Ministry of Tourism and Environmental Affairs

FOREST REFERENCE LEVEL

KINGDOM OF ESWATINI

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[4] https://www.kayavolunteer.com/destinations/country/eswatini/

LIST OF ACRONIMS AND ABREVIATIONS

AFOLU	Agriculture, Forestry, and Other Land Use
BUR	Biennial Update Report
BTR	Biennial Transparency Report
CfRN LUA App	Coalition for Rainforest Nations Land Use Assessment Application
CH_4	Methane
CO_2	Carbon dioxide
COP	Conference of the Parties
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization (of the United Nations)
FOLU	Forest and Other Land Use
FRL/FREL	Forest Reference Level / Forest Reference Emissions Level
Gg	Gigagrams
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
GPG	Good Practice(s) Guidance
GWP	Global Warming Potential
Ha	Hectare
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
LULUCF	Land Use, Land Use Change and Forestry
LDC	Least Developed Countries
m^3	Cubic metre
MPG	Modalities Procedures and Gridlines
MRV	Monitoring, reporting, and Verification

[5] https://www.lavidanomad.com/what-eswatini-is-best-known-for/

N_2O	Nitrous oxide
NFI	National Forest Inventory
NIR	National Inventory Report
NAP	National Adaptation Plan
NDC	National Determined Contributions
NDVI	Normalised Difference Vegetation Index
PA	Paris Agreement
SoER	State of the Environment Report
TNC	Third National Communication
TOA	Top of Atmosphere
UNESWA	University of Eswatini

Table of Content

Summary 10
1. Introduction 10
1.1 Justification of Zero FRL 10
1.2 Modalities for FRL according to Decision 12/CP.17 14
2. General context 17
2.1 Policies and plans 21
2.1.1 National Policy Documents addressing Climate Change Issues 22
2.1.2 Policies in the context of Forest 23
2.2 National institutional arrangements 24
3. Data, methodologies and procedures 24
3.1 Information used by the Party to construct the FRL 24
3.2 Pools, gases and activities included in FRL 26
3.2.1 Scale 26
3.2.2 Pools and gases included 27
3.2.3 REDD+ Activities included 28
3.3 Methodologies information, including description of data sets, approaches and methods 29
3.3.1 Methods for land representation 29
3.3.1.I Definition of forest 30
3.3.1.II Land assessment using remote sensing 33
3.3.1.III Methodological approach 34
3.3.2 Methods for estimating activity data 35
3.3.2.I Land Use classes and changes through time 1
3.3.3 Methods for estimating carbon stocks and carbon stock changes 1
3.3.4 Methods for estimating uncertainties 5
4. Estimation of the emissions/removals for FRL 6
4.1 IPCC Methodologies applied 6
4.1.1 Annual carbon stock changes for a stratum of a land-use category as a sum of changes in all pools (IPCC Equation 2.3, Ch2, V4) 8
4.1.2 Change in biomass carbon stocks (above-ground biomass and below-ground biomass) in forest lands remaining in the same category 9
4.1.3 Change in dead organic matter carbon stock in forest land remaining in the same category 16
4.1.4 Change in soil organic carbon stock in forest land remaining in the same category 16
4.1.5 Change in biomass carbon stocks (above-ground biomass and below-ground biomass) in land converted to a new land-use category 17
4.1.6 Change in dead organic matter in Carbon stock in land converted to a new land category 19
4.1.7 Change in Carbon stock in soils in land converted to a new land category 21
4.1.8 Non-CO2 Emissions 23
4.2 Estimations of emissions and removals and the Forest Reference level 26

4.3 Assessment of Uncertainties 28
6. Consistency with the National GHG inventory 30
7. Improvement plan 30
8. References 31
Annex I: Area of land and land use change 31
Annex I.1 Matrix I: area of land use and land use change 33
Annex I.2 Matrix II: land in transition for 19 years 40
Annex II: Protocol for the Land Use assessment 46
Annex II.1 Hierarchy of land use classes 47
Annex II.2 Matrix of impossible and possible land use conversions 49
Annex II.3 Roles and tasks for data collection 49
Annex II.4 Interpretation keys 49
Annex II.5 Disturbances 60

List of Tables

Table 1: Summary 10
Table 2: Net removals for the historical reference period and Reference level 13
Table 3:Modalities for FRL 14
Table 4: Proportion of forest in 2020 20
Table 5: Data used for the construction FRL 24
Table 6:Area of forest for the period 2000-2020 26
Table 7: Pools included 27
Table 8: Gases included 28
Table 9: REDD+ activities by land uses 29
Table 10: Comparison between GHGI classes and FRL classes 31
Table 11:Land Use classes definition in Eswatini's FRL 2024 32
Table 12: Method for estimating activity data 1
Table 13: Land use classes between the different reports to extract emission/removal factors 2
Table 14: Tier used and reference by carbon pools 4
Table 15: Tier used and reference by carbon pools 5
Table 16:Method applied for the estimations of emissions/removals on Forest land 6
Table 17: Carbon pools included 8
Table 18: Sources of activity data for land remaining 9
Table 19: Carbon fraction values 10
Table 20: Values of ratio of below to above ground biomass 11
Table 21: Values for Net biomass growth tonnes d. m. ha-1 yr-1 12
Table 22: Annual wood removals values 13
Table 23: Fraction affected 14
Table 24: Biomass available for logging tonnes C ha-1 yr-1 14
Table 25: Area disturbed in forest land (excluding fire) 15
Table 26: Biomass affected during disturbance 16
Table 27: Fraction of biomass loss due to disturbances 16
Table 28: Sources of area of land converted to a land-use category 17
Table 29: Biomass available before or after conversion tonnes C. ha-1 yr-1 18
Table 30: Dead wood/litter stock values 20
Table 31: Soil organic carbon by land use sub-category [tC ha] 22
Table 32: FLU, FMG and FI Values for values by Land use and sub-categories of land use 23
Table 33: MB, Cf, GefCH4, GefN2O values 24
Table 34: Forest area burnt 24
Table 35: Methods and EF used for the FRL 25
Table 36: Forest related emissions and removals 26
Table 37: Summary of Uncertainty by data used 28
Table 38: Random error of the activity data for Forest land (%) 29

List of Figures

Figure 1: Forest-related net removals for historical reference period 2000-2020 and the zero FRL for implementation period 2021-2025 12
Figure 2:: Map showing the Agro-ecological Zones in Eswatini. 17
Figure 3: Map showing forest cover in Eswatini 19
Figure 4: Proportion of forest types in Eswatini 27
Figure 5:Grid and plot structure 34
Figure 6: Example of the calculation of the areas of the plot groups 35
Figure 7: Two types of matrices for land use and land in transition 8
Figure 8: Emissions and removals related to Forest land 27
Figure 9: Total net removals for the historical period 2000-2020 & FRL 27
Figure 10: Matrix I Area of land remaining and land converted (ha) 33
Figure 11: Matrix II Land in transition for 19 years (ha) 40
Figure 12: Decision tree for the plot hierarchy 47
Figure 13: Example on how to assess the plot class when multiple land use classes can be observed inside the plot 48

Summary

Table 1: Summary

Date of submission	08 January 2024
REDD+ Activities Included	-Reducing emissions from deforestation -Reducing emissions from forest degradation -Conservation of forest carbon stocks -Sustainable management of forest -Enhancement of forest carbon stocks
Scale	National
Historical reference period	2000-2020
Results period	2021-2025
FRL value per year of results period	0 t CO2e / year

1. Introduction

Eswatini is presenting its first Forest Reference level (FRL) to the United Nations Framework Convention on Climate change (UNFCCC) with a view of accessing results-based payments for the reduction of emissions from deforestation, Forest degradation and the role in conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+). The country is also considering generating post-2021 REDD+ ITMOs following the requirements of article 6 of the Paris Agreement.

This submission is voluntary and for the purpose of obtaining and receiving result-based payments for REDD+ activities. The country has made its best effort to present the information in a transparent, accurate, consistent and complete manner following the principles of the 2006 Intergovernmental Panel of experts on Climate Change (IPCC) guidelines and decisions 13/CP.19 paragraph 2 and 14/CP.19 paragraphs 7 and 8. Eswatini is applying the step wise approach and is planning to improve over time by including national values instead of tier 1 default emission/removal factors.

This submission is Eswatini national FRL including all the forests of the country. The FRL serves as the benchmark for all five REDD+ activities as defined in paragraph 70 of decision 1/CP.16. The present national FRL submitted by Eswatini is based on the net Greenhouse gas (GHG) emissions and removals for the Forest remaining Forest land, and forest conversions to and from the other land use categories and country specific land use subcategories. The selected FRL has a value of zero, meaning that Eswatini would only seek results-based payment for net removals that occur at the national level after considering all sources of emissions associated to the land categories listed above for the period 2021-2025.

1.1 Justification of Zero FRL

Eswatini's FRL is defined as zero. The zero FRL aims to recognize the country's special circumstance of being a net carbon remover, meaning that the country has more removals than emissions according to the latest data for 2000-2020 (Figure 1). This places Eswatini in a unique position to lead climate action,

especially through strengthened governance and financial resources to allow forests to continue removing carbon from the atmosphere, thereby maintaining and potentially increasing net removals at the national level which in turn increases the contribution of the country to global CO2 atmospheric concentrations.

According to Eswatini's latest National GHG Inventory submitted as part of its Third National Communication to the UNFCCC[6], the balance between emissions and removals is -1.002 Gg CO2eq for the 2016 (latest reporting year). A total of 4.861 Gg CO2 was emitted in 2016 from the energy, IPPU, agriculture, IPPU and waste sectors, while -5.863 Gg CO2 of net removals resulted from the LULUCF sector. This means that Eswatini has already achieved the balance in emission and removals that the Paris Agreement requests of countries by the second half of the century (Article 4, paragraph 1 of the Paris Agreement). This serves as the basis for the adoption of the zero FRL approach.

Key principles of Eswatini's zero FRL:

1. Eswatini, as a net carbon remover country, provides an invaluable contribution by removing CO2 from the atmosphere directly impacting the global CO2 concentrations;
2. Eswatini seeks to maintain the current balance between emissions and removals by seeking result-based payments for net removals against a zero FRL, effectively recognizing the country's full extent from forests;
3. Eswatini's FRL includes all activities, meaning that any deforestation or forest degradation would impact the country's REDD+ performance. The zero FRL has environmental integrity because it considers all possible sources of emissions;
4. by defining the FRL as zero, Eswatini seeks recognition and results-based payments for net removals, meaning increased forest carbon stocks, following IPCC guidelines: "increases in total C stocks over time are equated with a net removal of CO2 from the atmosphere" (IPCC 2006, volume 4, chapter 1, p.1.6).

Non-permanence

Eswatini's zero FRL aims to recognize national net removals. However, if net emissions were to occur, no REDD+ results can be claimed. In such a case, Eswatini would not claim results and would also reflect these net emissions in the national REDD+ accounting for the corresponding NDC period, by subtracting any reversals from the total REDD+ results. The accounting is reset for each subsequent NDC period.

Historical reference period

The historical reference period is 2000-2020. As shown in Figure 1 below, Eswatini presented net removals during this period, serving as the scientific basis for adopting the zero FRL approach.

[6] https://unfccc.int/documents/81631

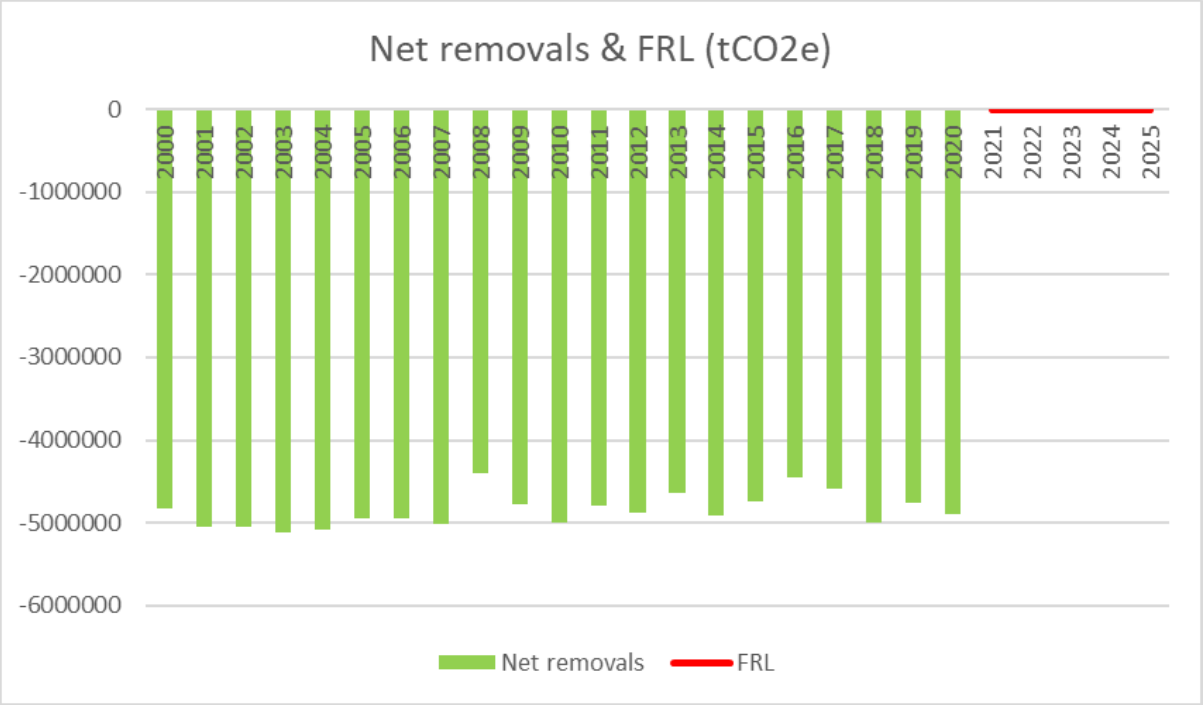


Figure 1: Forest-related net removals for historical reference period 2000-2020 and the zero FRL for implementation period 2021-2025

Table 2: Net removals for the historical reference period and Reference level

Net removals (t CO2e)			
Year	**Net removals**	**Reference level**	**Notes**
2000	-4.823.943		
2001	-5.055.472		
2002	-5.055.518		
2003	-5.117.058		
2004	-5.090.663		
2005	-4.953.768		
2006	-4.951.468		
2007	-5.007.212		
2008	-4.401.201		
2009	-4.773.020		
2010	-4.993.567		
2011	-4.785.588		
2012	-4.874.839		
2013	-4.640.194		
2014	-4.913.343		
2015	-4.740.987		
2016	-4.457.988		
2017	-4.589.593		
2018	-4.996.738		
2019	-4.764.084		
2020	-4.890.360		
2021		0	Eswatini reference level is a Zero RL
2022		0	
2023		0	
2024		0	
2025		0	

1.2 Modalities for FRL according to Decision 12/CP.17

The table below explains how the zero FRL approach fully aligns with COP decisions for REDD+ reference levels, particularly decision 12/CP.17:

Table 3:Modalities for FRL

Modalities for submission of FREL/FRL (12/CP.17)	Elements for justification
7. Agrees that, in accordance with decision 1/CP.16, paragraph 71(b), forest reference emission levels and/or forest reference levels expressed in tonnes of carbon dioxide equivalent per year are benchmarks for assessing each country's performance in implementing the activities referred to in decision 1/CP.16, paragraph 70;	· Eswatini's Zero FRL is expressed in tons of CO_2 equivalent per year. · It is a special benchmark designed for assessing Eswatini's efforts in maintaining yearly net removals (*when considering all forest-related emissions by sources and removals by sinks*). · By setting the FRL at zero, Eswatini expresses its intention to get recognition for all net removals.
8. Decides that forest reference emission levels and/or forest reference levels, in accordance with decision 1/CP.16, paragraph 71(b), shall be established taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with anthropogenic forest- related greenhouse gas emissions by sources and removals by sinks as contained in each country's greenhouse gas inventories;	· Eswatini's Zero FRL is based on the estimation of emissions and removals during a historical reference period 2000-2020, *i.e.* time-series in the national GHG inventory. · The updated time-series underlying the zero FRL will be the basis for the next national GHG inventory to be included as part of Eswatini's first BTR. · Updated methods, data, assumptions, and results will be consistent with (and will serve as the basis for) in the national GHG inventory included in the first BTR.

9. Invites Parties to submit information and rationale on the development of their forest reference emission levels and/or forest reference levels, including details of national circumstances and if adjusted include details on how the national circumstances were considered, in accordance with the guidelines contained in the annex to this decision and any future decision by the Conference of the Parties;	· When applying a Zero FRL approach, Eswatini is considering their national circumstance of being a net carbon remover, *i.e*. having net removals rather than net emissions. · This circumstance is the main reason behind the application of the approach, *i.e.* to recognize all removals. · As a net carbon remover, Eswatini contributes to reducing CO_2 from the global CO_2 concentrations and thus has a direct impact in the stabilisation of the climate. · Net removals are additional every year. Consequently, the best FRL approach is to set it at zero to get full recognition of Eswatini's contribution to climate change mitigation. · This approach does not require adjustments.
10. Agrees that a step-wise approach to national forest reference emission level and/or forest reference level development may be useful, enabling Parties to improve the forest reference emission level and/or forest reference level by incorporating better data, improved methodologies and, where appropriate, additional pools, noting the importance of adequate and predictable support as referenced by decision 1/CP.16, paragraph 71;	· The Zero FRL approach applies to the national scale in Eswatini. · Eswatini may use the step-wise approach to improve the estimation of emissions and removals that underlie the Zero FRL approach, following IPCC guidance and guidelines, and as methods, data and knowledge improves.
11. Acknowledges that subnational forest reference emission levels and/or forest reference levels may be elaborated as an interim measure, while transitioning to a national forest reference emission level and/or forest reference level, and that interim forest reference emission levels and/or forest reference levels of a Party may cover less than its entire national territory of forest area;	· The Zero FRL approach applies to national scale, as it attempts to recognize national-level efforts in conserving national-level net removals.
12. Agrees that a developing country Party should update a forest reference emission level and/or forest reference level periodically as appropriate, taking into account new knowledge, new trends and any modification of scope and methodologies;	· See above, on paragraph 10.

(a) Information that was used by Parties in constructing a forest reference emission level and/or forest reference level, including historical data, in a comprehensive and transparent way;	· Before applying a Zero FRL approach, Eswatini first estimated emissions and removals following IPCC guidance and guidelines for the period 2000-2020. · Through this process Eswatini may confirm that they have net removals, and thus they may apply the Zero FRL approach. **Note on the use of historical data:** The estimation of historical emissions and removals, and the understanding that Eswatini presents yearly net removals, is what enables a country to apply this approach, and as such, it is based on historical data.
(b) Transparent, complete, consistent and accurate information, including methodological information, used at the time of construction of forest reference emission levels and/or forest reference levels, including, inter alia, as appropriate, a description of data sets, approaches, methods, models, if applicable and assumptions used, descriptions of relevant policies and plans, and descriptions of changes from previously submitted information;	· The Zero FRL approach is based on transparent, complete, consistent, and accurate information, just as any other FREL/FRL should. · All descriptions of methods, data and assumptions are provided in this report.
(c) Pools and gases, and activities listed in decision 1/CP.16, paragraph 70, which have been included in forest reference emission levels and/or forest reference levels and the reasons for omitting a pool and/or activity from the construction of forest reference emission levels and/or forest reference levels, noting that significant pools and/or activities should not be excluded;	· A Zero FRL approach complies with the same decisions on the inclusion of carbon pools, gases and activities. · The Zero FRL ensures that the IPCC category forest land remaining forest land is included, often a key category in the forest sector.
(d) The definition of forest used in the construction of forest reference emission levels and/or forest reference levels and, if appropriate, in case there is a difference with the definition of forest used in the national greenhouse gas inventory or in reporting to other international organisations, an explanation of why and how the definition used in the construction of forest reference emission levels and/or forest reference levels was chosen.	· The forest definition used in the Zero FRL approach will be consistent with the national GHG inventory; any differences between definitions and with other definitions used in reporting to other international organisations would be explained.

2. General context

The kingdom of Eswatini is a landlocked country covering an area of 17.364km2 in Southern Africa between South Africa and Mozambique. Economically, the country relies on the exportation of Agricultural products such as sugar, beef, citrus, forestry products and textiles (Ministry of Tourism and Environmental Affairs, 2016). Agriculture being the primary economic sector with maize production for commercial and subsistence purposes and is the staple crop for the citizens. The national landscape is quite hilly with a mosaic of agricultural areas with high mountain grasslands for pasture, forest plantation for commercial and domestic wood production, indigenous forests, and wetlands forms and types (rivers, ponds, marshes, dams, and peatlands). Notably, the country has four physiographic regions, Highveld, Middleveld, Lowveld and Lubombo plateau, representing the different reliefs from west to east, see image below (Ministry of Tourism and Environmental Affairs, 2016) as shown in Figure 2. The total population in 2017 was estimated to be around 1.093.238 citizens with 76,2% of the population living in rural areas (Ministry of Tourism and Environmental Affairs,2021). The climate is tropical to temperate with a summer rainy season (October to April) and the dry season/ winter season (May to August).

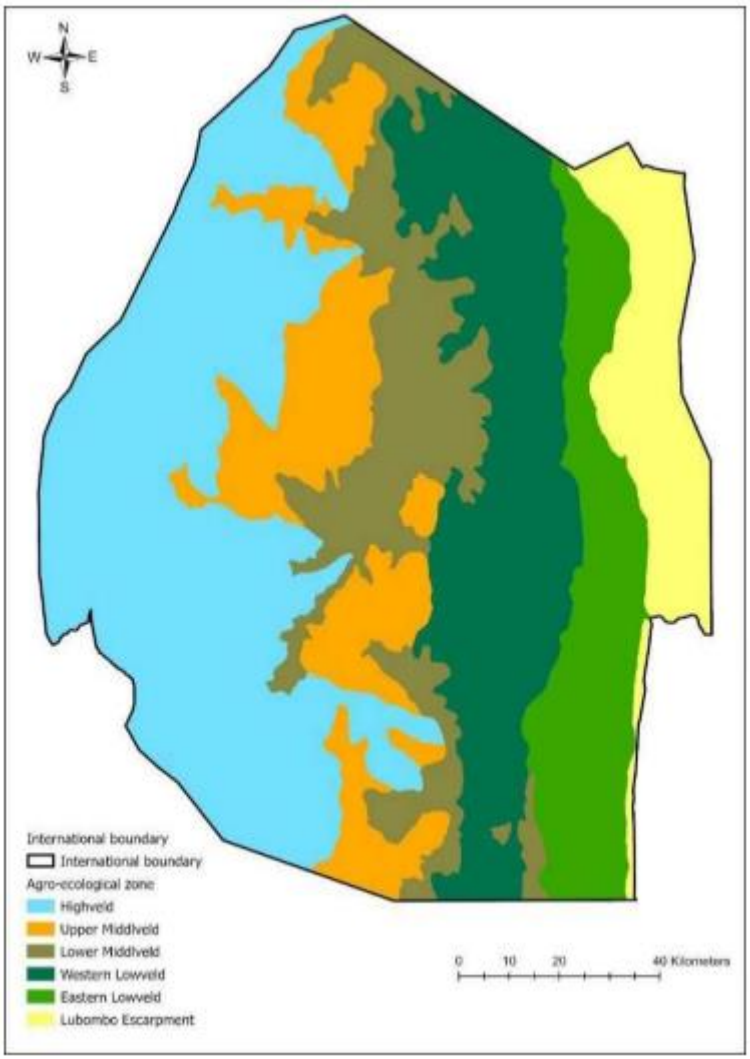


Figure 2:: Map showing the Agro-ecological Zones in Eswatini. (Source: SoER, 2022)

Rainfall also impacts the regions differently from the west to the east. Northern Highveld being the moister area with 1500mm during the rainy season. However, rainfalls have highly decreased between 2000-2010 according to Eswatini's Third national communication. Mean annual temperatures vary from 17°C in the Highveld to 22°C in the Lowveld. The Lowveld region on the border with Mozambique registers the highest temperatures.

