns of including the conservation of forest carbon stocks and SFM is required.

6.3 INITIAL SCALE

As recommended, it may be prudent to initially start a national REDD+ programme at a subnational jurisdiction and then to expand it over time. Based on forest definition, risk, maladaptation, practicality and effectiveness considerations, it is suggested that the first initial phase includes scarp and coastal forests, tall woodland and subtropical thicket (Table II). It should be noted that the spatial extent provided in Table II is the current extent of forest and does not include the additional area that would be reforested within each bioregion. That remains to be assessed.

In a subsequent phase of a national REDD+ programme, the scope could be expanded to include woodland and bushland, taking into consideration the range of land-use types and drivers within such landscapes.

This approach balances the urgent need for implementation on the ground in the near term, with the robust development of a longer term full national scale programme.

Table 10: The initial scope of a national REDD+ programme highlighted in bold.

Activities	Carbon Pools	Greenhouse Gases
<ul style="list-style-type: none"> • Reducing emissions from deforestation • Reducing emissions from forest degradation • Enhancement of forest carbon stocks • Conservation of forest carbon stocks • Sustainable management of forests 	<ul style="list-style-type: none"> • Aboveground biomass • Belowground biomass • Soil organic carbon • Dead wood • Litter 	<ul style="list-style-type: none"> • Carbon dioxide • Methane • Nitrous oxide

Table 11: The current extent of woody cover within each forest type and bioregion under consideration. Each bioregion is identified, described and mapped in Mucina and Rutherford (2011). Note that this is the current extent of forest and not the opportunity for additional reforestation.

Biome / Bioregion	Total extent ha	Woody cover fraction		
		'Forest' > 75% ha	35%-75% ha	< 35% ha
Tier A – Initial Phase – ‘Scarp and coastal forests, tall woodland and thicket’				
Forests				
Zonal and intrazonal forests				
FOz 1 Southern Afrotemperate Forest	77 536	37 842	367	38 209
FOz 2 Northern Afrotemperate Forest	19 383	6 456	468	6 924
FOz 3 Southern Mistbelt Forest	106 197	49 492	638	50 130
FOz 4 Northern Mistbelt Forest	37 910	28 878	522	29 400
FOz 5 Scarp Forest	83 582	45 982	397	46 379
FOz 6 Southern Coastal Forest	18 511	13 377	52	13 429
FOz 7 Northern Coastal Forest	67 879	46 869	135	47 004
FOz 8 Sand Forest	26 547	17 929	350	18 279
FOz 9 Ironwood Dry Forest	6 869	247	295	542
All Azonal Forests				
FOa 1 Lowveld Riverine Forest	13 266	5 591	97	5 688
FOa 2 Swamp Forest	10 044	7 483	34	7 516
FOa 3 Mangrove Forest	4 294	2 747	10	2 757
Indian Ocean Coastal Belt				
All coastal belt bioregions	1 169 280	163 448	22 989	186 437
Albany thicket				
All Albany Thicket Types	3 530 690	176 882	460 841	637 723
Initial phase - Sub-total	5 171 988	603 221	487 194	1 090 415
Tier B – Future expansion into woodlands and bushland				
Savanna				
Mopane Bioregion	2 567 260	1 234	120 329	121 563
Central Bushveld Bioregion	11 856 200	65 787	929 077	994 864
Lowveld Bioregion	5 382 640	334 012	1 027 280	1 361 292
Sub-escarpment Savanna Bioregion	2 858 030	205 814	280 958	486 772
Eastern Kalahari Bushveld Bioregion	12 453 000	9 289	42 289	51 578
Kalahari Dunveld Bioregion	4 294 520	1	41	42
Future expansion – Sub-total	47 568 100	619 605	2 708 206	3 016 110
TOTAL	52 740 088	1 222 826	3 195 399	4 106 524

7. INTERVIEWED EXPERTS AND STAKEHOLDERS

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APPENDIX A: MAPPING METHODOLOGY

NATIONAL WOODY VEGETATION STATUS MAP CIRCA 2018 LANDSCAPE CONDITIONS

OVERVIEW

A map representing the current (namely circa 2018) extent and characteristics of national woody vegetation cover has been prepared. The map illustrates the current spatial extent of key woody vegetation types across the country. The woody vegetation cover has been sub-divided into pre-selected vegetation types, as defined in the SANBI South African vegetation dataset. The woody vegetation types have been grouped into two groups or tiers, where the first tier (A) contains *all* the indigenous forest classes associated with the Forest Biome, whereas tier B contains the remaining woodland, bushland and thicket vegetation types representing *selected vegetation types* from within the Savanna, Fynbos and Thicket Biomes.