Croplands cover 23% of the country in 2020 (CfRN LUA Assessment, October 2023). Sugar cane represents 74% of the total agriculture output in 2015. This cash crop represents 13% of Eswatini GDP in 2015. Other cash crops are Citrus and bananas. On the other hand, Maize is the national staple crop requiring 118.000 metric tonnes annually. The country has been able to produce on average only 100 '000 metric tonnes annually, which implies large imports to cover local demand. Commercial Agricultural land is found mainly on Title Deed land, which is one type of land use management in the country. In Eswatini the land is managed under Title Deed Land (31%) or Swazi Nation Land (69%). This system ensures that all population has access to land ownership to build their house and grow some crops, even the poorest part of the population. Grazing can be found on the Eswatini Nation Land. It is estimated that 20% of the country area is arable land, increasing pressure on this natural resource due to human population growth.

The forestry sector involves mainly pine and eucalyptus plantations and wattle forest to provide wood timber, saw logs, pulp and biofuel, mining timber and other products from timber. In 2020, plantations, Wattle forest and woodlots represent 11% of the total country area (CfRN LUA Assessment, October 2023). Increase in fires and floods have fragilized the sector. First commercial production started in 1949 and the area of plantation has since expanded (National Forest Policy, 2002). Plantations of pine and eucalyptus have a high degree of management as compared to wattle forests where the scale has always been much smaller, and the management has greatly deteriorated over the years. The wattle forests today have spread uncontrollably around the highveld and upper Middleveld region. The commercial forestry and related processing industry form a very important part of the economy of Eswatini, contributing approximately 15 percent to GDP, mainly through exports. The forestry sector, including the secondary processing sector, provides employment to approximately 8 000 people, which is 8 percent of total formal employment in Eswatini. Commercial forestry in Eswatini is entirely run by private companies, of which Sappi-Usutu now trading as Montigny Investments, Mondi Forest now trading as TWK Peak Timbers and Shiselweni Forestry Company are the largest. These three companies, together with some smaller ones, manage a total area of about 130.000 ha covered by forest plantations. Of this total area, about 25.000 ha (twenty percent) is unplanted and used for infrastructure and for the protection of biodiversity and ecosystems (National Forest Policy, 2002).

The types of forest are distributed according to varied elevation and rainfall. On the western Highveld, the high elevation is favourable to dense montane and highland forest, the rainfall is also very good for commercial growing. This is where most of the plantations are located (National Forest Policy, 2002). The open grasslands on the top of Highveld hills are where livestock is brought for pasture. This region is also where most of the commercial plantations of eucalyptus and pine have been established as the climate favours fast growth. In the lower altitudes in the Highveld, some Acacia/wattle can be found. The Middleveld region is also split between upper and lower, the upper section has some of the wattle forest, where the lower part will be covered by the open bushlands and the open mixed woodland.

In the Lowveld, the forest will go from west to east from Acacia Woodland to Dry Acacia Woodland. The eastern part of the country at the border with Mozambique, which is called the Lubombo Region is covered mainly by the Mixed woodland and the dry acacia woodland. Figure 3. shows the general distribution of the forest cover types.

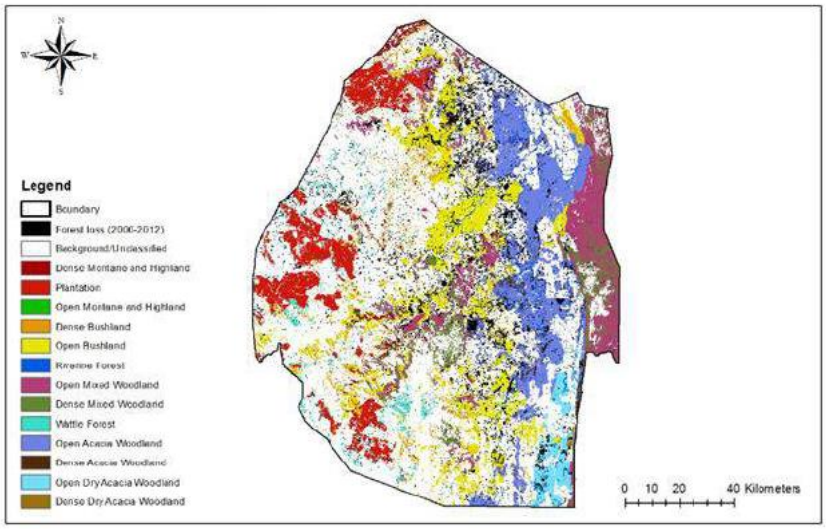


Figure 3: Map showing forest cover in Eswatini (Source: TNC, 2016)

The Forest inventory done in 1999 by the national authorities showed that forests covered 45% of the land of which 2,2% were natural forest, 22% natural woodlands, 13.4% natural bushlands, 1,4% wattle forest and 6,4% plantations. In 2020, the assessment indicates that the forest area covers around 46% of the country followed by Grasslands 24%, Croplands 23%, Settlements 4%, Wetlands 2% and Other land 1%. The 46% of forest comprises 24% plantations, wattle forest and woodlots and the rest is natural forest. Deforestation rate for the historical period 2000-2020 has been estimated at 811.61 ha of forest lost per year, which is a rate of 0,1% (CfRN LUA App assessment, October 2023).

Table 4: Proportion of forest in 2020

Area per land use in 2020		ha	proportion by national classes %	proportion by IPCC classes %
Forestland	Dryer Acacia Savannah Forest	401297	23,11%	46%
	Moister Acacia Savannah Forest	97619	5,62%	
	Montane and Highland	48471	2,79%	
	Plantations	125575	7,23%	
	Riparian	64253	3,70%	
	Wattle Forest	40581	2,34%	
	Woodlots	23221	1,34%	
Cropland	*Annual crop*	390250	22,47%	23%
	Perennial Crop	9018	0,52%	
	Agroforestry	6763	0,39%	
Grassland	Bushveld	215303	12,40%	24%
	High Mountain grasslands	206736	11,91%	
Wetland	Natural water bodies	18938	1,09%	2%
	Artificial Water bodies	8792	0,51%	
Settlement	Settlements	45766	2,64%	4%
	Woody Settlements	19163	1,10%	
Otherland	Other	13978	0,80%	1%
	Mining	676	0,04%	
Total		**1736400**	**100,00%**	100%

Drivers of land degradation in Eswatini have been listed in the Land Degradation Neutrality Target Setting programme (Dlamini T., 2018) prepared in 2018. The direct drivers of degradation are overgrazing, crop farming practices that compacts the soils, deforestation, over-exploitation of vegetation, Urbanization, etc. Natural causes that have been intensifying with climate change are loss of biodiversity, pests, floods and droughts and uncontrolled fires. Deforestation is observable in the Middleveld where urbanisation is expanding and firewood for domestic use is increasing. Extension of the sugar cane plantations and other commercial crops is also taking place on forest land in the Middleveld and Lowveld. Some of the indirect drivers are population growth which puts pressure on land tenure and intensification of land exploitation, governance and education as well as effects from HIV and AIDS (Dlamini T., 2018). In the 2002 National Forest Policy it was underlined that degradation was indirectly caused by poverty, hunger, access to land and unemployment and that these problems will have to be solved in parallel to the policy making in order to ensure efficiency of the forest policies (National Forest Policy, 2002).
Based on the assessment for the FRL historical period the main drivers of degradation monitored are by order of amplitude: Infrastructure, Agriculture and grazing (CfRN LUA APP assessment, October 2023).

Traditionally, forestry has largely focused on industrial production, but today its impact on social and environmental matters is fully recognized. The proper use and management of forest and woodland

resources is essential to sustain the livelihoods of rural communities. Forestry today is an integral part of most land use systems; hence it must be considered in national planning as a priority in resource allocation. Cross-sectoral working relationships and integrated approaches in forest planning are key elements in today's holistic development strategies.

These development trends are also clearly occurring in Eswatini, and they consequently enhance the importance and relevance of forestry, such as in the following areas of interest:

- The essential contribution to GDP and national accounts, not only from the formal plantation sector, but also the informal sector, such as from non-timber forest products.
- Relevance of forestry in biodiversity conservation, an obligation of Eswatini to the Convention on Biological Diversity (CBD).
- Utilisation of forestry in combating desertification, an obligation of Eswatini to the Convention to Combat Desertification (CCD).
- Importance of forestry in providing essential sources of energy.
- Relevance of forestry to tourism development, in particular eco-tourism.
- The role of urban and peri-urban forestry, to improve quality of life.
- Cooperation and partnership between the industrial forestry sector, Government, rural communities and other relevant stakeholders.

2.1 Policies and plans

The Kingdom of Eswatini ratified the United Nations Framework Convention on Climate change (UNFCCC) in 1996. This was followed by the adoption of the Kyoto Protocol in 1997, recognizing the complex effects of climate change on the evolution of humankind. Eswatini ratified the Paris Agreement in 2016. As a party to the convention, Eswatini is committed to pursue coordinated actions to reduce greenhouse gas (GHG) emissions and climate change impacts while continuing to advance sustainable economic development.

Eswatini is not a major contributor to the global Greenhouse Gas (GHG) emissions. Although the impacts of climate change are largely linked to the historical and contemporary industrial development of other nations, like most countries in the Global South, the country is disproportionately impacted by the changing climate. Under these circumstances Eswatini presented its enhanced Nationally Determined Contribution (NDC) in October 2021, acknowledging that despite their contribution to climate change emissions being miniscule, the country is committed to climate action. The country intends to communicate that climate resilient, sustainable, and equitable development are its priorities (Ministry of Tourism and Environmental Affairs, October 2021).

The Eswatini's updated NDC contains contributions planned in the adaptation sectors of Agriculture, Water, Health, Ecosystems and Biodiversity and Infrastructure; mitigation sectors of Energy and Transport, Waste, Industrial Processes and Product Use (IPPU) and Agriculture, Forestry and Other Land Use (AFOLU) and cross cutting areas of Gender, Youth and Disaster Risk Reduction (DRR). These include 33 outcomes, 96 outputs and 270 key performance (NDC Implementation Plan Narrative, April 2023). The forest sector is included in the section of Ecosystems and biodiversity adaptation contribution with the goal to:

- **Strategically plan and manage** ecological infrastructure including grasslands, rivers, wetlands, woodlands, and **forests** including updating and implementing the National Biodiversity Strategy and Action Plan (NBSAP) and ensuring that vulnerable ecosystems are addressed in national adaptation programmes.
- **Reduce pressures driving biodiversity loss** (e.g., **deforestation**, human settlements) to improve carbon sinks and promote eco-tourism
- **Conduct research, innovation, and knowledge sharing** for income generation through use of **tree resources and non-timber forest products**.

In the AFOLU sector Eswatini commits to move from Tier 1 to Tier 2 GHG inventory and improve data collection and institutional arrangements by 2030. Furthermore, the country commits to reducing land degradation (including in mountain ecosystems) through restoration including tree planting and improving livelihoods through better livestock management. The country aims to plant 10 million trees (Ministry of Tourism and Environmental Affairs, 2021).

The agricultural sector represents opportunities for mitigation measures, particularly those related to conservation agriculture, manure management and changing practices associated with sugar cane production, the restoration and management of grasslands, afforestation, reforestation and forest conservation, among others. The forestry sector is vulnerable to the effects of climate change impacts, specifically drought, increased fire risks, floods and pests. The protection of this sector is critical not only due to its status as a national industry (and source of employment) and its GHG removal potential, but also due to the forestry sector being a source of energy in both rural and industrial contexts (Ministry of Tourism and Environmental Affairs, 2021).

2.1.1 National Policy Documents addressing Climate Change Issues

The Government of the Kingdom of Eswatini has embarked on several initiatives and planning frameworks in pursuit of sustainable development of her people. Eswatini also has a set of policies and strategies more general to incorporate land use management in regard of adaptation to climate change, notably:

The Constitution of the Kingdom of Eswatini Act (No. 1/ 2005) – emphasises through Government; protection and rational/ sustainable use of its land, mineral and water resources as well as its fauna and flora. Section 216 (1) requires that every person shall promote the protection of the environment for the present and future generations.

National Climate Change Policy (2016), which supports the priorities outlined in the National Development Plan. The aim of the policy is to provide the enabling framework that will guide Eswatini in addressing the challenges posed by climate change, per relevant sectors in the country. The policy options are specifically aligned with the commitments.

The National Development Strategy (NDS), formulated in 1997 and reviewed in 2014, is the overarching framework that provides a platform for the achievement of sustainable development in the country. It seeks to balance the needs of the Swazi people with the environment carry's capacity

The draft National Land Policy (NLP) (2000) translates the vision of the NDS into a land-related context. The NLP addresses nation-wide issues under six headings, namely Human Rights Issues and Policies, Cultural Issues and Policies, Land Tenure Issues and Policies, Land Use and Land Management Issues and Policies, Land Market Issues and Policies and Land Administration Issues and Policies.

The draft National Environment Policy (NEP) (1999) is intended to be the national policy to protect and conserve the environment and to attain sustainable development in Eswatini. The most direct reference to forestry, which is an integral part of the environment affected by the policy, is the 'user-pays'

principle, which is explained as follows. Many natural resources including land, indigenous forestry, and water are free or under-priced, which leads to over-use and degradation or depletion. The costs and benefits of resource use should be internalised through the use of clearly defined property rights, providing 'green' subsidies to encourage environmentally beneficial behaviour and 'brown' taxes and charges to increase the cost of activities which pollute or otherwise degrade the environment.

The National Biodiversity Strategy and Action Plan (NBSAP) (2016 – 2022) recognises that the biodiversity in Eswatini is unusual for a country so small; six physiographic zones are normally spread over a much wider area. As is to be expected with the importance of forestry in the biosphere, references to forestry also pervade this document. It makes reference to forestry's importance in social value systems, both in the formal economic and traditional senses. It recognizes uncontrolled cutting of wood as one of the six serious threats to the habitat; the loss of indigenous trees is also the loss of shelter for birds, animals, etc.

Draft National Wetlands Policy (2020), Strategy and Action Plan (2020 - 2030), through these instruments it is anticipated that wetlands would be able to make a greater contribution to the sustainable development of the Kingdom of Eswatini through enhanced wetlands management, utilisation and conservation.

2.1.2 Policies in the context of Forest

Regarding the management of forest, the country enacted the **Flora Protection Act No.5 of 2001** which seeks to ensure that there is conservation and sustainable utilisation of indigenous forest resources in the country. The country further developed a **National Forest Policy** in 2002 which addresses the rapid population growth in relation to a complex of related issues, including changing health conditions and care, worsening unemployment, increased consumption needs and gender equity. The environment is recognized as an important factor in population matters. The draft Policy notes with concern the increasing environmental degradation, with increased population pressure as one of its main underlying causes. The draft Policy recommends to promote community forests and land reclamation programmes, as well as review of cultural practices that have a negative influence on the environment. High incidence of poverty and malnutrition are related to high levels of food insecurity. Agriculture and forestry are recognized as important sectors with respect to income and employment. The draft Policy recommends intensification and diversification of production to improve food security and nutrition levels.

The objectives of the National Forest Policy, National Development Strategy, the National Land Policy, the National Environmental Policy and the National Biodiversity Strategy are:

a. **To improve the access to land** for the utilisation and development of forest resources, and secure the tenure of forest and trees.
b. **To promote the rational and sustainable use of land**, and achieve a sustainable balance between forestry and other uses of the land and water resources.
c. **To improve the forest productivity**, and ensure sustainable supply of multiple forest products and services by maintaining the forest areas.
d. **To improve income and living conditions**, and alleviate poverty.
e. **To conserve the biodiversity** of the forest resources, encourage its sustainable use and ensure that benefits accrued are shared equitably.
f. To promote the **integration of forestry into urban development**.
g. To enhance the national capacity **to manage and develop the forestry sector** in collaboration with other stakeholders

2.2 National institutional arrangements

Eswatini's National MRV System for the GHG inventory, including REDD+, is still under development. The roles, responsibilities and legal framework (organisation mandates) supporting the reporting of the GHG inventory and REDD+ will be further formalised through upcoming support programmes including the United National Development Programme (UNDP) Climate Promise Initiative, the NDC Partnership Climate Action Enhancement Package (CAEP) and the Capacity Building Initiative for Transparency (CBIT) programmes of work.

The Ministry of Tourism and Environmental Affairs (MTEA) is the designated National Entity and hosts the UNFCCC Focal Point / REDD+ Focal point. MTEA has overall responsibility for the outputs of the MRV system including the GHG inventory, NIR, BURs and NCs. MTEA provides a key link between the domestic MRV system with the outside world and international community. MTEA coordinates the activities needed to ensure that outputs are prepared, and of sufficient quality, to meet Eswatini's commitments. The Department of Forestry and Department of Agriculture have legal mandates to coordinate data collection processes but otherwise no pre-existing data agreements.

The National Climate Change Committee (NCCC) is a steering committee made up of representatives from national ministries, private sector and non-government organisations. Although non-functional, the NCCC was designed to provide a focal point for collaboration around the GHG inventory and climate action and the monitoring of MRV system outputs, trends and challenges. The NCCC is inactive and is dependent on the budget available through project funding.

The FRL was compiled by the team, inside the departments of Forestry, Agriculture, Climate Change Unit, University of Eswatini (UNESWA), and Eswatini National Trust Commission (ENTC). These experts have a good understanding of national activities within the forest and land use sector either through previous involvement with the national MRV system or through related projects. The national experts were responsible for collecting the data, compiling the FRL estimates using the compilation tools and templates, and IPCC 2006 Guidelines, assessing completeness of the compiled inventory, undertaking QA/QC activities on the data, identifying improvements, and providing input into the FRL report.

3. Data, methodologies and procedures

3.1 Information used by the Party to construct the FRL

Table 5: Data used for the construction FRL

IPCC guidelines used	2006 IPCC guidelines for Greenhouse gas inventories
Time-series	Annual information in tonnes CO2e for the years 2000 to 2020
Data sources for representing land	**CfRN LUA assessment, October 2023.** Land use and land use change areas have been calculated based on a systematic sampling assessment undertaken on the CfRN LUA App. The whole country was covered by a systematic grid of 2,5 -2,5km which represents 7702 plots assessed. All six IPCC land use classes were observed with a subdivision of 18

	national land categories. The assessment was done between June and October 2023, by a team of 15 experts from the Ministry of Tourism and Environmental Affairs. The method for the estimation of area is presented in section Annex I : Area of land and land use change.
Data sources for activity data of Roundwood- Fuelwood	**CfRN LUA assessment, October 2023** Area of wood extracted from forestland was extracted from the CfRN LUA app assessment of October 2023. Thanks to the high resolution images and the indexes, it was possible to monitor the areas that have experienced wood extraction. At this point it was not possible to differentiate the proportion of roundwood and proportion of fuelwood. The country is currently collecting information of wood extraction from plantations companies to have a second set of data for comparison.
Data sources for activity data area under degradation/ fire	**CfRN LUA assessment, October 2023** Forest area affected by degradation activities including infrastructure, agriculture, grazing, firebreaks, mining, pest, floods/storms was monitored through the high-resolution images on the CfRN LUA App. Areas affected by fire were also detected during the assessment.
Data source for estimating carbon stocks	**Ministry of Tourism and Environmental Affairs, October 2020 & Department of Environment Affairs, 2015** Eswatini does not have national data on carbon stocks. Information used was the same one included in the GHGI 2020, which is in majority coming for a South African study 2015. Some default values from IPCC guidelines were also used to complement (see tables 14 & 15).
Eswatini Calculation sheet	To produce the estimations of emissions/removals for the historical period Eswatini develop an excel based calculation sheet. This calculation sheet can be accessed here: file:///G:\My%20Drive\Ewatini%20FRL%20Documents\ESWATINI_FRL_CalculationSheets_2024.xlsx The calculation sheet is composed of the following tabs: - **Introduction:** explanation of each sheet - **Database 241023**: plot assessment from CfRN LUA - **Land representation**: Presentation of land use categories used for the FRL and definition - **Land AD**: Matrix of land use and land use change - **Land_AD**_RandomError: Analysis of the random error for the activity data - **Land_EF-RF**: Presentation of the carbon stocks value used and the conversion of these values into emission factors and removal factors - **FL_ΔCL**: Estimation sof losses on forest land remaining forest land - **Land_ΔCO2**: estimations of gains on forest land remaining forest land and carbon stock change for land converted to/from forest - **Reporting table**: Final estimations - **Completeness**: tables of carbon pools and gases included - **Annex I Disturbance**: formatting of activity data for forest land under disturbance or logging To ease the review process, tables included in this report have referenced

	to the calculation sheets.

3.2 Pools, gases and activities included in FRL

3.2.1 Scale

This is a national forest reference level covering the whole kingdom of Eswatini, which is 17.364km2. All land is considered managed land following IPCC definition of managed land. The forest area was 801.918 ha in 2020 which represents 46,2% of the national territory. By definition, all forest areas have been included in the FRL.

Table 6:Area of forest for the period 2000-2020

Unit: Ha	Dryer Acacia Savannah Forest	Moister Savannah Forest	Montane and Highland	Plantations	Riparian	Wattle Forest	Woodlots	TOTAL	% national territory
2000	404.904	97.844	48.697	124.673	64.704	40.806	23.672	**805.300**	46,4%
2001	404.904	97.844	48.697	124.673	64.704	40.806	23.672	**805.300**	46,4%
2002	404.904	97.844	48.697	124.673	64.704	40.806	23.672	**805.300**	46,4%
2003	404.904	97.844	48.697	124.673	64.704	40.806	23.672	**805.300**	46,4%
2004	404.679	97.844	48.697	124.673	64.704	40.806	23.672	**805.075**	46,4%
2005	404.454	97.844	48.697	124.673	64.478	40.806	23.672	**804.624**	46,3%
2006	404.454	98.070	48.697	124.898	64.478	40.806	23.672	**805.075**	46,4%
2007	404.679	98.070	48.697	124.898	64.478	40.806	23.672	**805.300**	46,4%
2008	404.003	97.844	48.697	124.898	64.478	40.806	23.672	**804.398**	46,3%
2009	403.777	97.844	48.697	124.898	64.478	40.581	23.672	**803.947**	46,3%
2010	403.552	97.844	48.697	124.898	64.478	40.581	23.672	**803.722**	46,3%
2011	403.777	97.844	48.697	125.124	64.478	40.581	23.672	**804.173**	46,3%
2012	403.777	97.844	48.697	125.124	64.478	40.581	22.996	**803.496**	46,3%
2013	404.454	97.844	48.922	125.124	64.478	40.806	22.770	**804.398**	46,3%
2014	403.777	98.070	48.922	125.124	64.478	40.806	22.770	**803.947**	46,3%
2015	403.326	98.070	48.922	125.124	64.253	40.806	22.770	**803.271**	46,3%
2016	401.974	98.070	48.922	125.124	64.253	40.806	22.770	**801.918**	46,2%
2017	402.199	98.070	48.922	125.349	64.253	40.355	22.770	**801.918**	46,2%
2018	402.875	98.070	48.922	125.349	64.253	40.355	22.770	**802.595**	46,2%
2019	401.974	98.070	48.922	125.349	64.253	40.355	23.221	**802.144**	46,2%
2020	401.974	97.844	48.697	125.575	64.253	40.355	23.221	**801.918**	46,2%

Source: CfRN LUA App assessment 2023

The main forest is Dryer Acacia Savannah on the east side of the country followed by the plantation area in the highveld on the west of the country.

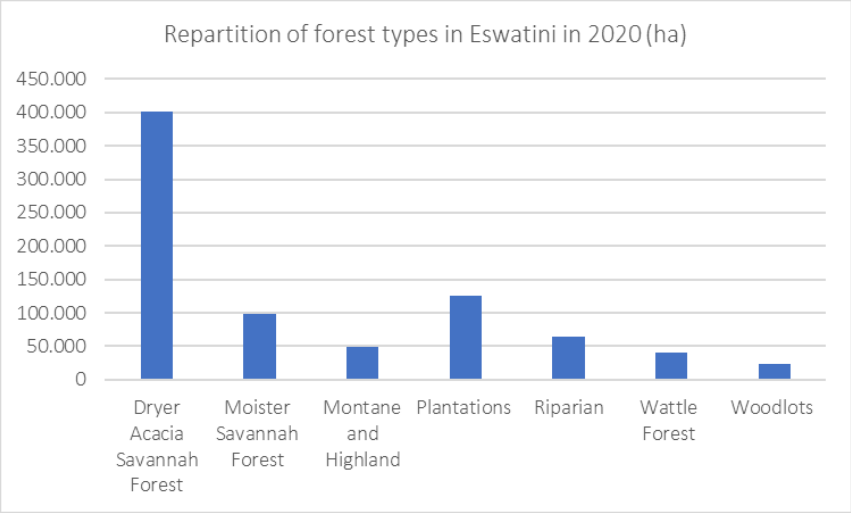


Figure 4: ***Proportion of forest types in Eswatini***

Source: CfRN LUA App assessment, 2023

3.2.2 Pools and gases included

Table 7: ***Pools included***

Land-based carbon stock changes		Biomass	Dead organic matter	Soils	
Land-use category	Land-use subcategory			Mineral	Organic
Forest land (FL)	FL remaining FL	Yes	Yes	Yes	NA
	Land converted to FL	Yes	Yes	Yes	NA
Cropland (CL)	Forest converted to CL	Yes	Yes	Yes	NA
Grassland (GL)	Forest converted to GL	Yes	Yes	Yes	NA
Wetland (WL)	Forest converted to WL	Yes	Yes	Yes	NA
Settlement (SL)	Forest converted to SL	Yes	Yes	Yes	NA
Other land (OL)	Forest converted to OL	Yes	Yes	Yes	NA

Table 8: ***Gases included***

Land-use Category	Land-use subcategory	CO2	Non-CO2 emissions	CH4 emissions	N2O emissions
Forest land (FL)	FL remaining FL	Yes	Yes	NA	NA
	Forest converted to FL	Yes	IE*	NA	NA
Cropland	Forest converted to CL	Yes	NA	NA	NA
Grassland	Forest converted to GL	Yes	NE	NA	NA
Wetland	Forest converted to WL	Yes	NE	NA	NE
Settlement	Forest converted to SL	Yes	NA	NA	NA
Other land	Forest converted to OL	Yes	NA	NA	NA

*All forest fires were included under FL remaining FL

3.2.3 REDD+ Activities included

All five REDD+ activities have been included in this FRL since all forest-related emissions and removals are considered. The Land based approach was used to estimate emissions and removals following IPCC guidance and guidelines, specifically the 2006 IPCC Guidelines for National GHG Inventories.

The table below provides an illustration, in the form of a land use and land use change matrix, where REDD+ activities may have a mitigation impact with respect to forest-related emissions and removals. By adopting the land-based approach, Eswatini takes responsibility for all emission by sources and removals by sinks affecting national forests.

Table 9: ***REDD+ activities by land uses***

REDD+ activities by land use	Dryer Acacia Savannah Forest	Moister Savannah Forest	Montane and Highland	Plantations	Riparian	Wattle Forest	Woodlots	Annual Crops	Perennial Crops	Agroforestry	Bushveld	High Mountain grasslands	Natural Water Body	Artificial Water Body	Settlement	Woody Settlement	Other Lands	Mine
Dryer Acacia Savannah Forest																		
Moister Savannah Forest																		
Montane and Highland																		
Plantations																		
Riparian																		
Wattle Forest																		
Woodlots																		
Annual Crops																		
Perennial Crops																		
Agroforestry																		
Bushveld																		
High Mountain grasslands																		
Natural Water Body																		
Artificial Water Body																		
Settlement																		
Woody Settlement																		
Other Lands																		
Mine																		

Legend	**Colour coding**	**REDD+ activities**
Forest remaining forest		Reducing emissions from Degradation
		Enhancement of forest carbon stocks
		Conservation of forest carbon stock
		Sustainable forest management
Land converted to forest		Enhancement of forest carbon stocks
Forest converted to land		Reducing emissions from Deforestation
Other land uses		Not relevant for REDD+

3.3 Methodologies information, including description of data sets, approaches and methods

3.3.1 Methods for land representation

In order to have a full data set all six IPCC categories were assessed during the data collection and all possible land use changes were observed. For the purpose of this FRL, only information for Forest is presented.

3.3.1.I Definition of forest

Following FAO's definition of forest, this land use category refers to all land with woody vegetation. Compared to the GHGI FOLU from 2020, where Forest land was disaggregated into two forest types, plantation and indigenous forests, this current FRL has divided the forest in 7 classes: Montane and Highland, Dryer Acacia Savannah Forest, Moister Acacia Savannah Forest, Riparian, Plantations, Wattle forest and Woodlots.

Forest land category in Eswatini as follows:

- Minimum Mapping Unit (MMU) is 0,5 ha
- Minimum tree cover is 10 %
- Potential to reach minimum height at maturity (in situ) as 5 m

(Ministry of Tourism and Environmental Affairs, October 2020)

To remain consistent with the National GHGI, the seven classes have been subdivided into plantations and Indigenous forest as follow:

Table 10: ***Comparison between GHGI classes and FRL classes***

GHGI FOLU 2020	FRL 2024
Plantation forests refer to the woody vegetation that at maturity is predominantly composed of trees established through planting and/or deliberate seeding. These are typically intensively managed forests that at maturity are composed of one or two species, with uniform age classes, and have regular tree spacing.	● **Plantations** ● **Wattle** ● **Woodlots**
Indigenous forests include all savannah woodlands and bushlands. It also includes systems with a vegetation structure that currently fall below, but in situ and could potentially reach the proposed national values used to define the forest land category in Eswatini - 0.5ha, 10% cover, potential to reach 5m.	● **Montane and Highland** ● **Dryer Acacia Savannah Forest** ● **Moister Acacia Savannah Forest** ● **Riparian**
Source: Ministry of Tourism and Environmental Affairs, October 2020	Source: CfRN LUA Assessment, October 2023

The definitions of each land use classes presented in this FRL are included in the table below:

*Table 11:**Land Use classes definition in Eswatini's FRL 2024***

Land Use Category Level 1	Sub-Land Use category Level 2	Elevation	Description	Location
Forest	Montane and Highland	>800m	Afromontane and mixed woodland, Indigenous forest.	Highveld Upper Middleveld
	Wattle Forest	>800m	*A. mearnsii* dominated forests. Man-made Forest.	Highveld
	Plantations		Clear felling – planned logging Man-made Forest. Plantations of pines and eucalypts	Mainly Highveld
	Moister Savannah Forest	400-800m	Mainly broadleaved, mixed woodland. Indigenous forest.	Middleveld Lubombo range.
	Dryer Acacia Savannah Forest	200-400m	Acacia dominated woodland, Indigenous forest. Precipitation <600mm.	(East) Lowveld
	Riparian	All physiographic zones	Mixed woodland. Indigenous forest.	Occurring along rivers
	Woodlots	>600m	Different ages for allowing regeneration. Mostly for domestic use (fuelwood).	Found next to urban/rural areas. Common in the Middleveld and Highveld
Cropland	Annual Crops	Cotton	Harvest around wintertime. Annual. Some crop lands abandoned	
		Sugar Cane	Some crop lands are abandoned (Farmer's communal lands / electricity). Harvest time (April to November)	
		Maize	Harvest time March-May.	Throughout the country
		Other annual crops		
	Perennial Crops	Citrus		Mostly Lowveld. Also, in the Highveld
		Banana		Mostly Lowveld and Middleveld

		Macadamia		Mostly Highveld and Middleveld
		Pineapple		Mostly Middleveld
		Other Perennial Crops		
	Agroforestry		<10% canopy cover.	
			Fruit trees intercropped with annual/legumes crop	
Grassland	Bushveld	200-800m	<5m canopy height	Lowveld to Middleveld
			Bush/thicket communities	
			Natural	
	High Mountain grasslands	>800m	<5m canopy height. Mostly Open grasslands	Highveld
Wetland	Natural water bodies		Lakes and rivers	
	Artificial Water bodies		Dams (irrigation / animals), off streams.	
Settlement	Settlements		Urban/ rural areas (housing, industry)	
	Woody Settlements		Urban/ rural areas combined with trees - homestead forestry	
Other lands	Other lands		Bare rock	
	Mining		Coal	

3.3.1.II Land assessment using remote sensing

The Activity data for all the land use classes was derived from remote sensing products generated by Eswatini Ministry of Tourism and Environmental Affairs team, Ministry of Agriculture, University of Eswatini and Eswatini National Trust Commission team members.

The data was collected between June and October 2023 following the systematic sampling approach as recommended by the 2006 IPCC guidelines for an Approach 3 for Land Representation. The CfRN Land Use Assessment Application (CfRN LUA) was used to access and analyse the images through time.

This approach was favoured:

- To produce a consistent and complete database of land use and land use change for a long period of time,
- To ensure the six land use categories recommended by IPCC were taken into account,
- To allow for rapid and efficient estimations of the forested area at national level and the changes through time,
- To build more specific maps and land use assessments in the future,
- As this approach is consistent with IPCC guidelines and will be used for REDD+ and GHGI reporting, ensuring consistency between the reports.

3.3.1.III Methodological approach

Eswatini applied the systematic sampling approach covering the whole country. The assessment was executed by national experts within a period of 4 months in 2023 with the use of the CfRN LUA App[7].
CfRN LUA App is a land Use assessment application derived from the Collect Earth Online application developed by SERVIR (joint USAID and NASA program) and FAO, and was adapted to ensure full consistency with the format needed for the GHG Inventories and REDD+ under the UNFCCC. The CfRN LUA gives access to different satellite imagery of different resolution as well as indexes that help interpreters assess the land use and the land use changes/disturbances through time.

The information collected with this land assessment application was then imported into an Excel spreadsheet to apply 2006/2019 IPCC Guidelines estimations of emissions and removals (see chapter 4); in addition, showing information by IPCC land use classes (Forest land, Grasslands, etc.).
CfRN LUA uses the IPCC Land representation approach 3 meaning that information is spatially explicit. It is based on a sampling approach, where a systematic grid is superimposed over the national territory. In each plot the land use is assessed by national experts on any land usage or disturbance such as fires, agriculture, grazing, etc.

The land use assessment grid has plots every 2,5km with a total of 7702 plots. Each plot represents an area of 0,5 ha to represent the national forest definition. Each of the plots contains 49 samples to help with the visual interpretation. The period cover is the land use and land use changes that occurred between 2000 and 2022. Figure 5 below shows how the grid and the plots are seen on the CfRN LUA.

*Figure 5:**Grid and plot structure***

[7] https://lua.rainforestcoalition.org/

The protocol for the land use assessments included; hierarchy of land classes, matrix of impossible and possible land use conversions, roles and tasks for data collection, interpretation keys as well as disturbances. See Annex II : Protocol for the Land Use assessment

3.3.2 Methods for estimating activity data

Each plot assessed has a story of land use and land use change and disturbance that may have occurred, such as fire. Each plot represents an area of the country. The sum of all the plots represent the country area. To calculate the area of each plot, the plot is multiplied by an expansion factor.

The proportion of each assignment category (pi), also known as the expansion factor, is obtained by dividing the number of points in the given category (ni), by the total number of points available for collection (n).

$$p_i = \frac{ni}{n}$$

The area is calculated by multiplying the proportion of each category (expansion factor) by the total area inventoried.

$$A_i = A\ x\ p_i$$

The confidence interval is derived from the calculation of the standard error of area estimation (described in Appendix 3.A.3.5 of Volume 4 – 2006 IPCC GL) obtained by the following equation:

$$SD_i = A\ x \sqrt{\frac{p_i\ x\ (1 - p_i)}{n - 1}}$$

"Pi is the proportion of points in the particular land use category, A is the total known area, and n is the total number of sample points." Ultimately, the 95 percent confidence interval is obtained by multiplying the standard error by the independent coefficient for the confidence level, i.e. 1.96.

Country area (km²)	750	75000
Expansion factor	46,73	
STEP 2 - AREA ESTIMATION (Plot count * Exp. Factor)		
	3210	150000
Row Labels	Count of Transition Coding	Area
CC/CANNUAL/_	130	6074,8
CC/CPER/_	84	3925,2
CF/CANNUAL>FRAIN_2013/Hurricane_2017	1	46,7
CG/CANNUAL>GGRASS_2014/_	1	46,7
CG/CPER>GGRASS_2014/_	1	46,7
CG/CPER>GGRASS_2018/_	1	46,7
CG/CPER>GWGRASS_2017/_	1	46,7
CS/CANNUAL>SSET_2016/_	1	46,7
CS/CPER>SSET_2014/_	1	46,7
FC/FCLOUD>CANNUAL_2011/_	1	46,7
FC/FDEC>CANNUAL_2005/_	1	46,7
FC/FDSCRUB>CANNUAL_2011/_	1	46,7
FC/FEVER>CANNUAL_2017/_	1	46,7
FC/FEVER>CANNUAL_2018/_	1	46,7

Figure 6: Example of the calculation of the areas of the plot groups

All activity data used in this FRL comes from CfRN LUA Assessment, October 2023 and is composed of:

Table 12: ***Method for estimating activity data***

Data included		Final format of the Activity data
	Area of land and land use change	
- Forest remaining forest - Land converted to forest - Forest converted to land *Other data Not relevant for REDD+* - *Non-forest land remaining* - *Non forest Land conversion to other non-forest land*		Annual matrices of land use and land use change (see full tables in Annex I : Area of land and land use change) 1. **Matrix I:** Total area in hectares split by land use remaining and land converted in that year 2. **Matrix II:** For land in transition in hectares. These matrices represent the land that has been converted to a new land use but that needs 20 years for its carbon stocks to reach new stability. For example: Grassland is converted to Forestland in 2005, the Dead Organic matter and the Soil will need 20 years to reach new stability: year of conversion 2005 + transition **19** = new stability reached **2024**. Calculation sheets on tab **LAND_AD**
	Area where logging was monitored	
- Logging on plantations, wattle forest and woodlots where the management practice is to expect some wood extraction through time - Logging on natural forest such as Dryer Acacia Savannah forest, Moister Acacia Savannah forest, Montane and Highland forest, Riparian, where extraction of wood is illegal and not planned.		Annual area of forest that is logged by forest types. Average of proportion of the area that is affected by the logging (fd) Calculation sheets on tab **FL_ΔCL**
	Area where disturbances were monitored	
Different types of disturbances can be monitored on the forestland. Natural and uncontrolled disturbances included in this assessment are **pests**. The anthropogenic degradation		Annual area of forest that is disturbed by Infrastructure, agriculture, grazing, firebreaks, pest and mining

monitored during this assessment are **agriculture, infrastructure, grazing, firebreaks and mining**. Areas affected by **fires** have been included and are estimated separately to other disturbances.		Average of proportion of the area that is affected by disturbance (fd) Annual area of forest affected by fire Average of proportion of area affected by the fire (fd) Calculation sheets on tab **FL_ΔCL**

3.3.2.I Land Use classes and changes through time

All six land use IPCC categories as well as subnational categories were assessed during the data collection. In 2020, the country is covered at 46% of forestland, 24 % of grassland, 23% of cropland, 3% of settlement, the rest between wetland and other land as presented in the table below. The land is quite stable through the years. The conversion from and to forest is minimal and presented in matrix in annex I of this report. The main conversion is forest to cropland (27% of conversions). However, there is also a high number of new forests being created through the years (30% of conversions).

3.3.3 Methods for estimating carbon stocks and carbon stock changes

The information on Emission/Removal Factors (EF/RF) was obtained in part from default values of the 2006 IPCC Guidelines, that have been also used for the Eswatini National Greenhouse Gas Inventory: Agriculture, Forestry and Land Use (AFOLU) Sector Report from October 2020. The other part of the values used in this report come from the South African study prepared by the Department of Environmental Affairs in 2015 (Department of Environment Affairs, 2015).

South Africa study - National Terrestrial Carbon Sinks Assessment 2015 (Tier 1)

In 2015, South Africa published their National Terrestrial Carbon Sinks Assessment. This report was prepared to allow the country to report on their Nationally Determined Contributions and Enhanced Transparency framework. It provides information on the carbon stocks, their dynamics, drivers and climate change mitigation and adaptation opportunities. South Africa also worked on the Carbon Sink Atlas (CSA), whose results are also included in the previous mentioned report. The CSA provides spatial distribution data on carbon stocks and fluxes across the country.

The methodology assesses the carbon stocks and fluxes with a wall to wall mapping of land areas of the whole country in combination with geostatistical methods, models and remote sensing to extrapolate the large set of field measurements.

Carbon stocks of the different pools, namely biomass and dead organic matter, were estimated using remotely sensed tree height from ICESAT-GLAS and canopy cover (MODIS) and published data from IPCC guidelines. Soils carbon pools are from the Africa Soil Property map which was created based on 3000 soil profiles in South Africa and 6000 elsewhere on the African continent. This information is reported into the National Land Cover studies 1990-2014 and 2018. It is expected that it will be produced at two-year intervals in the future.

For their 4th National Communications, Eswatini used emissions factors from the South African studies to estimate emissions and removals from the land sectors. In a view to maintain as much consistency as possible with the latest GHGI, this Forest Reference level used most of these same emissions factors as described in the following chapter.

The link between South African classes and Eswatini classes are as followed:

Table 13: ***Land use classes between the different reports to extract emission/removal factors***

IPCC land use classes	South African classes 2015	Eswatini GHGI 2020	Eswatini FRL 2024
Forestlands	Woodland- Thickets	Indigenous forest	**Montane and Highland Forest**
			Moist Acacia Savanna Forest
			Dry Acacia Savanna Forest
			Riparian Forest
	Plantations	Plantation	**Plantations**
			Wattle forest
			Woodlot
Croplands	Annual Crop	Croplands irrigated	**NA**
		Cropland rainfed	**Annual Croplands**
			Agroforestry
	NA	NA	**Perennial Cropland**
Grasslands	Grasslands	Grasslands	**Bushveld**
			High mountain grassland
Wetlands	Wetland	Wetland	**Natural Water body**

			Artificial Water body
Settlements	Settlements	Settlement	**Settlement**
			Woody settlement
Other lands	Other land	Other land	**Other land**
			Mines

The carbon pools included with the related values are presented in the two tables below.

Table 14: ***Tier used and reference by carbon pools***

Completeness	***AGB***	***BGB***	***DOM***	***SOC***
Dryer Acacia Savannah Forest	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Moister Savannah Forest	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Montane and Highland	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Plantations	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Riparian	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Wattle Forest	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Woodlots	Tier 1, SA	Tier 1, SA	Tier 1, SA	Tier 1, DE
Annual Crops	Tier 1, SA	Tier 1, DE	Tier 1, DE	Tier 1, DE
Perennial Crops	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Agroforestry	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Bushveld - Before	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Bushveld - after	Tier 1, SA	Tier 1, DE	Tier 1, DE	Tier 1, DE
High Mountain grasslands - Before	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
High Mountain grasslands - after	Tier 1, SA	Tier 1, DE	Tier 1, DE	Tier 1, DE
Natural Water Body	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Artificial Water Body	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Settlement	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Woody Settlement	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Other Lands	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE
Mine	Tier 1, SA	Tier 1, DE	Tier 1, SA	Tier 1, DE

AGB: above-ground biomass, **BGB**: below-ground biomass, **DOM**: Dead organic matter (deadwood & litter), **SOC**: soil organic carbon.

CS = country specific, **SA** = National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa, **DE** = IPCC default value

Table 15: ***Tier used and reference by carbon pools***

	Gw	***(1+R)***	***Gtotal***	***CF***	***ΔCG***
Dryer Acacia Savannah Forest	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Moister Savannah Forest	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Montane and Highland	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Plantations	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Riparian	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Wattle Forest	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Woodlots	Tier 1, SA	Tier 1, SA	Tier 1	Tier 1, DE	Tier 1
Annual Crops	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Perennial Crops	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Agroforestry	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Bushveld	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
High Mountain grasslands	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Natural Water Body	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Artificial Water Body	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Settlement	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Woody Settlement	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Other Lands	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1
Mine	Tier 1, DE	Tier 1	Tier 1	Tier 1, DE	Tier 1

Gw: Average annual above-ground biomass growth (tons d.m./ha/yr.)**; R:** is the ratio of BGB to AGB (tons d.m./ha/yr.)**; Gtotal:** Mean annual biomass growth (tons d.m./ha/yr.) [Note 1]**; CF:** Carbon fraction of dry matter (tons C/tons d.m.)**;ΔCG**: Annual increase in biomass carbon stocks due to biomass increment (tons C/ha/yr.)