MAP CONTENT & CONSTRUCTION

A third tier (C) contains a combination of plantation forest, bush encroachment and alien vegetation affected areas. This has been overlaid on-top of the 'natural' woody cover extent in order to illustrate and report on the losses associated with each woody cover class. The 'natural' woody cover vegetation classes have been further sub-divided by canopy cover density ranges, in order to illustrate possible local impacts.

In terms of overlay hierarchy and the resulting map representation and spatial statistics reporting the plantation extent always overwrote all tier A and B 'natural' woody vegetation classes, and both the bush encroachment and aliens data; with the bush encroachment data overwriting the aliens data.

All the source datasets have been spatially standardised to a uniform 50 x 50m resolution reporting cell framework,

regardless of the resolution or detail contained in the source data. All the source data with the exception of the aliens species data coverage were originally at a spatial resolution smaller than 50 x 50m; whereas the aliens dataset was sourced at 120 x 120m. The final digital map representation from which all spatial statistics have been generated is based on Albers Equal Area map projection.

The spatial area statistics as reported in the table below, show for each selected SANBI vegetation type, the current remaining area of 'natural' woody vegetation, reported for canopy density ranges >75%, 35 – 75% and < 35%; as well as the area under forest plantations, or covered by the independently mapped bush encroachment and/or alien species areas.

Note the extent of bush encroachment and alien species coverage is limited in the map representation to only those areas identified as currently containing woody vegetation. The alien species coverage used represents the 10–100% alien density range as contained in the source dataset.

DATA SOURCES

The spatial extent of dense woody cover (> 75%) was modelled from a combination of Sentinel and Landsat imagery representing 2018 landscape characteristics. The additional sub-divisions of woody cover representing the other canopy density ranges was borrowed from the latest pre-release (non-verified) version of the 2018 National Land-Cover Dataset (also produced for DEA) DEA (2018) South African National Land-Cover (SANLC) 2018. Website accessed at: https://www.environment.gov.za/projectsprogrammes/egis_landcover_datasets. The SANBI vegetation boundaries were extracted from the SANBI VegMap 2018 release, '2012 Vegetation Map of South Africa, Lesotho and Swaziland - SANBI.' Web. 6 Mar. 2018. Available at: <https://www.sanbi.org/documents/vegetation-map-of-south-africa-lesotho->



and-swaziland-edn-2-11-000-000-scale-sheet-maps/ The bush encroachment data was extracted from the spatial dataset available from SAEON representing the results of Skowno, A. L., Thompson, M. W., Hiestermann, J., Ripley, B., West, A. G. and Bond, W. J. (2017), Woodland expansion in South African grassy biomes based on satellite observations (1990–2013): general patterns and potential drivers. *Glob Change Biol*, 23: 2358–2369. doi:10.1111/gcb.13529. The aliens data was extracted from the SANBI aliens datasets <http://bgis.sanbi.org/EDRR/NIAPS.asp>

APPENDIX B: PILOT PROJECT: LAND COVER CHANGE DATA

Table B1: The change in land cover in the Blyde Escarpment Pilot Project Area: 1990–2018. Metric: Hectares