CS = country specific, **SA** = National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa, **DE** = IPCC default value

Source: Calculation spreadsheet, tab Land_EF-RF

3.3.4 Methods for estimating uncertainties

This FRL submission provides a description of the uncertainty related to the data used. No propagation error estimate was applied to the FRL at this moment as not all the information is available to do a proper propagation analysis. This will be included in the improvement plan for future submissions.
The section 4.3 includes a detailed qualitative explanation on the uncertainty for each type of data included in this FRL.

4. Estimation of the emissions/removals for FRL

4.1 IPCC Methodologies applied

For the estimation of GHG emissions and removals, Eswatini has followed the 2006 IPCC guidelines. It includes the analysis for Land remaining in a land-use category and lands converted to a new land-use category. The estimation of the emissions and removals used a combination of: (a) country-specific data; (b) emissions factors from the regions and default values from IPCC and (c) IPCC methodologies Tier 1 were applied. All definitions, methods and assumptions are described.

Good practice: To ensure high quality in the GHG inventories, IPCC guidelines provide a set of good practice that Eswatini implemented in the following manner:

- Transparency: All background information used to produce Eswatini's FRL is openly available. National reports and documentation are made available through an online shared folder. This folder contains the Calculation tool of Eswatini which present all the details of the activity data, the random error estimation for the activity data and the estimations for emissions and removals.file:///G:\My%20Drive\Ewatini%20FRL%20Documents\ESWATINI_FRL_CalculationSheets_2024.xlsx
- Accuracy: The data included in this report is the most accurate data available at this time in Eswatini. The activity data covers the whole country and all the land use change dynamic for a period of twenty years. This data provides also information about the area of forest land that is affected by logging, fire and other disturbances such as agriculture, grazing, etc.
- Consistency: The methodology applied for the estimation is annual and consistent through the whole period from 2000 to 2020. The information produced for this FRL will be used for future GHGI submissions for this sector to increase consistency between the reports.

*Table 16:**Method applied for the estimations of emissions/removals on Forest land***

Carbon pool	Land category	
	Forest land remaining forest land	**Land converted to/from forest land**
Biomass	**Gain-loss method** Gains: 2006 IPCC GL equation 2.9 - section 4.1.2 of this report - *Details of estimation included in calculation sheet Land_ΔCO2 using Matrix type I* [8] Losses: equations 2.11 - *Details of estimation included in calculation sheet Land_ΔCL*	**Carbon stock change** difference following 2006 IPCC GL equation 2.15 - section 4.1.5 of this report - *Details of estimation included in calculation sheet Land_ΔCO2 using Matrix type I*
Dead organic matter	The Tier 1 assumption - zero changes - section 4.1.3 of this report	**Carbon stock change** following 2006 IPCC GL equation 2.23 - section 4.1.6 of this report

[8] See explanation of Matrix types in figure 7 below

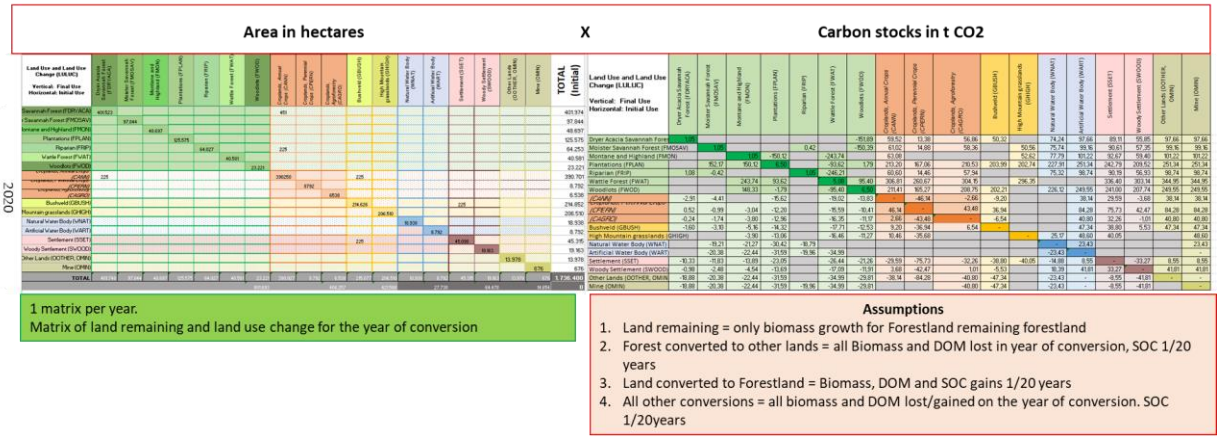
		- Details of estimation included in calculation sheet Land_ΔCO2 using Matrix type I and II
Soil	The Tier 1 assumption - zero changes - section 4.1.3 of this report	**Carbon stock change** following 2006 IPCC GL equation 2.25 - section 4.1.7 of this report *- Details of estimation included in calculation sheet Land_ΔCO2 using Matrix type I and II*
Fire	**Non CO2** - 2006 IPCC GL equation 2.27 - section 4.1.8 of this report *- Details of estimation included in calculation sheet Land_ΔCL*	All fires are assumed in forest land remaining forest land

The equations were applied to each of the land use dynamics included in the matrix of land use and land use change. However only the estimations related to forest are presented in this report following IPCC methods.

To ensure that the land in transition is estimated (following IPCC assumption the land converted is under transition for 20 years), two types of matrices where applies as presented in the figure below. On the left the matrices for the area of land and use change and on the right the matrices with carbon stock changes for carbon pools of biomass, DOM and SOC. What are called Matrix type 1 are the matrix with land use remaining and land use converted on that year. What are called Matrix type 2 are represent the addition of the land in transition for the last 19 years.

Matrix I and Matrix II - **Gains** on forest land remaining **+**
Carbon stock change on land converted to/from forest land

Matrix type I



Assumptions

1. Land remaining = only biomass growth for Forestland remaining forestland
2. Forest converted to other lands = all Biomass and DOM lost in year of conversion, SOC 1/20 years
3. Land converted to Forestland = Biomass, DOM and SOC gains 1/20 years
4. All other conversions = all biomass and DOM lost/gained on the year of conversion. SOC 1/20years

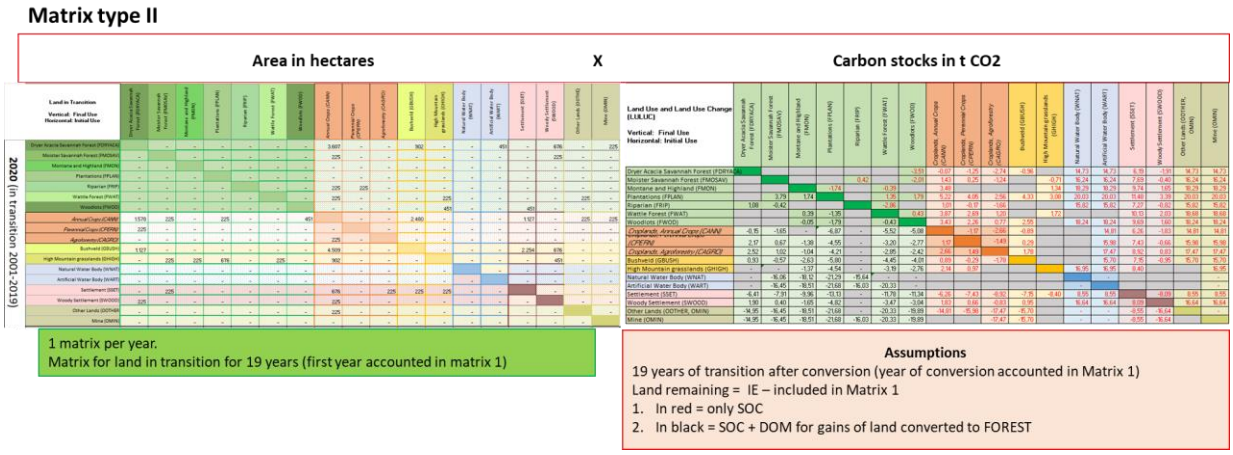


Figure 7: ***Two types of matrices for land use and land in transition***

4.1.1 Annual carbon stock changes for a stratum of a land-use category as a sum of changes in all pools (IPCC Equation 2.3, Ch2, V4)

$$\Delta CLUi = \Delta CAB + \Delta CBB + \Delta CDW + \Delta CLi + \Delta CSOC + \Delta CHWP$$

Where:

ΔCLU$_i$ = carbon stock changes for a stratum of a land-use category. subscripts denote the following carbon pools:

AB = above-ground biomass
BB = below-ground biomass
DW = deadwood
LI = litter
SOC = soils
HWP = harvested wood products

Table 17: ***Carbon pools included***

	Included
ΔC$_{AB}$	Yes
ΔC$_{BB}$	Yes
ΔC$_{DOM}$	Yes
ΔC$_{SOC}$	Yes
ΔC$_{HWP}$	No

Clarification Notes

Data on HWP was not available.

4.1.2 Change in biomass carbon stocks (above-ground biomass and below-ground biomass) in forest lands remaining in the same category

Annual change in carbon stocks in biomass in forest land remaining in the same category (gain-loss method) (IPCC Equation 2.7, Ch2, V4)

$$\Delta C = \Delta CG - \Delta CL$$

Where:

ΔC_B = annual change in carbon stocks in biomass for each land sub-category, considering the total area, tonnes C yr^{-1}

ΔC_G = annual increase in carbon stocks due to biomass growth for each land sub-category, considering the total area, tonnes C yr^{-1}

ΔC_L = annual decrease in carbon stocks due to biomass loss for each land sub-category, considering the total area, tonnes C yr^{-1}

Annual increase in biomass carbon stocks due to biomass increment in forest land remaining in the same land-use category (IPCC Equation 2.9, Ch2, V4)

$$\Delta CG = \sum_{i,j} (Ai,j \bullet GTOTAL\, i,j \bullet CFi,j)$$

Where:

ΔC_G= annual increase in biomass carbon stocks due to biomass growth in land remaining in the same land-use category by vegetation type and climatic zone, tonnes C yr^{-1}
A = area of land remaining in the same land-use category, ha
GTOTAL= mean annual biomass growth, tonnes d. m. ha^{-1} yr^{-1}
i = ecological zone (i = 1 to n)
j = climate domain (j = 1 to m)
CF = carbon fraction of dry matter, tonne C (tonne d.m.)$^{-1}$

Table 18: **Sources of activity data for land remaining**

A: area of land remaining in the same land-use category			
LU	**Sub-Category**	**Source**	**Notes**
F	Forest lands	CfRN LUA assessment 2023 –under Ministry of Tourism and Environmental Affairs	Annual time series 2000-2020 see matrix of land area in Annex I of this report also available available in calculation sheet tab Land_AD
C	Croplands		Not applicable for REDD+
G	Grasslands		
W	Wetlands		
S	Settlements		
O	Other lands		

Table 19: **Carbon fraction values**

CF: Carbon Fraction t C (t d.m.)$^{-1}$						
LU	**Category**	**Value**	**Default Value (tier 1)**	**Error o range reported**	**Source**	**Comments and assumptions**
F	**Dryer Acacia Savannah Forest**	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest.
	Moister Savannah Forest	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest
	Montane and Highland	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest
	Plantations	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest
	Riparian	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest
	Wattle forest	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest
	Woodlot	0,47	X	(0,44 - 0,49)	2006 IPCC, Vol 4, Ch4, Table 4.3. Carbon fraction of aboveground forest biomass	Tropical/Subtropical forest
C	**Annual Crops**	0	X		Assumption	
	Perennial Crops	0	X		Assumption	
	Agroforestry	0	X		Assumption	
G	**Bushveld**	0	X		Assumption	
	High Mountain grasslands	0	X		Assumption	
W	**Natural Water Body**	0	X		Assumption	
	Artificial Water Body	0	X		Assumption	
S	**Settlements**	0	X		Assumption	
	Woody Settlements	0	X		Assumption	
O	**Other Lands**	0	X		Assumption	
	Mining	0	X		Assumption	

Clarification Notes

IPCC 2006 Default values are used as to date not country-specific research has been carried out.

Table 20: **Values of ratio of below to above ground biomass**

R: Ratio of below ground biomass to above ground biomass					
LU	**Category**	**Type**	**Value**	**Source**	**Comments and assumptions**
F	**Dryer Acacia Savannah Forest**	Indigenous	0,24	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Moister Savannah Forest	Indigenous	0,24	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Montane and Highland	Indigenous	0,24	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Plantations	plantation	0,28	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Riparian	Indigenous	0,24	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Wattle forest	plantation	0,28	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Woodlot	plantation	0,28	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
C	**Annual Crops**		NE	Assumption Tier 1	
	Perennial Crops		NE	Assumption Tier 1	
	Agroforestry		NE	Assumption Tier 1	
G	**Bushveld**		NE	Assumption Tier 1	
	High Mountain grasslands		NE	Assumption Tier 1	
W	**Natural Water Body**		NE	Assumption Tier 1	
	Artificial Water Body		NE	Assumption Tier 1	
S	**Settlements**		NE	Assumption Tier 1	
	Woody Settlements		NE	Assumption Tier 1	
O	**Other Lands**		NE	Assumption Tier 1	
	Mining		NE	Assumption Tier 1	

Average annual increment in biomass [Tier 1] (IPCC Equation 2.10, Ch2, V4)

$$GTOTAL = \sum_{i,j} \{GW \bullet (1 + R)\}$$

Where:

GTOTAL = average annual biomass growth above and below-ground, tonnes d. m. ha^{-1} yr^{-1}

GW = average annual above-ground biomass growth for a specific woody vegetation type, tonnes d. m. ha^{-1} yr^{-1}

R = ratio of below-ground biomass to above-ground biomass for a specific vegetation type, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$.

Table 21: **Values for Net biomass growth tonnes d. m. ha-1 yr-1**

GW: Net biomass growth tonnes d. m. ha-1 yr-1						
LU	**Category**	**Type**	**Value**	**TIER**	**Source**	**Comments and assumptions**
F	**Dryer Acacia Savannah Forest**	Indigenous	0,9	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Moister Savannah Forest	Indigenous	0,9	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Montane and Highland	Indigenous	0,9	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Plantations	plantation	9,79	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	See explanation below
	Riparian	Indigenous	0,9	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Wattle forest	plantation	9,79	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	See explanation below
	Woodlot	plantation	9,79	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	See explanation below

Clarification Notes

The time to reach maximum stock is estimated to be 20 years as per IPCC default assumptions.
For the forest categories no country specific values are available now of the report, the values used come for a study undertaken in South Africa.
Eswatini is aware that the value for the Plantation is very high and although national experts are confident that plantations have a higher capacity of growth rate than natural forest, plantation are a big part of national forest, the country will put more efforts to collect national information to improve the estimation of removals coming from planted forests.

Annual decrease in carbon stocks due to biomass losses in forest land remaining in the same land-use category (IPCC Equation 2.11, Ch2, V4)

$$\Delta CL = \Delta Lwood - removals + \Delta Lfuelwood + \Delta Ldisturbance$$

Where:

ΔC_L= annual decrease in carbon stocks due to biomass loss in land remaining in the same land-use category, tonnes C yr^{-1}

Lwood-removals = annual carbon loss due to wood removals, tonnes C yr^{-1} (See Equation 2.12)

Lfuelwood = annual biomass carbon loss due to fuelwood removals, tonnes C yr^{-1} (See Equation 2.13)

Ldisturbance = annual biomass carbon losses due to disturbances, tonnes C yr^{-1} (See Equation 2.14)

Annual carbon loss in biomass of wood removals (IPCC Equation 2.12, Ch2, V4)

$$Lwood-removals = \{Alogged \bullet fraction\,affected \bullet C \bullet (44/12)\}$$

Where:

Lwood-removals = annual carbon loss due to biomass removals, tonnes CO2 yr^{-1}

Alogged = Area of forest that is affected by planned and unplanned logging, ha

Fraction affected = proportion of plot that is affected by logging on average, %

C = Carbon stock available in each forest types for logging, included aboveground and belowground biomass, tonne C $(ha)^{-1}$

(44/12) = conversion of t C to t CO2

Table 22: **Annual wood removals values**

Area = Area of forest affected by logging (ha)							
Year	**Dryer Acacia Savannah Forest**	**Moister Savannah Forest**	**Montane and Highland**	**Plantations**	**Riparian**	**Wattle forest**	**Woodlot**
2000	NO	NO	225	4284	225	225	NO
2001	225	NO	NO	1804	NO	451	NO
2002	NO	NO	NO	2029	NO	225	NO
2003	NO	NO	NO	1578	NO	NO	NO
2004	NO	NO	NO	1804	NO	NO	NO
2005	NO	NO	NO	3156	NO	NO	NO
2006	NO	NO	NO	3382	NO	NO	NO
2007	NO	NO	NO	2254	NO	451	NO
2008	NO	NO	451	6989	NO	451	676
2009	NO	225	225	4284	NO	NO	NO
2010	NO	NO	NO	2705	225	NO	NO
2011	NO	NO	NO	4960	NO	NO	225
2012	NO	NO	NO	3382	NO	NO	225
2013	NO	NO	NO	5185	NO	902	225
2014	NO	NO	NO	2705	NO	676	NO
2015	NO	NO	NO	4509	NO	225	225
2016	NO	NO	NO	7440	NO	NO	225
2017	NO	NO	NO	5411	NO	225	225
2018	NO	NO	NO	2480	NO	NO	225
2019	NO	NO	NO	4284	NO	225	NO
2020	NO	NO	NO	3607	225	225	NO
Error	Interpretation error estimated at 18% for random error see calculation sheet Land_AD-RandomError						
source	CfRN LUA Assessment, 2023 available in calculation sheet tab FL_ΔCL						

NO = Not occuring

Table 23: **Fraction affected**

Fraction affected: Average fraction of biomass loss (%)				
LU	**Sub-Category**	**Value**	**Forest types**	**source**
F	Planned logging	81,56%	FDRYACA, FMOSAV,FMON, FRIP	CfRN LUA Assessment October 2023
	Unplanned logging	53,38%	FPLAN, FWAT, FWOD	CfRN LUA Assessment October 2023

Table 24: **Biomass available for logging tonnes C ha-1 yr-1**

AG & BG biomass: Biomass available for logging tonnes C ha-1 yr-1					
LU	**Category**	**Type**	**Value**	**TIER**	**Source**
F	**Dryer Acacia Savannah Forest**	Indigenous	11,6	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8
	Moister Savannah Forest	Indigenous	11,6	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8
	Montane and Highland	Indigenous	11,6	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8
	Plantations	plantation	31,28	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8
	Riparian	Indigenous	11,6	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8
	Wattle forest	plantation	31,28	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8
	Woodlot	plantation	31,28	TIER 1	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8

Clarification Notes

Unplanned logging refers to the wood that is extracted on the natural forest such as Dryer Acacia Savannah Forest, Moister Acacia Savannah Forest, Montane and Highland Forest, Riparian forest. The extraction is smaller and less consistent. The planned logging is for the forest types that have a management practice that plan for logging extraction such as plantations, Wattle and Woodlots.

Annual carbon loss in biomass of fuelwood removal

Fuelwood extraction is included in the roundwood section as this was extracted from the remote sensing data that see all types of wood extractions for every forest type. In the case of Eswatini, fuelwood is very common practice in the country. For example, it is expected that local communities will use the Wattle Forest and the woodlots to extract fuelwood. Further studies will be implemented to be able to extract a more precise value. At this point the only data available was FAOSTAT but this would have included a double count of part of the estimations because of the extraction captured by remote sensing. Small extraction of branches and small trees are most likely not captured by remote sensing. However, a good part of the bigger extraction of big trees will be captured by remote sensing and included in the roundwood estimations above.

Annual carbon losses in biomass due to disturbances (IPCC Equation 2.14, Ch2, V4)

$$Ldisturbance = Adisturbance \bullet BW \bullet (1+R) \bullet CF \bullet fd$$

Where:

Ldisturbances = annual other losses of carbon, tonnes C yr^{-1}

Adisturbance = area affected by disturbances, ha yr^{-1}

BW = average above-ground biomass of land areas affected by disturbances, tonnes d.m. ha^{-1}

R = ratio of below-ground biomass to above-ground biomass, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$.

CF = carbon fraction of dry matter, tonne C (tonnesd.m.)$^{-1}$

fd = fraction of biomass lost in disturbance

Table 25: **Area disturbed in forest land (excluding fire)**

Adisturbance : area affected by disturbances (ha)							
Year	**Agriculture**	**Infrastructure**	**Firebreak**	**Grazing**	**Storm**	**Pest**	**Mine**
2000	225	NO	NO	NO	NO	NO	NO
2001	NO	NO	NO	NO	NO	NO	NO
2002	225	NO	NO	NO	NO	NO	NO
2003	NO	NO	NO	NO	NO	NO	NO
2004	NO	NO	NO	NO	NO	NO	NO
2005	676	225	NO	NO	NO	NO	NO
2006	NO	NO	NO	NO	NO	NO	NO
2007	225	NO	NO	NO	NO	NO	NO
2008	225	225	451	225	225	NO	NO
2009	NO	NO	451	451	NO	225	NO
2010	NO	NO	NO	225	NO	NO	NO
2011	NO	NO	NO	NO	NO	NO	NO
2012	NO	225	NO	225	225	NO	NO
2013	225	NO	NO	225	NO	NO	NO
2014	NO	NO	NO	NO	NO	NO	NO
2015	NO	NO	NO	451	225	NO	NO
2016	451	225	NO	225	NO	NO	NO
2017	451	225	451	451	NO	NO	NO
2018	NO	451	NO	NO	NO	NO	NO
2019	225	451	NO	225	NO	NO	NO
2020	NO	451	NO	NO	NO	NO	NO
Error	Interpretation error estimated at 18% for random error see calculation sheet Land_AD-RandomError						
Source	CfRN LUA Assessment 2023 available in calculation sheet tab FL_ΔCL						

NO= Not occurring

Table 26: **Biomass affected during disturbance**

Biomass lost after a disturbance					
LU	**Category**	**Value**	**Error of range reported**	**Source**	**Comments and assumptions**
FL	**Biomass affected by disturbance**	19		Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	Average of above ground biomass for indigenous forest, and plantations
FL	**Ration of below biomass**	0,37		Mills et al. (2005), Van der Vyver et al. (2013) & Du Toit et al. (2016)	Average of above ground biomass for indigenous forest, plantations and Wattle forest
FL	**Carbon fraction**	0,47	(0.44 - 0.49)	IPCC 2006 Table 4.3	

Table 27: **Fraction of biomass loss due to disturbances**

fd: Fraction of biomass loss due to disturbance (dimensionless)							
LU	**Agriculture**	**Infrastructure**	**Firebreak**	**Grazing**	**Storm**	**Pest**	**Mine**
Forests	0,44	0,39	0,76	0,50	0,67	0,01	0,40
source	Average of fraction disturbed assessed during the Data collection on CfRN LUA Ap						

Clarification Notes

Fd values were selected based on expert judgment of the interpreters who did the CfRN LUA Assessment in 2023, estimated as an average of the lost seen in the images, caused the by the indicated disturbance.

4.1.3 Change in dead organic matter carbon stock in forest land remaining in the same category

The Tier 1 assumption for both dead wood and litter pools for all forest land sub-categories is that their stocks are not changing over time if the land remains within the same land-use category. Thus, the carbon in biomass killed during a disturbance or management event (less removal of harvested wood products) is assumed to be released entirely to the atmosphere in the year of the event.

4.1.4 Change in soil organic carbon stock in forest land remaining in the same category

The assumption in Tier 1 is that the SOC carbon stocks in all Forest land Remaining Forest land are insignificant or are not changing and therefore no emission/removal factors and activity data are needed.

4.1.5 Change in biomass carbon stocks (above-ground biomass and below-ground biomass) in land converted to a new land-use category

Annual change in biomass carbon stocks on land converted to other land-use category (IPCC Equation 2.15, Ch2, V4)

$$\Delta CB = \Delta CG + \Delta CCONVERSION - \Delta CL$$

Where:

ΔC_B= annual change in carbon stocks in biomass on land converted to other land-use category, in tonnes C yr^{-1}

ΔC_G= annual increase in carbon stocks in biomass due to growth on land converted to another land-use category, in tonnes C yr^{-1}

$\Delta C_{CONVERSION}$ = initial change in carbon stocks in biomass on land converted to other land-use category, in tonnes C yr^{-1}

ΔC_L = annual decrease in biomass carbon stocks due to losses from harvesting, fuel wood gathering and disturbances on land converted to other land-use category, in tonnes C yr^{-1}

Table 28: **Sources of area of land converted to a land-use category**

A: area of land converted to a land-use category			
LU	**Sub-Category**	**Source**	**Notes**
Non-F>F	Non-Forest Lands > Forest Lands	Ministry of Tourism and Environmental Affairs	CfRN LUA App – Annual time series 2000-2022
F>C	Forest lands > Croplands	Ministry of Tourism and Environmental Affairs	CfRN LUA App – Annual time series 2000-2022
F>G	Forest lands > Grasslands	Ministry of Tourism and Environmental Affairs	CfRN LUA App – Annual time series 2000-2022
F>W	Forest lands > Wetlands	Ministry of Tourism and Environmental Affairs	CfRN LUA App – Annual time series 2000-2022
F>S	Forest lands > Settlements	Ministry of Tourism and Environmental Affairs	CfRN LUA App – Annual time series 2000-2022
F>O	Forest lands > Other lands	Ministry of Tourism and Environmental Affairs	CfRN LUA App – Annual time series 2000-2022

Annual increase in biomass carbon stocks on land converted to other land-use category (IPCC Equation 2.9, Ch2, V4)

Annual increase in carbon stocks in biomass due to land converted to another land-use category is estimated to 0 of the year of conversion follow IPCC assumption. When a land is converted to a forest, the biomass growth will be assumed the year after the conversion as standard biomass growth. This was assumed as not specific data on biomass growth is presently available at national level.

Initial change in biomass carbon stocks on land converted to another land category (IPCC Equation 2.16, Ch2, V4)

$$\Delta CCONVERSION = \sum_{i} \{(BAFTER - BBEFORE) \bullet \Delta ATO\_OTHERS\} \bullet C$$

Where:

$\Delta C_{CONVERSION}$ = initial change in biomass carbon stocks on land converted to another land category, tonnes C yr^{-1}

$BAFTER_i$ = biomass stocks on land type i immediately after the conversion, tonnes d.m. ha^{-1}

$BBEFORE_i$ = biomass stocks on land type i before the conversion, tonnes d.m. ha^{-1}

ΔATO_OTHERS_i = area of land use i converted to another land-use category in a certain year, ha yr^{-1}

CF = carbon fraction of dry matter, tonnes C (tonnes d.m.)$^{-1}$

i = type of land use converted to another land-use category

Table 29: **Biomass available before or after conversion tonnes C. ha-1 yr-1**

B_Before or B_After : Biomass stocks tonnes C. ha-1 yr-1					
LU	**Category**	**AGB**	**BGB**	**Source**	**Comments and assumptions**
F	**Dryer Acacia Savannah Forest**	9,4	2.,26	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Moister Savannah Forest	9,4	2,26	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Montane and Highland	9,4	2,26	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Plantations	24,44	6,84	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Riparian	9,4	2,26	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Wattle forest	24,44	6,84	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Woodlot	24,44	6,84	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
C	**Annual Crops**	1,88	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Perennial Crops	25,38	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	

	Agroforestry	1,88	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
G	**Bushveld**	Bbefore : 4,62 Bafter: 2,26	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	For after conversion only herbaceous biomass is accounted. Before conversion herbaceous + woody biomass are accounted
	High Mountain grasslands	Bbefore : 4,62 Bafter: 2,26	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	For after conversion only herbaceous biomass is accounted. Before conversion herbaceous + woody biomass are accounted
W	**Natural Water Body**	2	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
	Artificial Water Body	0	0	Assumption	
S	**Settlements**	0	0	Assumption	
	Woody Settlements	1,97	0	Ministry of Tourism and Environmental affairs, 2020, Eswatini National GHGI: AFOLU sector report, Table 8	
O	**Other Lands**	0	0	Assumption	
	Mining	0	0	Assumption	

Clarification Notes

It is assumed that all the biomass is lost during the year of conversion when we have a forest converted to another land. When a land is converted to forest only a fraction of 1/20 is gained on the year of conversion. The rest is assumed under the forest remaining forest the following years equation 2.9 (this is to avoid double counting).

Annual decrease in carbon stocks in biomass due to losses, ΔCL (IPCC Equation 2.11-2.14, Ch2, V4)

Assumed to be 0 for the year of conversion following TIER 1 of IPCC Guidelines.

4.1.6 Change in dead organic matter in Carbon stock in land converted to a new land category

Land converted to another land-use category (IPCC Equation 2.23, Ch2, V4)

$$\Delta CDOM = \frac{(Cn - Co) * Aon}{Ton}$$

Where:

ΔC_{DOM} = annual change in carbon stocks in dead wood or litter, tonnes C yr-1

C_o = dead wood/litter stock, under the old land-use category, tonnes C ha-1

C_n = dead wood/litter stock, under the new land-use category, tonnes C ha-1

A_{on} = area undergoing conversion from old to new land-use category, ha

T_{on} = time period of the transition from old to new land-use category, yr. The Tier 1 default is 20 years for carbon stock increases and 1 year for carbon losses.

Table 30: **Dead wood/litter stock values**

DOM = Dead wood/litter stock tonnes C ha-1					
LU	**Category**	**DOM**	**Error o range reported**	**Source**	**Comments and assumptions**
F	**Dryer Acacia Savannah Forest**	1,19		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Moister Savannah Forest	1,19		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Montane and Highland	1,19		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Plantations	9,00		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Riparian	1,19		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Wattle forest	9,00		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Woodlot	9,00		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
C	**Annual Crops**	0		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Perennial Crops	6,23		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	GHGI TEAM 4th NAT COM
	Agroforestry	0		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
G	**Bushveld**	1,01		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	

	High Mountain grasslands	1,01		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
W	**Natural Water Body**	2,14		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
	Artificial Water Body	0		Assumption	
S	**Settlements**	0		Assumption	
	Woody Settlements	1,17		National Terrestrial Carbon Sinks Assessment: Technical Report (2020), Department of Environment, Forestry and Fisheries, Pretoria, South Africa	
O	**Other Lands**	0		Assumption	
	Mining	0		Assumption	

Clarification Note

Matrix type I: For lands converted to Forest lands, T=20, until Forest lands is considered stable (F>F), then changed to DOM=0. **Matrix type II:** To estimate the remaining 19 years after the year of conversion, same equation is applied but estimation on Matrix II (see Calculation tool tab Land_EF-RF). For Forest converted to land, T=1, meaning that all DOM is lost during the year of conversion.

4.1.7 Change in Carbon stock in soils in land converted to a new land category

Annual change in carbon stocks in mineral soils, tonnes C yr-1 (IPCC Equation 2.25, Ch2, V4)

$$\Delta CMineral = \frac{(SOCo - SOC_{o-t})}{D}$$

$$\Delta SOC = \sum_{c,s,i} \{(SOC_{REF} * F_{LU} * F_{MG} * F_I * A)\}$$

Where,

$\Delta C_{Mineral}$ = annual change in carbon stocks in mineral soils, tonnes C yr^{-1}

SOC0 = soil organic carbon stock in the last year of an inventory time period, tonnes C
SOC(0-T) = soil organic carbon stock at the beginning of the inventory time period, tonnes C
T = number of years over a single inventory time period, yr
D = Time dependence of stock change factors which is the default time period for transition between equilibrium SOC values, yr.
c **=** represents the climate zones, *s* the soil types, and *i* the set of management systems that are present in a country.

SOCREF = the reference carbon stock, tonnes C ha^{-1}

FLU = stockchangefactorforland-usesystemsorsub-systemforaparticularland-use, dimensionless
FMG = stock change factor for management regime, dimensionless
FI = stock change factor for input of organic matter, dimensionless
A = land area of the stratum being estimated, ha.

Table 31: **Soil organic carbon by land use sub-category [tC ha]**

SOC_ref in tonnes C. ha-1 yr-1					
LU	**Category**	**SOC ref**	**Error**	**Source**	**Comments and assumptions**
F	**Dryer Acacia Savannah Forest**	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Moister Savannah Forest	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Montane and Highland	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Plantations	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Riparian	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Wattle forest	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Woodlot	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
C	**Annual Crops**	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Perennial Crops	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Agroforestry	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
G	**Bushveld**	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	High Mountain grasslands	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
W	**Natural Water Body**	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Artificial Water Body	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
S	**Settlements**	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Woody Settlements	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
O	**Other Lands**	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral
	Mining	88	90%	IPCC 2006, Volume 4, Chapter 2, table 2.3	High Activity Clay Mineral

Table 32: **FLU, FMG and FI Values for values by Land use and sub-categories of land use**

	Notation	*FLU*	*FMG*	*FI*		
LU	**Category**	**Factor land use systems**	**Factor management regime**	**Factor input organic matter**	**error**	**Source**
		Dimensionless	**Dimensionless**	**Dimensionless**		
F	**Dryer Acacia Savannah Forest**	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
	Moister Savannah Forest	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
	Montane and Highland	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
	Plantations	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
	Riparian	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
	Wattle forest	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
	Woodlot	1	1	1	20%	IPCC 2006, Vol 4, Ch 4, pg 4.40
C	**Annual Crops**	0,69	1	0,95	13%	IPCC 2019 RF, Ch 5, Table 5.5,
	Perennial Crops	0,69	1,006	0,96	13%	IPCC 2019 RF, Ch 5, Table 5.5,
	Agroforestry	0.69	1	0,95	13%	same system as forest plantation, IPCC 2006, Vol 4, Ch 4, pg 4.40
G	**Bushveld**	1	0,939		40%	IPCC 2019 RF, Ch 6, Table 6.2
	High Mountain grasslands	1	0,939		40%	IPCC 2019 RF, Ch 6, Table 6.2
W	**Natural Water Body**	0	0	0	20%	Assumption TIER 1
	Artificial Water Body	0	0	0	20%	Assumption TIER 1
S	**Settlements**	0,831	1	1	20%	IPCC 2006, Vol 4, Ch 8, section 8.3.3.2
	Woody Settlements	1	1	1	20%	IPCC 2006, Vol 4, Ch 8, section 8.3.3.2
O	**Other Lands**	0	0	0	20%	TIER 1 - The reference C stock at the end of the 20 years default transition period is assumed to be zero.
	Mining	0	0	0	20%	TIER 1 - The reference C stock at the end of the 20years default transition period is assumed to be zero.

Clarification Note

Matrix type I : For lands converted to Forest lands, D=20, until Forest lands is considered stable (F>F), then changed to SOC=0. For Forest lands converted to other lands, D=20, until new land is considered stable, then change to SOC= 0.

Matrix type II: To estimate the remaining 19 years after the year of conversion, same equation is applied but multiplied by the area in Matrix II (see Calculation tool tab Land_EF-RF).

The SOC reference is a default value from IPCC that is used for the whole country. More detailed information about soil types in the country will be developed in future submissions.

4.1.8 Non-CO2 Emissions

Management of forest fires: The use of fire in Eswatini is recognized as an efficient tool in the management of natural forests and rangelands. Most of the burning that takes place in the natural woodlands is intended to improve grazing conditions. However, there is evidence that uncontrolled and random fires result in the destruction of natural forest resources and loss of biodiversity. There is no full understanding of the effects of the fire regimes occurring in Eswatini. Fires tend to favour certain species to the detriment of others and reduce overall diversity. Uncontrolled fires caused by strained social relations between forest companies and neighbouring communities also affect industrial forestry (Minister of Agriculture and Cooperatives, 2002).

Estimation of Greenhouse Gas Emissions from fires (IPCC Equation 2.27, Ch2, V4)

$$Lfire = A \bullet MB \bullet Cf \bullet Gef \bullet 10{-}3$$

Where:

Lfire = amount of greenhouse gas emissions from fire, tonnes of each GHG (CH4, N2O).
A = area burnt, ha
MB = mass of fuel available for combustion, tonnes ha^{-1}.
Cf = combustion factor, dimensionless
Gef = emission factor, g kg-1 dry matter burnt

Table 33: **MB, Cf, GefCH4, GefN2O values**

		MB *Cf	Gef CH4	Gef N2O
LU	**Sub-Category**	**Mass of fuel available for combustion * Combustion factor**	**Emission factor- CH4**	**Emission factor- N2O**
		tonnes ha^{-1}	g kg-1 dry matter burnt	g kg-1 dry matter burnt
F	Average of all forest types	23,93	3,5	0,24
	Error	Interpretation error 18%	SD ±2,8	SD ±0,23
	Reference	CfRN LUA Assessment, October 2023	IPCC 2006, V4, table 2.5 Average of Extra tropical forest and Savanna-Grassland	

Table 34: **Forest area burnt**

A= area of forest burnt (ha)				
Year	**Forest burnt**	**Error**	**Source**	**Notes**
2000	3.833	Interpretation error estimated at 18% for random error see calculation sheet Land_AD-RandomError	CfRN LUA Assessment, 2023 Available in calculation spreadsheet tab LFL_ΔCLand_AD	Average of the fire affecting all the forest types
2001	225			
2002	451			
2003	1.804			
2004	451			
2005	4.509			
2006	902			
2007	2.029			

2008	10.145			
2009	3.382			
2010	676			
2011	1.127			
2012	3.607			
2013	2.254			
2014	1.127			
2015	2.705			
2016	5’636			
2017	3’607			
2018	1’578			
2019	5’411			
2020	676			

A summary of the level of the methods used for activity data and emission factors is included in table below.

Table 35: **Methods and EF used for the FRL**

Category	CO_2		N_2O		CH_4	
	AD	**EF**	**AD**	**EF**	**AD**	**EF**
5. LULUCF						
A. Forest Lands	CS	T1	CS	T1	CS	T1
B. Croplands	CS	T1	NA	NA	NA	NA
C. Grasslands	CS	T1	NA	NA	NA	NA
D. Wetlands	CS	T1	NA	NA	NA	NA
E. Settlements	CS	T1	NA	NA	NA	NA
F. Other lands	CS	T1	NA	NA	NA	NA

T1 – Tier 1, T2 – Tier 2, T3 –Tier 3, CS – Country specific, D – IPCC default, IE – Included Elsewhere; NA – Not Applicable; NE – Not Estimates; NO – Not Occurring

4.2 Estimations of emissions and removals and the Forest Reference level

As presented in Section 1.1, Eswatini is a net carbon remover which means that the country removes more carbon than it emits CO2 for the forest sector. The table below presents the tonnes of CO2 equivalent removed for the historical period from 2000 to 2020. This reference level will cover the implementation period of 2021 to 2025. The full table is available in the Calculation sheet tab "Reporting table".

Table 36: **Forest related emissions and removals**

Emissions & removals (t CO2e)					
Year	**Forest land remaining Forest land (Gross gains)**	**Forest land remaining Forest land (Gross losses)**	**Land converted to Forest**	**Forest converted to land**	**Net removals**
2000	-5.269.797	431.154	-	-	**-4.823.943**
2001	-5.269.797	213.460	-	-	**-5.055.472**
2002	-5.269.797	212.550	-	-	**-5.055.518**
2003	-5.269.797	145.821	-	-	**-5.117.058**
2004	-5.269.363	166.653	-	10.318	**-5.090.663**
2005	-5.268.496	308.081	-7.922	-2.727	**-4.953.768**
2006	-5.273.798	312.474	-7.640	14.038	**-4.951.468**
2007	-5.274.232	261.452	-5.934	3.720	**-5.007.212**
2008	-5.272.498	793.828	-7.236	45.792	**-4.401.201**
2009	-5.267.195	430.221	-7.236	58.219	**-4.773.020**
2010	-5.266.762	259.903	-16.241	26.939	**-4.993.567**
2011	-5.272.064	479.127	-14.848	17.874	**-4.785.588**
2012	-5.257.458	348.197	-31.201	51.788	**-4.874.839**
2013	-5.259.192	592.299	-34.351	52.403	**-4.640.194**
2014	-5.258.325	312.474	-35.362	63.546	**-4.913.343**
2015	-5.257.025	474.229	-34.958	66.389	**-4.740.987**
2016	-5.254.423	725.260	-42.750	92.306	**-4.457.988**
2017	-5.249.988	577.864	-50.421	119.116	**-4.589.593**
2018	-5.251.289	257.454	-55.116	46.159	**-4.996.738**
2019	-5.259.292	433.121	-55.963	97.296	**-4.764.084**

2020	-5.263.293	366.756	-58.155	61.739	**-4.890.360**

The figure below presents the values in graphical format. This shows clearly the capacity of removals in Eswatini compared to the emissions

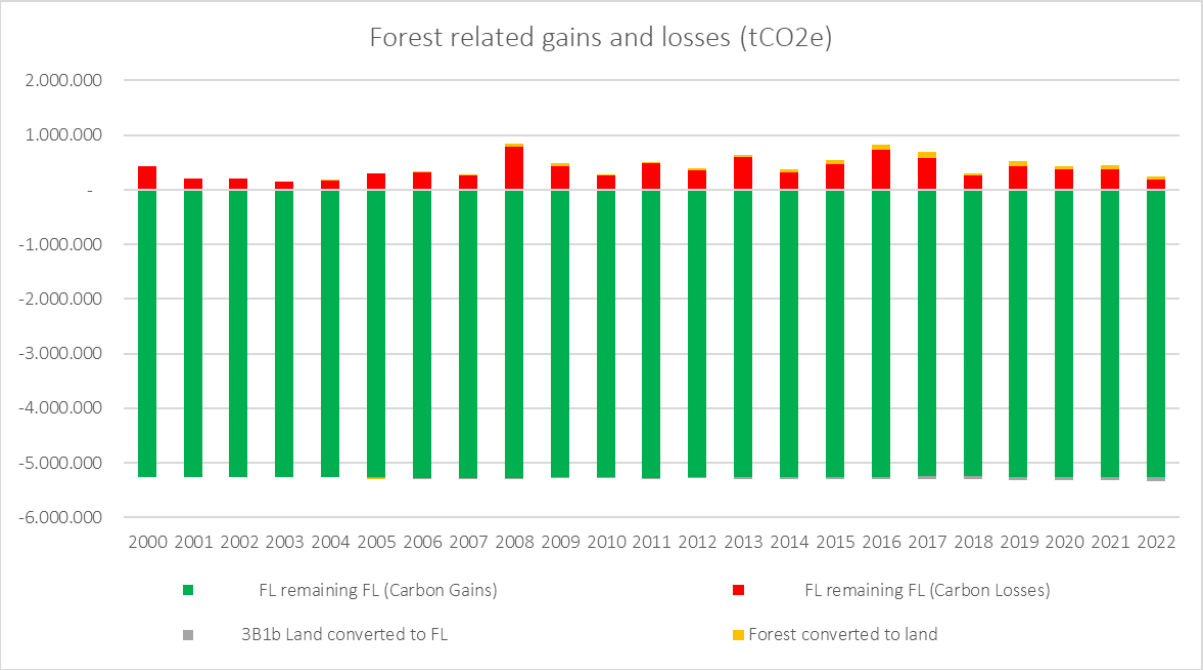


*Figure 8: E***missions and removals related to Forest land**

As presented in section 1.1 the below graph shows the net removals for the historical period 2000-2020 and the zero FRL for the period 2021-2025 that is presented in this report.

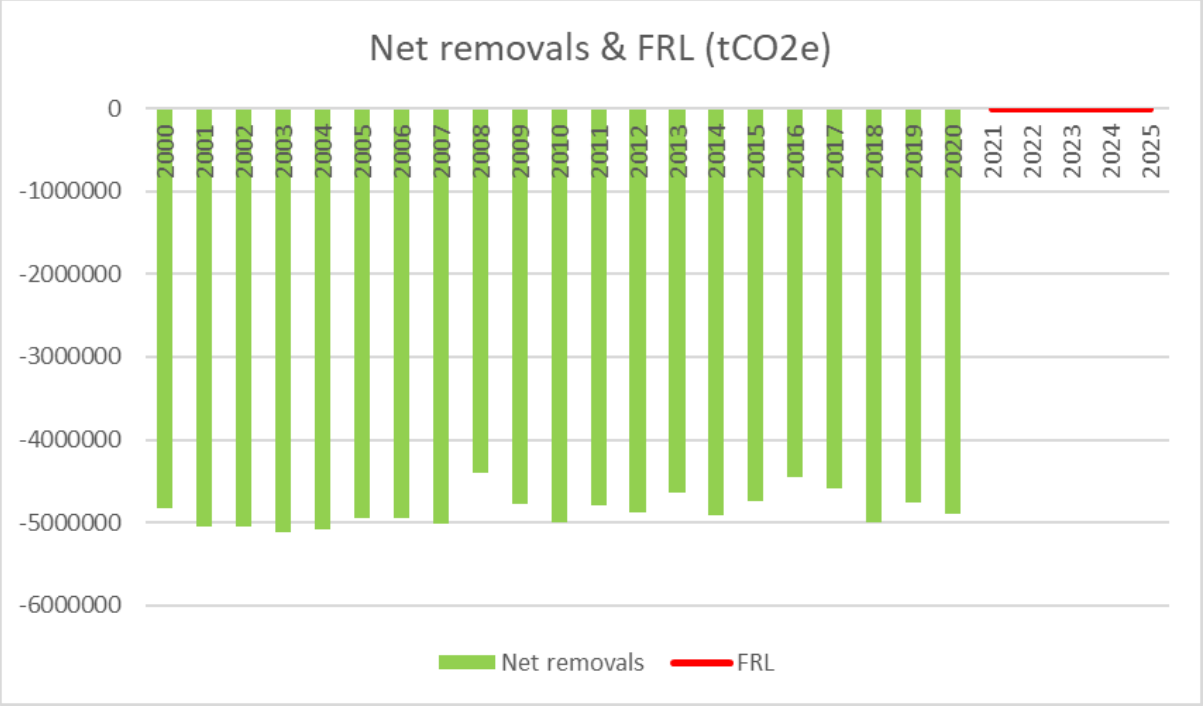


*Figure 9: **Total net removals for the historical period 2000-2020 & FRL***

4.3 Assessment of Uncertainties

The table below present a qualitative uncertainty assessment for the data used in this FRL.