Blyde Escarpment Pilot Area: Change in land cover over the period 1990 - 2018. Total extent of pilot area: 84 198 ha.											
											1990
											Total 2018
2018	Indigenous Forest	Thicket / dense Bush	Natural Wooded Land	Planted Forest	Water	Other natural low veg. / bare	Cultivated	Built-up	Mines	Horizontal numbers, increase since 1990	
	2 892	5	84	767	1	369	3	2	0	4 123	Horizontal numbers, increase since 1990
	354	325	47	878	4	236	28	6	0	1 878	Horizontal numbers, increase since 1990
	434	15 048	2 639	2 578	30	6 337	969	204	71	52 311	Horizontal numbers, increase since 1990
	2	73	128	1 401	0	60	151	0	0	1 814	Horizontal numbers, increase since 1990
	1	31	23	0	116	17	5	0	0	194	Horizontal numbers, increase since 1990
	38	1 227	6 582	191	9	2 625	172	37	31	10 912	Horizontal numbers, increase since 1990
	2	423	1 757	39	1	441	7 493	82	0	10 238	Horizontal numbers, increase since 1990
	0	117	385	23	0	229	17	1 912	1	2 685	Horizontal numbers, increase since 1990
	0	2	6	0	0	7	0	4	24	43	Horizontal numbers, increase since 1990
	Total 1990	3 724	17 251	5 877	161	10 322	8 837	2 248	127	84 198	Horizontal numbers, increase since 1990
	Vertical numbers, decrease since 1990										
	Numbers on the diagonal indicate the area in which there has been no change between assessment years										

Table B2: The change in land cover in the Southern KZN Pilot Project Area: 1990–2018. Metric: Hectares

Southern KZN Pilot Area: Change in land cover over the period 1990 - 2018. Total extent of pilot area: 274 374 ha.											
											1990
											Total 2018
	Indigenous Forest	Thicket / dense Bush	Natural Wooded Land	Planted Forest	Water	Other natural low veg. / bare	Cultivated	Built-up	Mines	Horizontal numbers, increase since 1990	
	2 441	4	217	485	1	1 298	14	88	0	4 549	Horizontal numbers, increase since 1990
	55	719	94	371	6	2 516	223	80	0	4 063	Horizontal numbers, increase since 1990
	23	601	164	219	27	3 356	220	77	0	4 687	Horizontal numbers, increase since 1990
	18	320	372	6 872	12	13 966	576	16	1	22 153	Horizontal numbers, increase since 1990
	0	52	17	6	760	949	92	2	0	1 878	Horizontal numbers, increase since 1990
	91	4 612	2 259	1 199	154	175 851	2 188	385	10	186 749	Horizontal numbers, increase since 1990
	1	227	54	186	13	5 138	28 286	3 248	1	37 153	Horizontal numbers, increase since 1990
	3	77	6	102	0	1 498	48	11 361	2	13 097	Horizontal numbers, increase since 1990
	0	1	0	0	0	26	4	6	10	46	Horizontal numbers, increase since 1990
	Total 1990	2 631	6 612	3 182	9 440	972	264 598	31 652	15 262	23	Horizontal numbers, increase since 1990
	Vertical numbers, decrease since 1990										
	Numbers on the diagonal indicate the area in which there has been no change between assessment years										

Table B3: The change in land cover in the Pondoland Project Area: 1990–2018. Metric: Hectares

Pondoland Pilot Area: Change in land cover over the period 1990 - 2018. Total extent of pilot area: 351 730 ha.											
	Indigenous Forest	Thicket / dense Bush	Natural Wooded Land	Planted Forest	Water	Other natural low veg. / bare	Cultivated	Built-up	Mines	1990	
Indigenous Forest	15 330	118	729	323	3	1 152	11	271	0	1 7937	How Essential numbers, Increase since 1990
Thicket / dense Bush	5 542	40 750	4 175	555	28	22 570	724	1 336	0	75 679	Increase since 1990
Natural Wooded Land	222	11 680	1 761	98	25	35 474	961	1 282	1	51 504	
Planted Forest	10	154	33	3 025	0	1 694	26	309	3	5 254	
Water	6	128	38	0	45 752	1 233	5	14	0	47 177	
Other natural low veg. / bare	244	7 073	514	208	60	66 260	1 037	716	9	76 122	
Cultivated	210	564	30	83	1	1 810	29 168	1 503	0	33 370	
Built-up	73	711	21	521	2	2 410	42	40 862	0	44 643	
Mines	0	2	0	0	0	33	0	1	8	44	
Total 1990	21 638	61 180	7 302	4 813	45 871	132 636	31 975	46 294	22	351 730	
	<i>Vertical numbers, decrease since 1990</i>										
	Numbers on the diagonal indicate the area in which there has been no change between assessment years										



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