*Table 37: **Summary of Uncertainty by data used***

Data	Related uncertainty
Area of land use, Area of land use change Area logged Area under a disturbance/fire from CfRN LUA Assessment, October 2023	**Systematic error** **Interpretation error 18%** The uncertainty of data collection was calculated on the following basis: **10% of the plots interpreted by national assignment classes** will be interpreted a second time by an external GIS expert. The result of this assessment show that 82% of the plot double check result in the same interpretation. **The error of interpretation is 18%** which is very good results for a first assessment. This represent the uncertainty related to the land use assessment and the possibility that a plot has been wrongly interpreted. Another systematic error comes from the **land in transition**: for each conversion, IPCC recommend to estimate 20years of land in transition before this land is in a new remaining category. To follow IPCC recommendation, Eswatini estimated the land in transition in order to apply the carbon stock changes through time for 20years. This is the reason why two types of Matrices are presented in this report. However, activity data available was only for the period 2000-2022. Which means that for many years, we do not have the full picture of the land in transition before the years 2000. For example, for year 2010 - the land of transition which should be included in matrix II - 2010 should represent the years 1990-2009 however we only have information from 2000-2009. Other related uncertainty not quantified above: - Lack of images available - Difference of resolution through the years - 2000 to 2015 Landsat and Google earth pro, after also Sentinel 2, Planet NICFI, etc. - Missing disturbance or logging because the area affected is very small **Random error** Random error is the variation above and below a mean value following the equation: 1,96if ni>30 or 2,365 if ni<30*s_AD/ADi*100 where: AD = area ADi = Standard deviation of area ni = number of plots The smaller the sampling the higher the uncertainty is. It was calculated for the activity data to provide the precision of this activity data. **The Uncertainty related to Forestland is calculated at 2% (see table below)** - the detail of the estimation is included in the Calculation sheet tab Land_AD-Random Error

Table 38: ***Random error of the activity data for Forest land (%)***

Random Error unit : %	**Forestland**	Dryer Acacia Savannah Forest	Moister Acacia Savannah Forest	Montane and Highland	Plantations	Riparian	Wattle Forest	Woodlots	Cropland to Forest	Grassland to Forest	Settlement to Forest	*Forest to cropland*	Forest to grassland	Forest to Wetland	Forest to Settlement	Forest to otherland
2000	2	4	9	13	8	11	14	19	-	-	-	137	-	-	118	-
2001	2	4	9	13	8	11	14	19	-	-	-	-	-	-	-	-
2002	2	4	9	13	8	11	14	19	-	-	-	-	-	-	-	-
2003	2	4	9	13	8	11	14	19	-	-	-	-	-	-	-	-
2004	2	4	9	13	8	11	14	19	-	-	-	236	-	-	-	-
2005	2	4	9	13	8	11	14	19	236	236	236	167	-	-	-	-
2006	2	4	9	13	8	11	14	19	236	-	-	236	-	-	-	-
2007	2	4	9	13	8	11	14	19	-	-	-	-	-	-	-	-
2008	2	4	9	13	8	11	14	19	-	-	-	167	236	-	236	-
2009	2	4	9	13	8	11	14	19	-	-	-	236	236	236	-	-
2010	2	4	9	13	8	11	14	19	-	167	-	236	-	-	-	-
2011	2	4	9	13	8	11	14	19	-	-	-	-	-	-	-	-
2012	2	4	9	13	8	11	14	19	167	236	-	-	167	-	236	-
2013	2	4	9	13	8	11	14	19	236	236	-	-	-	-	236	-
2014	2	4	9	13	8	11	14	19	236	-	-	137	-	236	-	-
2015	2	4	9	13	8	11	14	19	-	-	-	167	-	-	236	236
2016	2	4	9	13	8	11	14	19	236	236	236	137	167	-	236	-
2017	2	4	9	13	8	11	14	19	236	236	-	167	236	-	-	236
2018	2	4	9	13	8	11	14	19	167	236	-	-	-	-	-	-
2019	2	4	9	13	8	11	14	19	167	-	-	137	236	-	236	-
2020	2	4	9	13	8	11	14	19	236	-	-	167	236	-	-	-

Emission/removal factors from Ministry of Tourism and Environmental Affairs, 2020 & IPCC, 2006	IPCC 2006 provides SD, error or mean for the default values. The details are included in the tables included in the previous section. For the Values extracted from the GHGI 2020, that come from the South African study, no information is provided on the uncertainty of these values. As these values are not country specific, the uncertainty related to them is very high. Also considering that the classes were not exactly the same between South Africa and Eswatini's FRL (see section 3.3.3), this increases the error.

6. Consistency with the National GHG inventory

The FRL was developed following the guidance provided in Decision 12/CP.17, decision 4/CP.15, paragraph 7, and seeks to maintain consistency with the anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks to be included in the next update of the national greenhouse gas (GHG) inventory. It was however not possible to maintain consistency with the GHGI prepared for the fourth National Communication. It was estimated that the dataset used for the FRL was the most accurate at this time as it provides details of the different forest types and the disturbance occurring of forest land as well as area of logging. The dataset used in the FRL was developed by the national team inside the Ministry of Tourism and Environmental Affairs. The country will work on streamlining the process to ensure that only one dataset is produced and used in the future submissions.

The work undertaken for the development of this Forest Reference level was well integrated inside the Ministry and the team involved will be responsible to develop future GHGI and REDD+ reports which will ensure full consistency in the next report to be submitted to the UNFCCC.

Consistency will be possible in the future between the FRL and the GHGI, as this FRL follows 2006 IPCC guidelines and provides a transparent explanation of the estimations and assumptions taken.

7. Improvement plan

Following REDD+ decisions of the stepwise approach, the country has decided to present this submission using the best available data at that time. Eswatini is aware that some improvements are needed to provide more accurate information on the Forestland sector. The national team has already taken into consideration the following elements to be improved for the future submissions:

- **Activity data** – Eswatini provided newly collected data on land use and land use change covering the entire country and looking at all the six IPCC land use categories. This tremendous work allows Eswatini to have a full time series of areas of land use and land use change which is completely new to the country. Previous submissions used extrapolations from FAO data. This great improvement has allowed Eswatini to present this FRL. However, the country is aware that improvements are still needed in terms of assessment.
    - **Disturbances**: In particular for the areas that are under disturbances and specific management practice. It is well known in the country that agriculture and grazing affects forest areas, more research will need to be done to ensure that fully affected areas are recorded through time.
    - **Fire**: Fire is also present in the country; some studies have shown that big areas of land are affected by fires. For this assessment Fire is included using the remote sensing data available in CfRN LUA App. Parallel studies will need to be undertaken to make sure the areas affected by fire have been captured accurately.
    - **Logging**: The country has an important production of Timber. The West side of the country is covered by big timber companies extracting roundwood from plantations. The country is currently contacting all the timber companies to get more details on the amount of wood they extract on a yearly basis, this information will be compared to the data collected with remote sensing to make sure current estimations are accurate. Although it was very clear on the high-resolution images when wood extraction occurred on plantations, it was a bit

more difficult to see the extraction of wood from other types of forest where local communities use the wood for their day-to-day use. This information is more difficult to get on the ground as this is part of the informal economy. Other studies will need to be undertaken to provide better quality of the local practice on wood extraction.

- **Emission/Removal Factors** – All values used in the FRL are TIER default values from IPCC guidelines and from a South African study. The country is looking for funding to execute a National Forest Inventory to collect carbon stock data directly from the national forests. This work will tremendously improve estimations. The priority should be given to plantation forests as these are the areas with the highest uncertainty at the moment due to the big removal capacity of these ecosystems.
- **Uncertainty** – For this submission the country provided a qualitative assessment of the related uncertainty of emission/removal factors. The random and systematic error of the activity data provides some estimations of the uncertainty related to the activity data. As the data used is all tier 1, error is expected to be high. In the future, the country would like to include a quantitative estimation of the uncertainty using the propagation of error. propagation of error following IPCC guidelines.
- **HWP** - not included in this submission due to lack of data. The country will work on including this information in future submissions.

8. References

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Annex I: Area of land and land use change

Annex I.1 Matrix I: area of land use and land use change

Figure 10: ***Matrix I Area of land remaining and land converted (ha)***

LAND USE CHANGES

2020

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	401.974								225										402.199
Moister Savannah Forest (FMOSAV)		97.844						225											98.070
Montane and Highland (FMON)			48.697									225							48.922
Plantations (FPLAN)				125.575															125.575
Riparian (FRIP)					64.253														64.253
Wattle Forest (FWAT)						40.355													40.355
Woodlots (FWOD)							23.221												23.221
Annual Crops (CANN)						225		389574											389.799
Perennial Crops (CPERN)									8567										8.567
Agroforestry (CAGRO)										6538									6.538
Bushveld (GBUSH)											214.852								214.852
High Mountain grasslands (GHIGH)								225				206.285							206.510
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.792					8.792
Settlement (SSET)								451							45.315				45.766
Woody Settlement (SWOOD)								225								13.163			19.389
Other Lands (OOTHER																	13.978		13.978
Mine (OMIN)																		676	676
Decembre 2020 – TOTAL	401.974	97.844	48.697	125.575	64.253	40.581	23.221	390.701	8.792	6.538	214.852	206.510	18.938	8.792	45.315	19.163	13.978	676	1.736.400
							802.144			406.032		421.362		27.730		64.478		14.654	0

2019

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	401.974							451			225					225			402.875
Moister Savannah Forest (FMOSAV)		98.070						225											98.295
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.349															125.349
Riparian (FRIP)					64.253														64.253
Wattle Forest (FWAT)						40.355													40.355
Woodlots (FWOD)							23.221												23.221
Annual Crops (CANN)				225				388898			451								389.574
Perennial Crops (CPERN)	225								8567										8.792
Agroforestry (CAGRO)										6538									6.538
Bushveld (GBUSH)								225			214.176								214.401
High Mountain grasslands (GHIGH)												206.510							206.510
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.792					8.792
Settlement (SSET)															45.766				45.766
Woody Settlement (SWOOD)																13.163			19.163
Other Lands (OOTHER																	13.978		13.978
Mine (OMIN)																		676	676
Decembre 2019 – TOTAL	402.199	98.070	48.922	125.575	64.253	40.355	23.221	389.799	8.567	6.538	214.852	206.510	18.938	8.792	45.766	13.303	13.978	676	1.736.400
							802.595			404.904		421.362		27.730		65.154		14.654	0

2018

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	402.875																		402.875
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.349															125.349
Riparian (FRIP)					64.253														64.253
Wattle Forest (FWAT)						40.355													40.355
Woodlots (FWOD)							22.770												22.770
Annual Crops (CANN)							451	388898			451						225		390.025
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)								225		6538									6.763
Bushveld (GBUSH)								451			213.950				225				214.626
High Mountain grasslands (GHIGH)		225										206.510							206.736
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.792					8.792
Settlement (SSET)															45.540				45.540
Woody Settlement (SWOOD)																13.163			19.163
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		676	676
Decembre 2018 – TOTAL	402.875	98.295	48.922	125.349	64.253	40.355	23.221	389.574	8.792	6.538	214.401	206.510	18.938	8.792	45.766	13.163	13.970	676	1.736.400
							803.271			404.904		420.911		27.730		64.329		14.654	0

LAND USE CHANGES

2017

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	402.199							225											402.425
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.349															125.349
Riparian (FRIP)					64.253														64.253
Wattle Forest (FWAT)						40.355						225					225		40.806
Woodlots (FWOD)							22.770												22.770
Annual Crops (CANN)	225							389349			225				451			225	390.476
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6763									6.763
Bushveld (GBUSH)	451							225			214.401				676				215.754
High Mountain grasslands (GHIGH)								225				206.510							206.736
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.792					8.792
Settlement (SSET)															44.413				44.413
Woody Settlement (SWOOD)																19.163			19.163
Other Lands (OOTHER																	13.527		13.527
Mine (OMIN)																		451	451
Decembre 2017 – TOTAL	402.875	98.070	48.922	125.349	64.253	40.355	22.770	390.025	8.792	6.763	214.626	206.736	18.938	8.792	45.540	19.163	13.752	676	1.736.400
							802.595			405.581		421.362		27.730		64.704		14.429	0

2016

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	401.974							676			451					225			403.326
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.124															125.124
Riparian (FRIP)					64.253														64.253
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							22.770												22.770
Annual Crops (CANN)	225							388447			451				225				389.349
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6763									6.763
Bushveld (GBUSH)								302			214.852				451	451			216.655
High Mountain grasslands (GHIGH)				225				225				206.736				225			207.412
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.792					8.792
Settlement (SSET)								225							43.737				43.962
Woody Settlement (SWOOD)	225															18.261			18.487
Other Lands (OOTHER																	13.527		13.527
Mine (OMIN)																		451	451
Decembre 2016 – TOTAL	402.455	98.070	48.922	125.349	64.253	40.806	22.770	390.476	8.792	6.763	215.754	206.736	18.938	8.792	44.413	19.163	13.527	451	1.736.400
							802.595			406.032		422.489		27.730		63.576		13.978	0

2015

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	403.326							225								225		225	404.003
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.124															125.124
Riparian (FRIP)					64.253			225											64.478
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							22.770												22.770
Annual Crops (CANN)								388221			225				225				388.672
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6763									6.763
Bushveld (GBUSH)								451			216.430								216.881
High Mountain grasslands (GHIGH)												207.187							207.187
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.792					8.792
Settlement (SSET)												225			43.737				43.962
Woody Settlement (SWOOD)																18.261			18.261
Other Lands (OOTHER								225									13.527		13.752
Mine (OMIN)																		225	225
Decembre 2015 – TOTAL	403.326	98.070	48.922	125.124	64.253	40.806	22.770	389.349	8.792	6.763	216.655	207.187	18.938	8.792	43.962	18.487	13.527	451	1.736.400
							802.271			404.904		424.043		27.730		62.449		13.978	0

LAND USE CHANGES

2014

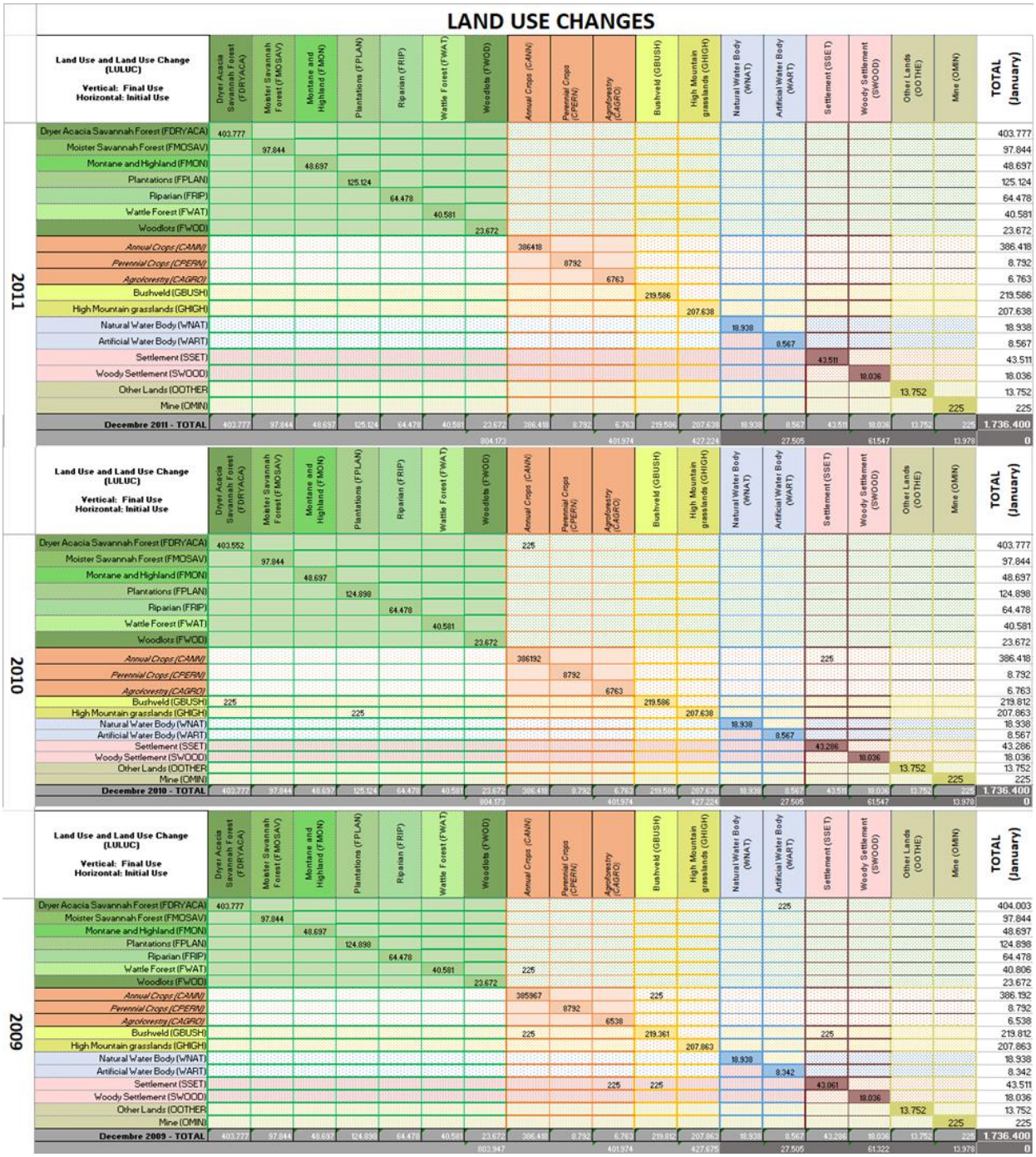
Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	403.777							676						225					404.679
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.124															125.124
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							22.770												22.770
Annual Crops (CANN)	225							387545			225								387.996
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6763									6.763
Bushveld (GBUSH)								225			216.655					225			217.106
High Mountain grasslands (GHIGH)												207.187							207.187
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.567					8.567
Settlement (SSET)								225							43.962				44.188
Woody Settlement (SWOOD)																18.036			18.036
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2014 - TOTAL	404.003	98.070	48.922	125.124	64.478	40.806	22.770	388.672	8.792	6.763	216.88	207.187	18.938	8.792	43.962	18.261	13.752	225	**1.736.400**
							804.173			404.228		424.068		27.730		62.224		13.978	**0**

2013

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.454																		404.454
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.922																48.922
Plantations (FPLAN)				125.124															125.124
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							22.770								225				22.996
Annual Crops (CANN)		225						386418											386.643
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6763									6.763
Bushveld (GBUSH)	225							1127			217.106				451				218.910
High Mountain grasslands (GHIGH)								225				207.187							207.412
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.567					8.567
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)								225								18.036			18.261
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2013 - TOTAL	404.679	98.070	48.922	125.124	64.478	40.806	22.770	387.984	8.792	6.763	217.10	207.187	18.938	8.567	44.188	18.054	13.752	224	**1.736.400**
							804.849			403.552		424.293		27.505		62.224		13.978	**0**

2012

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	403.777																		403.777
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				125.124															125.124
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.581													40.581
Woodlots (FWOD)							22.996					451			225				23.672
Annual Crops (CANN)	451							385967											386.418
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6763									6.763
Bushveld (GBUSH)	225							451			218.910								219.586
High Mountain grasslands (GHIGH)			225			225						206.961				225			207.638
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.567					8.567
Settlement (SSET)								225							43.286				43.511
Woody Settlement (SWOOD)																18.036			18.036
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2012 - TOTAL	404.454	97.844	48.922	125.124	64.478	40.806	22.996	386.643	8.792	6.763	218.910	207.412	18.938	8.567	43.511	18.261	13.752	224	**1.736.400**
							804.624			402.199		426.322		27.505		61.773		13.978	**0**



LAND USE CHANGES

2011

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	403.777																		403.777
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				125.124															125.124
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.581													40.581
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								386.418											386.418
Perennial Crops (CPERN)									8.792										8.792
Agroforestry (CAGRO)										6.763									6.763
Bushveld (GBUSH)											219.586								219.586
High Mountain grasslands (GHIGH)												207.638							207.638
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.567					8.567
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																18.036			18.036
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2011 - TOTAL	403.777	97.844	48.697	125.124	64.478	40.581	23.672	386.418	8.792	6.763	219.586	207.638	18.938	8.567	43.511	18.036	13.752	225	**1.736.400**
							804.173			401.974		427.224		27.505		61.547		13.978	**0**

2010

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	403.552							225											403.777
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.898															124.898
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.581													40.581
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								386.192							225				386.418
Perennial Crops (CPERN)									8.792										8.792
Agroforestry (CAGRO)										6.763									6.763
Bushveld (GBUSH)	225										219.586								219.812
High Mountain grasslands (GHIGH)				225								207.638							207.863
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.567					8.567
Settlement (SSET)															43.286				43.286
Woody Settlement (SWOOD)																18.036			18.036
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2010 - TOTAL	403.777	97.844	48.697	125.124	64.478	40.581	23.672	386.418	8.792	6.763	219.586	207.638	18.938	8.567	43.511	18.036	13.752	225	**1.736.400**
							804.173			401.974		427.224		27.505		61.547		13.978	**0**

2009

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	403.777													225					404.003
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.898															124.898
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.581		225											40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.967			225								386.192
Perennial Crops (CPERN)									8.792										8.792
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)								225			219.361				225				219.812
High Mountain grasslands (GHIGH)												207.863							207.863
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)										225	225				43.061				43.511
Woody Settlement (SWOOD)																18.036			18.036
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2009 - TOTAL	403.777	97.844	48.697	124.898	64.478	40.581	23.672	386.418	8.792	6.763	219.812	207.863	18.938	8.567	43.286	18.036	13.752	225	**1.736.400**
							803.947			401.974		427.675		27.505		61.322		13.978	**0**

LAND USE CHANGES

2008

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.003							451			225								404.679
Moister Savannah Forest (FMOSAV)		97.844														225			98.070
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.898															124.898
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.741											385.741
Perennial Crops (CPERN)									8.792										8.792
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.586								219.586
High Mountain grasslands (GHIGH)												207.863							207.863
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2008 - TOTAL	404.003	97.844	48.697	124.898	64.478	40.806	23.672	386.192	8.792	6.538	219.812	207.863	18.938	8.342	43.511	18.028	13.752	225	**1.736.400**
							804.398			401.523		427.675		27.279		61.547		13.978	**0**

2007

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.679																		404.679
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.898															124.898
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385741			225								385.967
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6538									6.538
Bushveld (GBUSH)											219.361								219.361
High Mountain grasslands (GHIGH)												207.863							207.863
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2007 - TOTAL	404.679	98.070	48.697	124.898	64.478	40.806	23.672	385.741	8.792	6.538	219.586	207.863	18.938	8.342	43.511	17.810	13.752	225	**1.736.400**
							805.300			401.072		427.449		27.279		61.322		13.978	**0**

2006

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.454							225											404.679
Moister Savannah Forest (FMOSAV)		98.070																	98.070
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.898															124.898
Riparian (FRIP)					64.478														64.478
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)	225							385516											385.741
Perennial Crops (CPERN)									8792										8.792
Agroforestry (CAGRO)										6538									6.538
Bushveld (GBUSH)								225			219.361								219.586
High Mountain grasslands (GHIGH)												207.863							207.863
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2006 - TOTAL	404.679	98.070	48.697	124.898	64.478	40.806	23.672	385.967	8.792	6.538	219.361	207.863	18.938	8.342	43.511	17.810	13.752	225	**1.736.400**
							805.300			401.297		427.224		27.279		61.322		13.978	**0**

LAND USE CHANGES

2005

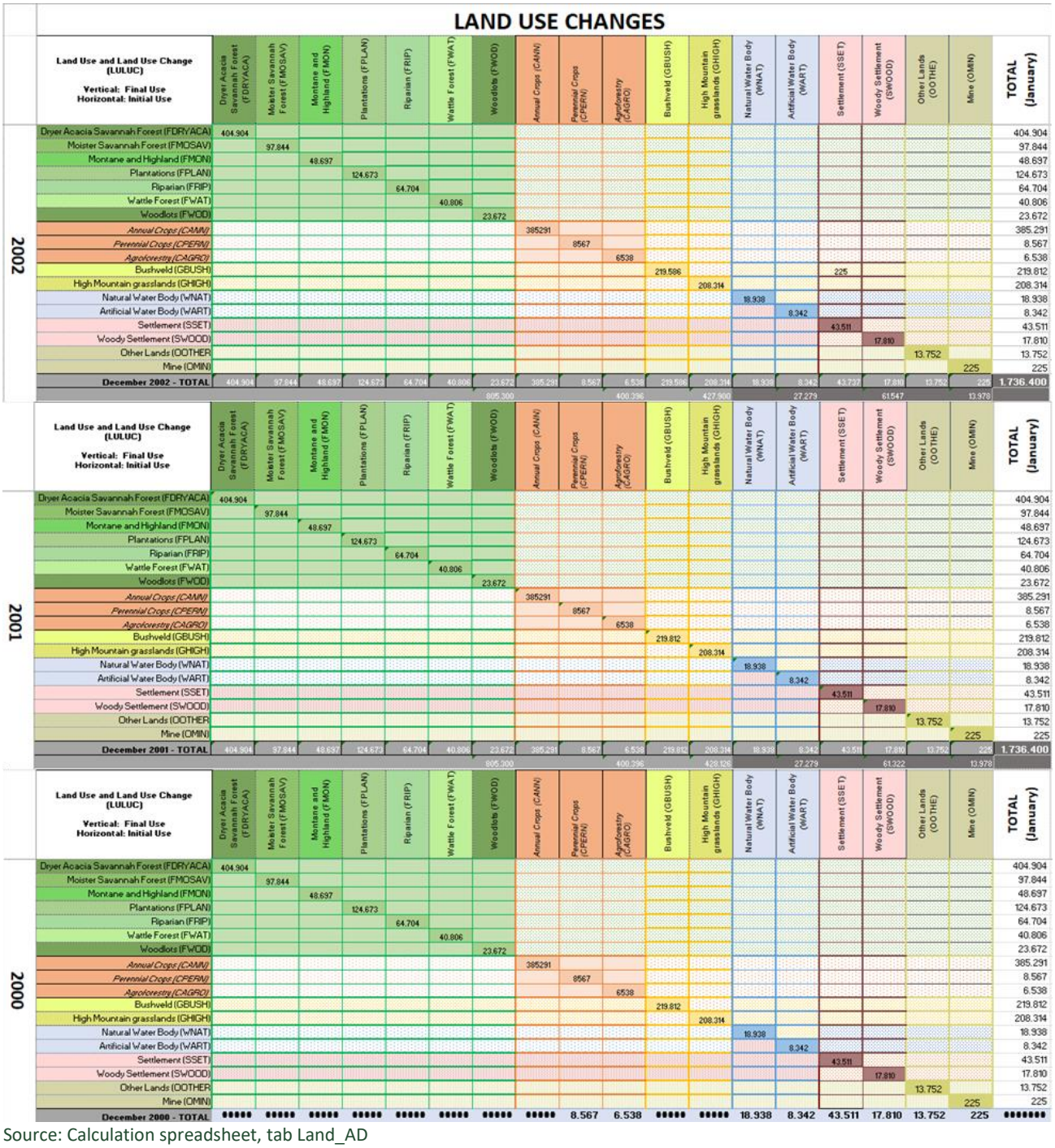
Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.454							225											404.679
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.673															124.673
Riparian (FRIP)					64.478				225										64.704
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)	225							385.516											385.741
Perennial Crops (CPERN)									8.567										8.567
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.586								219.586
High Mountain grasslands (GHIGH)				225								207.863							208.088
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)		225													43.511				43.737
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2005 - TOTAL	404.679	98.070	48.697	124.898	64.478	40.806	23.672	385.741	8.792	6.538	219.586	207.863	18.938	8.342	43.511	17.810	13.752	225	**1.736.400**
							805.300			401.072		427.449		27.279		61.322		13.978	**0**

2004

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.679							225											404.904
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.673															124.673
Riparian (FRIP)					64.704														64.704
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.516											385.516
Perennial Crops (CPERN)									8.567										8.567
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.586								219.586
High Mountain grasslands (GHIGH)												208.088							208.088
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.737				43.737
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
Decembre 2004 - TOTAL	404.679	97.844	48.697	124.673	64.704	40.806	23.672	385.741	8.567	6.538	219.586	208.088	18.938	8.342	43.737	17.810	13.752	225	**1.736.400**
							805.075			400.846		427.675		27.279		61.547		13.978	**0**

2003

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.904																		404.904
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.673															124.673
Riparian (FRIP)					64.704														64.704
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.291											385.291
Perennial Crops (CPERN)									8.567										8.567
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.586								219.586
High Mountain grasslands (GHIGH)								225				208.088							208.314
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.737				43.737
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2003 - TOTAL	404.904	97.844	48.697	124.673	64.704	40.806	23.672	385.516	8.567	6.538	219.586	208.088	18.938	8.342	43.737	17.810	13.752	225	**1.736.400**
							805.390			400.621		427.675		27.279		61.547		13.978	**0**



LAND USE CHANGES

2002

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.904																		404.904
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.673															124.673
Riparian (FRIP)					64.704														64.704
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.291											385.291
Perennial Crops (CPERN)									8.567										8.567
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.586				225				219.812
High Mountain grasslands (GHIGH)												208.314							208.314
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2002 - TOTAL	404.904	97.844	48.697	124.673	64.704	40.806	23.672	385.291	8.567	6.538	219.586	208.314	18.938	8.342	43.737	17.810	13.752	225	**1.736.400**
							805.300			400.396		427.900		27.279		61.547		13.978	

2001

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.904																		404.904
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.673															124.673
Riparian (FRIP)					64.704														64.704
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.291											385.291
Perennial Crops (CPERN)									8.567										8.567
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.812								219.812
High Mountain grasslands (GHIGH)												208.314							208.314
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2001 - TOTAL	404.904	97.844	48.697	124.673	64.704	40.806	23.672	385.291	8.567	6.538	219.812	208.314	18.938	8.342	43.511	17.810	13.752	225	**1.736.400**
							805.300			400.396		428.126		27.279		61.322		13.978	

2000

Land Use and Land Use Change (LULUC) Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)	TOTAL (January)
Dryer Acacia Savannah Forest (FDRYACA)	404.904																		404.904
Moister Savannah Forest (FMOSAV)		97.844																	97.844
Montane and Highland (FMON)			48.697																48.697
Plantations (FPLAN)				124.673															124.673
Riparian (FRIP)					64.704														64.704
Wattle Forest (FWAT)						40.806													40.806
Woodlots (FWOD)							23.672												23.672
Annual Crops (CANN)								385.291											385.291
Perennial Crops (CPERN)									8.567										8.567
Agroforestry (CAGRO)										6.538									6.538
Bushveld (GBUSH)											219.812								219.812
High Mountain grasslands (GHIGH)												208.314							208.314
Natural Water Body (WNAT)													18.938						18.938
Artificial Water Body (WART)														8.342					8.342
Settlement (SSET)															43.511				43.511
Woody Settlement (SWOOD)																17.810			17.810
Other Lands (OOTHER																	13.752		13.752
Mine (OMIN)																		225	225
December 2000 - TOTAL	#####	#####	#####	#####	#####	#####	#####	#####	8.567	6.538	#####	#####	18.938	8.342	43.511	17.810	13.752	225	#######

Source: Calculation spreadsheet, tab Land_AD

Annex I.2 Matrix II: land in transition for 19 years

Figure 11: ***Matrix II Land in transition for 19 years (ha)***

This is only accumulation of the land in transition for 20 years

2020 (in transition 2001-2019)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	3.607	-	-	902	-	-	451	-	676	-	225
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	225	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	225	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	225	-	-	-	-	225	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Annual Crops (CANN)	1.578	225	-	225	-	-	451		-	-	2.480	-	-	-	1.127	-	225	225
Perennial Crops (CPERN)	225	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Agroforestry (CAGRO)	-	-	-	-	-	-	-	225	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	1.127	-	-	-	-	-	-	4.509	-	-		-	-	-	2.254	676	-	-
High Mountain grasslands (GHIGH)	-	225	225	676	-	225	-	902	-	-	-		-	-	-	451	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	676	-	225	225	225	-	-		-	-	-
Woody Settlement (SWOOD)	225	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2019 (in transition 2000-2018)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	3.158	-	-	676	-	-	451	-	451	-	225
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	225	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	225	-	-	-	-	225	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Annual Crops (CANN)	1.578	225	-	-	-	-	451		-	-	2.029	-	-	-	1.127	-	225	225
Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Agroforestry (CAGRO)	-	-	-	-	-	-	-	225	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	1.127	-	-	-	-	-	-	4.284	-	-		-	-	-	2.254	676	-	-
High Mountain grasslands (GHIGH)	-	225	225	676	-	225	-	902	-	-	-		-	-	-	451	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	676	-	225	225	225	-	-		-	-	-
Woody Settlement (SWOOD)	225	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2018 (in transition 1999(2000)-2017)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	3.156	-	-	676	-	-	451	-	451	-	225
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	225	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	225	-	-	-	-	225	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Annual Crops (CANN)	1.578	225	-	-	-	-	-		-	-	1.578	-	-	-	1.127	-	-	225
Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	1.127	-	-	-	-	-	-	3.833	-	-		-	-	-	2.029	676	-	-
High Mountain grasslands (GHIGH)	-	-	225	676	-	225	-	902	-	-	-		-	-	-	451	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	676	-	225	225	225	-	-		-	-	-
Woody Settlement (SWOOD)	225	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2017 (in transition 1998 (2000)-2016)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	2.931	-	-	676	-	-	451	-	451	-	225
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	225	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Annual Crops (CANN)	1.353	225	-	-	-	-	-		-	-	1.353	-	-	-	676	-	-	-
Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	676	-	-	-	-	-	-	3.607	-	-		-	-	-	1.353	676	-	-
High Mountain grasslands (GHIGH)	-	-	225	676	-	225	-	676	-	-	-		-	-	-	451	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	676	-	225	225	225	-	-		-	-	-
Woody Settlement (SWOOD)	225	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2016 (in transition 1996 (2000)-2015)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	2.254	-	-	225	-	-	451	-	225	-	225
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	225	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Annual Crops (CANN)	1.127	225	-	-	-	-	-		-	-	902	-	-	-	451	-	-	-
Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	676	-	-	-	-	-	-	2.705	-	-		-	-	-	902	225	-	-
High Mountain grasslands (GHIGH)	-	-	225	451	-	225	-	451	-	-	-		-	-	-	225	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	451	-	225	225	225	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2015 (in transition 1995 (2000)-2014)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	2.029	-	-	225	-	-	451	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Croplands, Annual Crops (CANN)	1.127	225	-	-	-	-	-		-	-	676	-	-	-	225	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	676	-	-	-	-	-	-	2.254	-	-		-	-	-	902	225	-	-
High Mountain grasslands (GHIGH)	-	-	225	451	-	225	-	451	-	-	-		-	-	-	225	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	451	-	225	225	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2014 (in transition 1994 (2000)-2013)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	*Annual Crops (CANN)*	*Perennial Crops (CPERN)*	*Agroforestry (CAGRO)*	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	1.353	-	-	225	-	-	225	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	451	-	-	-
Croplands, Annual Crops (CANN)	902	225	-	-	-	-	-		-	-	451	-	-	-	225	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	676	-	-	-	-	-	-	2.029	-	-		-	-	-	902	-	-	-
High Mountain grasslands (GHIGH)	-	-	225	451	-	225	-	451	-	-	-		-	-	-	225	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	225	-	225	225	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	225	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2013 (in transition 1993 (2000)-2012)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	*Annual Crops (CANN)*	*Perennial Crops (CPERN)*	*Agroforestry (CAGRO)*	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	1.353	-	-	225	-	-	225	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	451	-	-	225	-	-	-
Croplands, Annual Crops (CANN)	902	-	-	-	-	-	-		-	-	451	-	-	-	225	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	451	-	-	-	-	-	-	902	-	-		-	-	-	451	-	-	-
High Mountain grasslands (GHIGH)	-	-	225	451	-	225	-	225	-	-	-		-	-	-	225	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	225	-	225	225	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2012 (in transition 1992 (2000)-2011)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	*Annual Crops (CANN)*	*Perennial Crops (CPERN)*	*Agroforestry (CAGRO)*	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	1.353	-	-	225	-	-	225	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	451	-	-	-	-	-	-		-	-	451	-	-	-	225	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	225	-	-	-	-	-	-	451	-	-		-	-	-	451	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	451	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	225	225	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2011 (in transition 1991 (2000)-2010)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	1.353	-	-	225	-	-	225	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	451	-	-	-	-	-	-		-	-	451	-	-	-	225	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	225	-	-	-	-	-	-	451	-	-		-	-	-	451	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	451	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	225	225	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2010 (in transition 1990 (2000)-2009)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	1.127	-	-	225	-	-	225	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	225	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	451	-	-	-	-	-	-		-	-	451	-	-	-	-	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	451	-	-		-	-	-	451	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	225	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	225	225	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2009 (in transition 1989 (2000)-2008)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	1.127	-	-	225	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	451	-	-	-	-	-	-		-	-	225	-	-	-	-	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	225	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	225	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2008 (in transition 1988 (2000)-2007)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	676	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	451	-	-	-	-	-	-		-	-	225	-	-	-	-	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	225	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	225	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2007 (in transition 1987 (2000)-2006)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	451	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	225	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	225	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2006 (in transition 1986 (2000)-2005)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	451	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	225	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands, Annual Crops (CANN)	225	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands, Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands, Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	225	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	225	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2005 (in transition 1985 (2000)-2004)

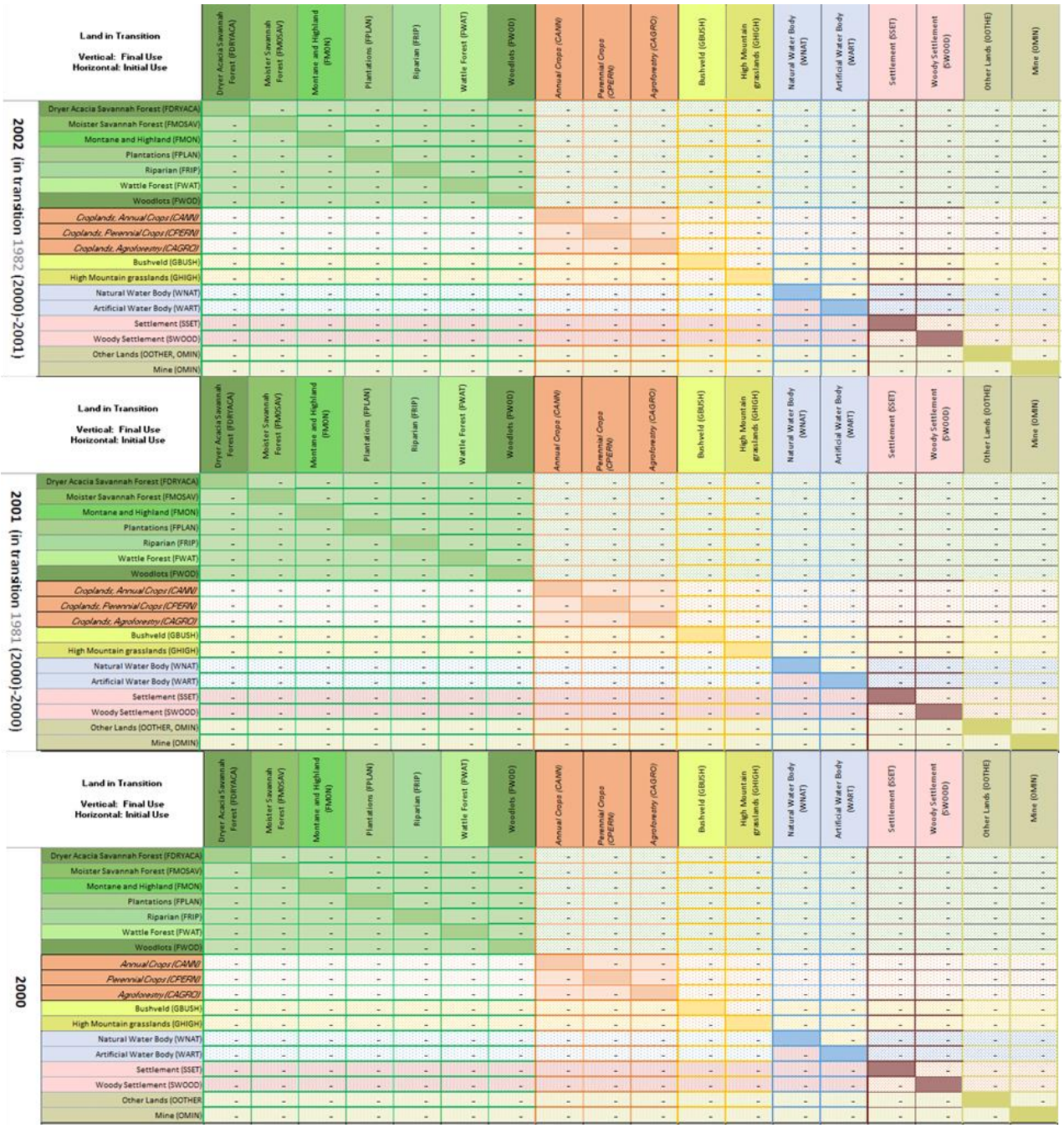
Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	225	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands: Annual Crops (CANN)	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands: Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands: Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	-	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2004 (in transition 1984 (2000)-2003)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands: Annual Crops (CANN)	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands: Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands: Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	-	-	-	-	225	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2003 (in transition 1983 (2000)-2002)

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands: Annual Crops (CANN)	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands: Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands: Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	225	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	



Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
2002 (in transition 1982) (2000)-2001)																		
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands; Annual Crops (CANN)	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands; Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands; Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
2001 (in transition 1981 (2000)-2000)																		
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Croplands; Annual Crops (CANN)	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Croplands; Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Croplands; Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER, OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Land in Transition Vertical: Final Use Horizontal: Initial Use	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Annual Crops (CANN)	Perennial Crops (CPERN)	Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHE)	Mine (OMIN)
2000																		
Dryer Acacia Savannah Forest (FDRYACA)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moister Savannah Forest (FMOSAV)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montane and Highland (FMON)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantations (FPLAN)	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riparian (FRIP)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
Wattle Forest (FWAT)	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Woodlots (FWOD)	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Annual Crops (CANN)	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Perennial Crops (CPERN)	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Agroforestry (CAGRO)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Bushveld (GBUSH)	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
High Mountain grasslands (GHIGH)	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
Natural Water Body (WNAT)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Artificial Water Body (WART)	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Settlement (SSET)	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Woody Settlement (SWOOD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Other Lands (OOTHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Mine (OMIN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Source: Calculation spreadsheet, tab Land_AD

Annex II: Protocol for the Land Use assessment

The Activity data for all the land use classes was derived from remote sensing products generated by the Eswatini Ministry of Tourism and Environmental Affairs team.

The data was collected between June and October 2023 following the systematic sampling approach as recommended by the 2006 IPCC guidelines. The CfRN Land Use Assessment Application (CfRN LUA) was used to access and analyse the images through time.

The land use assessment grid has plots every 2,5km with a total of 7700 plots. Each plot represents an area of 0,5 ha to represent the national forest definition. Each of the plots contains 49 samples to help with the visual interpretation. The period cover is the land use and land use changes that occurred between 2000 and 2022.

Annex II.1 Hierarchy of land use classes

In some cases, the plot covers different land use classes. In the case of this assessment, only one land use category can be given to each plot. With some sub information of the composition of the plot, as for example, proportion covered by trees, by infrastructure, etc. To classify the plot into one land use class a hierarchy of priority classes have been established by the national team. The hierarchy is presented in the figure below and an example is provided in Figure 12.

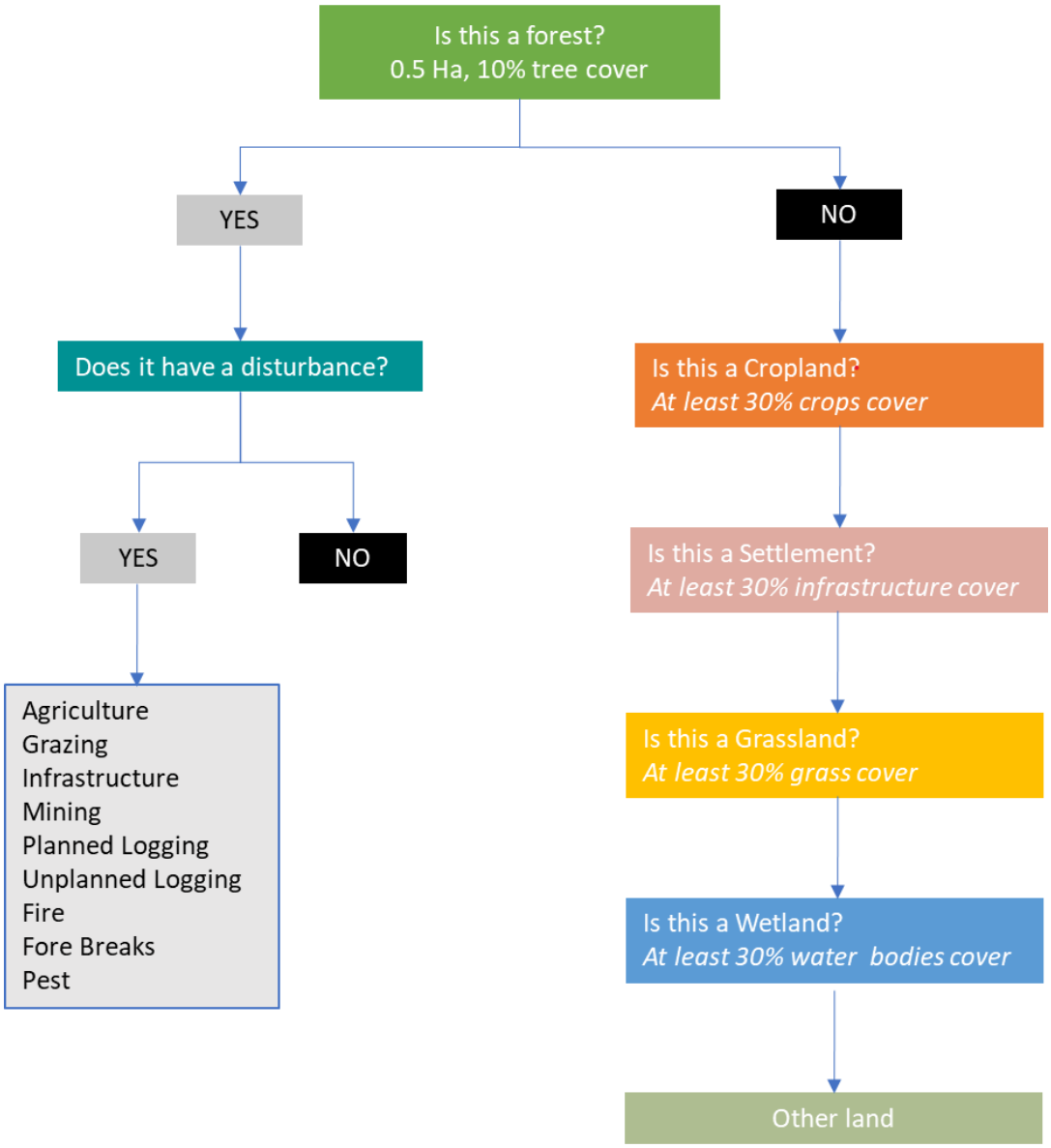


Figure 12: **Decision tree for the plot hierarchy**

Figure 13: ***Example on how to assess the plot class when multiple land use classes can be observed inside the plot***

Annex II.2 Matrix of impossible and possible land use conversions

To limit errors during the land use assessment, experts have determined which land use classes cannot be converted into a different land use. Some land use conversions are physically impossible, because the classes are located at different altitudes or areas of the country. For example, it is impossible to see a Montane and Highland forest which is always located above 800m from sea level, converted into Acacia Savannah Forests which are located between 200-400m above sea level. In the same understanding some disturbances are not visible on some forest types.

Impossible conversions related to Forest	Dryer Acacia Savannah Forest (FDRYACA)	Moister Savannah Forest (FMOSAV)	Montane and Highland (FMON)	Plantations (FPLAN)	Riparian (FRIP)	Wattle Forest (FWAT)	Woodlots (FWOD)	Croplands, Annual Crops (CANN)	Croplands, Perennial Crops (CPERN)	Croplands, Agroforestry (CAGRO)	Bushveld (GBUSH)	High Mountain grasslands (GHIGH)	Natural Water Body (WNAT)	Artificial Water Body (WART)	Settlement (SSET)	Woody Settlement (SWOOD)	Other Lands (OOTHER, OMIN)	Mine (OMIN)
Dryer Acacia Savannah Forest (FDRYACA)																		
Moister Savannah Forest (FMOSAV)																		
Montane and Highland (FMON)																		
Plantations (FPLAN)																		
Riparian (FRIP)																		
Wattle Forest (FWAT)																		
Woodlots (FWOD)																		
Croplands, Annual Crops (CANN)																		
Croplands, Perennial Crops (CPERN)																		
Croplands, Agroforestry (CAGRO)																		
Bushveld (GBUSH)																		
High Mountain grasslands (GHIGH)																		
Natural Water Body (WNAT)																		
Artificial Water Body (WART)																		
Settlement (SSET)																		
Woody Settlement (SWOOD)																		
Other Lands (OOTHER, OMIN)																		
Mine (OMIN)																		

Impossible conversion	

Annex II.3 Roles and tasks for data collection

Training on UNFCCC decisions and REDD+ concept	March to June 2023 Online training held by CfRN for the Ministry of Tourism and Environmental Affairs.
Data collection and protocol	June to October 2023 Team of 15 experts from the Ministry of Tourism and Environmental Affairs
Workshop finalisation of data collection	October 2023 Ministry of Tourism and Environmental Affairs - guided by CfRN
QA of the data collection	November 2023 10% of plots checks by GIS CfRN expert = 18% interpretation error
Preparation of estimations	November 2023 Ministry of Tourism and Environmental Affairs with CfRN support
Preparation of Report	December 2023 Ministry of Tourism and Environmental Affairs with CfRN support

Annex II.4 Interpretation keys

The identification of the classes is based on the observation of four (4) visual characteristics: **colour, shape, size and texture** that allow better analysis and interpretation of objects on the satellite image. The **context** plays a big role as well and will influence the final interpretation of land use.

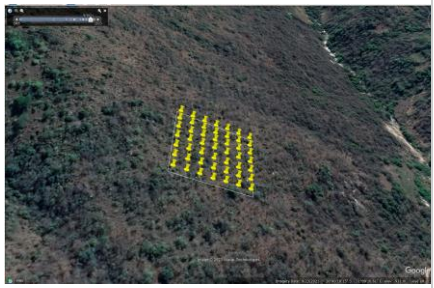
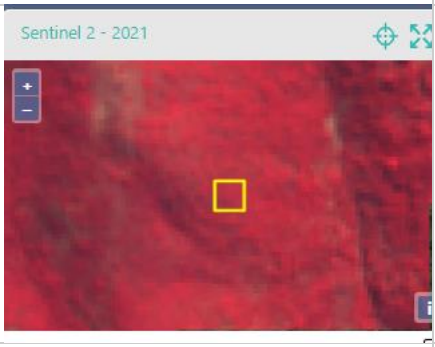
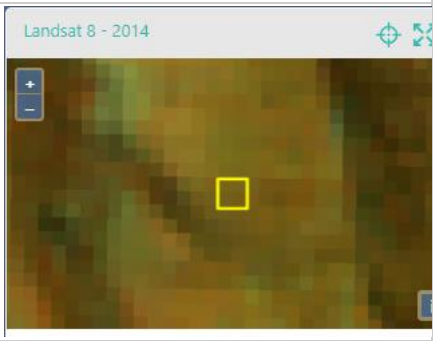
Characteristics	Definition
Colour	Association of a colour channel; primary colours red, green, blue to spectral bands; this is called: coloured composition. In the context of the visual interpretation of images we say that colour or hue refers to the **relative clarity of objects on an image.**
Shape	The shape refers to the **general appearance, structure or outline of individual objects**. Shapes with **straight edges** are usually found in urban areas (settlement) or constitute cultivated land, while natural structures, such as forest edges, are generally more **irregular**, except in places where man has built a road.
Size	A quick assessment of the approximate area of an object often facilitates interpretation. Thus, in an image where one would have to distinguish between small-scale and large-scale crop areas, the dimension provides clarification. At the time of interpretation, it will therefore **be necessary to zoom out** to be interested in this characteristic
Texture	Texture refers to the **arrangement and frequency of hue variations** in particular regions of an image. **Rough** textures and **smooth** textures are mainly distinguished. Rough textures are generally referred to as when there are many tonal variations in a small region of the image, whereas smooth textures would have little or no tonal variations. Uniform surfaces such as fields will be associated with smooth textures while targets such as forests are associated with rough textures
Context	Context refers to the **entire environment around the object being observed**. The interpreter will need to take this environment into account when interpreting, especially in the absence of a very high-resolution image. Gaps in the canopy at the edge of a mosaic of occupation, often indicate a fragmentation of the forest; The building is mainly observed in urban areas, and a green and uniform surface will suggest that you are in the middle of the natural forest, without observed losses. These indications may seem obvious at first, but they allow the interpreter to analyse more quickly the land cover he observes.

Source: Collect Earth Online Manual

Land Use Category Level 1: Forest

Land Use Sub- Category Level 2: Montane and Highland

Colour	True colours: dark green with some brown for the ground during dry season Not uniformed colour as there is a mix of vegetation
Shape	Irregular canopy is not too dense with small and big trees.
Size	Big areas of forest
Texture	Rough
Context	Above 800m altitude. Can be found in the Highveld, Upper and Middleveld. Afromontane and mixed woodland. Indigenous forest

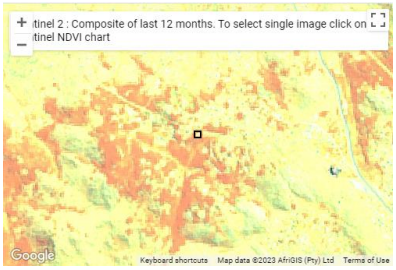
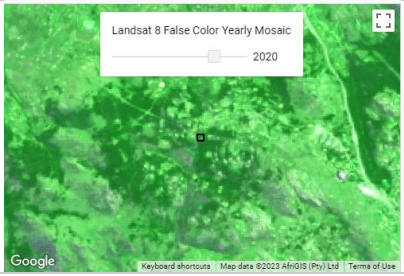
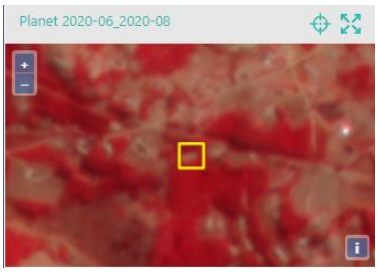
Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2021	2021	2014

Land Use Sub- Category Level 2: Wattle Forest

These forests are used as woodlots for fuelwood, pulpwood, mining timber, charcoal and tannin. They were originally planted and are today unmanaged forests although still exploited by local communities. The species are invasive species that could be a threat to indigenous biodiversity. The

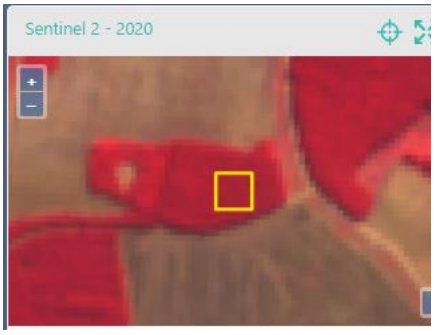
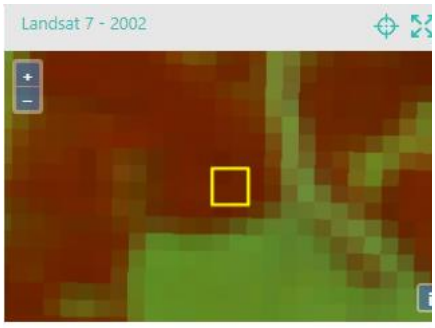
area wattle seems to have decreased over the years, but some sections are still encroaching on other vegetation such as croplands, grazing and valley floors (National Forest Policy, 2002, p.28).

Colour	True colours: dark green, brown ground visible after logging and fire False colours: red-orange colour, white when bare ground, black when fire
Shape	Regular canopy as this is only one type of trees
Texture	rough
Context	Above 800m altitude in Highveld, human made forest, clear felling - planned logging. In the Swazi National Land. *Acacia mearnsii* dominated forests, Invasive species. The canopy is closed, except when logging activities can create holes in the canopy

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2022	2021	2014
		
fire in 2019	Fire in 2019 – Planet NICFI	Logging in 2020 – Planet NICFI

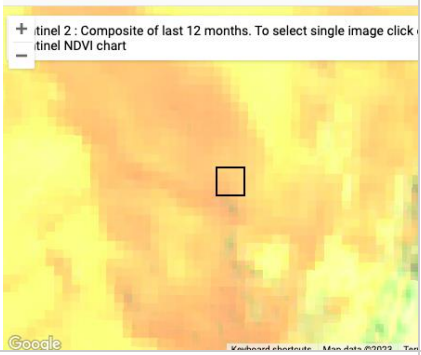
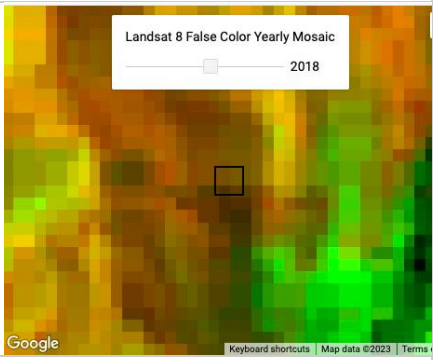
Land Use Sub- Category Level 2: Plantations

Shape	Straight well-defined lines
Size	Depends
Texture	Smooth
Context	Man-made Forest. Plantations of pines and eucalypts. Mainly Highveld, regular logging

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2013	2020	2002

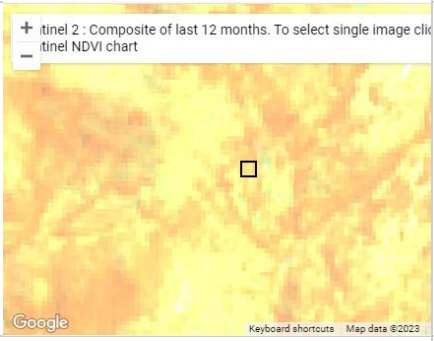
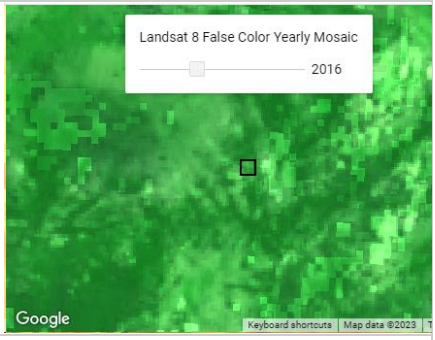
Land Use Sub- Category Level 2: Moister Acacia Savannah Forest

Context	Between 400-800m altitude mainly broadleaved mixed woodland, Indigenous Forest in the Middleveld Lubombo range

Google Earth pro	**Sentinel 2 or Planet NICFI**	**Landsat**
		
2018	Last 12 months	2018

Land Use Sub- Category Level 2: Dryer Acacia Savannah Forest

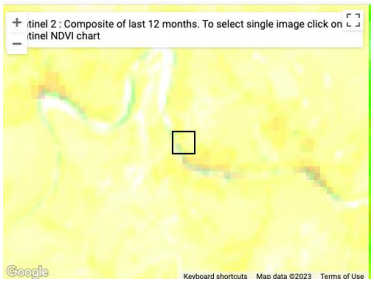
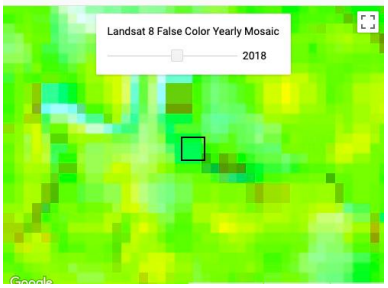
Colour	True colours: mix of green and brown False colours: mix of yellow, light orange, red
Shape	Natural irregular structure, with patches of vegetation and herbaceous soil/
Texture	Rough texture, with different tons or colours and texture
Context	Between 200-400m altitude. Acacia dominated woodland, Indigenous forest in the Lowveld (east) The scrubby nature of the vegetation. During dry season May to August (winter) – only a few evergreen trees are visible, rest of vegetation is dry Located in the same region where there are Sugar Cane plantations. This includes also the shrubland, which contains smaller trees and more grass. It was not possible to differentiate these classes on the images and therefore they are included together.

Google Earth pro	**Sentinel 2 or Planet NICFI**	**Landsat**
		
2016	Last 12 months	2016

Land Use Sub- Category Level 2: Riparian

Colour	True colours: dark green False colours: dark red, with very dark red in the middle where the water is
Shape	Irregular on the outside and but with a clear perception of the river bed in the middle
Size	Will extend from a few meters to XXX meters from the river bed.

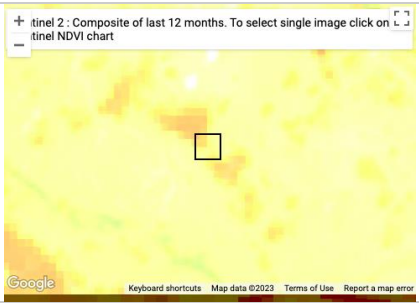
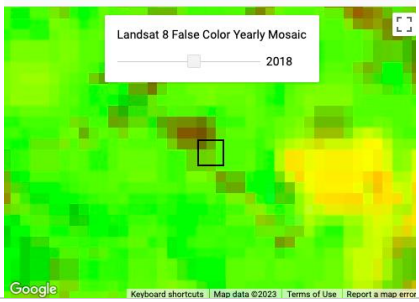
Texture	Round shapes
Context	All physiographic zones but along a river. Mixed woodland and Indigenous Forest

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2018	Last 12 months	2018

Land Use Sub- Category Level 2: Woodlots

Originally human-made, community-based woods to provide fuelwood and timer to communities in addition to wattle and natural forests. The main species planted was eucalyptus (gum.) (National Forest Policy, 2022, p.28).

Colour	True colours: patch of dark green False colours: patch of dark red
Shape	Irregular patches
Size	0.5ha – 5ha
Texture	Round shapes of the canopy
Context	Above 600m, next to urban/rural areas. Common in the Middleveld and Highveld. Different ages for allowing regeneration. Mostly for domestic use (fuelwood).

Bing Load	Sentinel 2 or Planet NICFI	Landsat
		
2018	Last 12 months	2018

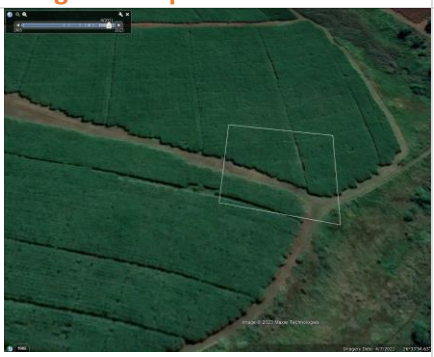
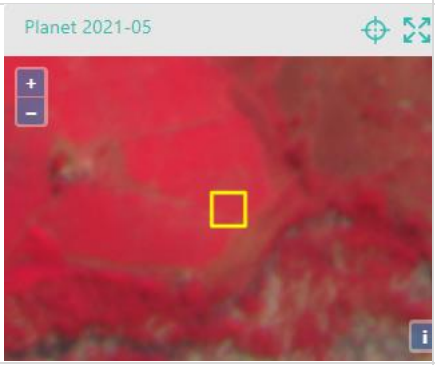
Land Use Category Level 1: Cropland

Land Use Category Level 2: Annual Crops

Land Use Category Level 3: Sugar Cane

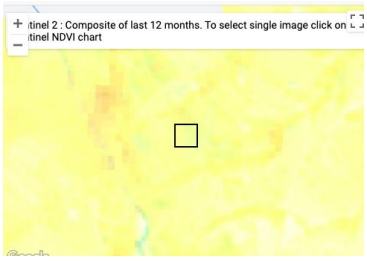
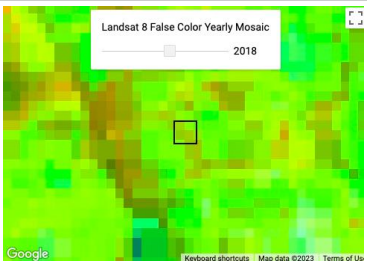
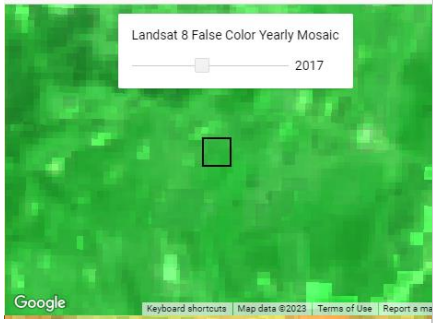
Colour	True colours: Dense green False colours: dense red when the plant is green, orange after the harvest
Shape	Varying shapes
Size	Vary
Texture	Dense structure

Context	The fields are very densely populated by dark green grass with clear lines for the machines to go through. Majority of the sugar cane fields are visible on the east of the country. Some crop lands are abandoned (Farmer's communal lands / electricity). Harvest time (April to November)

Google Earth pro	**Sentinel 2 or Planet NICFI**	**Landsat**
		
2021	2021	2010

Land Use Category Level 3: Maize

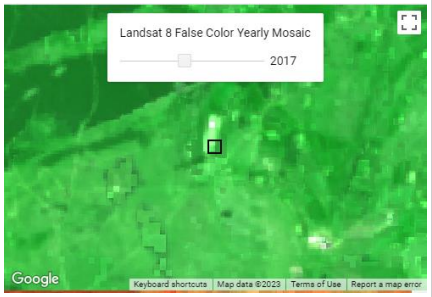
Shape	Rectangular fields
Texture	Before the harvest the texture is very rough
Context	The rectangular fields are split by high grass. During harvest it is possible to see piles of crop residues (white circle) left on the fields. Harvest March-May.

Bing load	**Sentinel 2 or Planet NICFI**	**Landsat**
		
	Last 12 months	2018
		
2017		


harvested maize

Land Use Category Level 3: Other annual crops

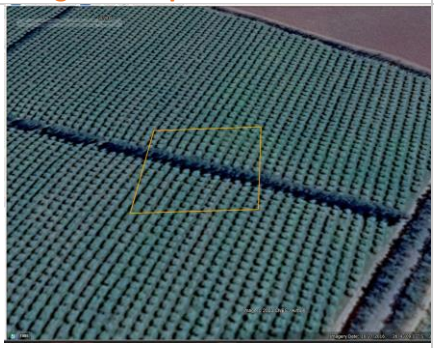
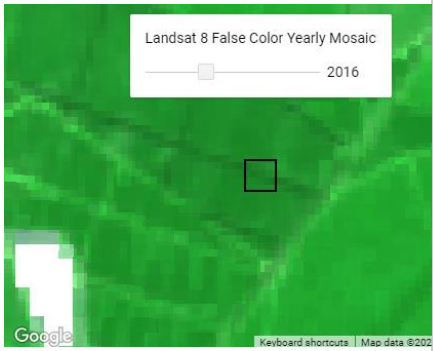
Shape	Straight lines of crop planted
Texture	Smooth
Context	Other annual crops regroup all other crops such as cotton, legumes, vegetables, etc. For cotton, the land is usually abandoned during the winter time. Roads, urban areas in the nearby, clear lines of the crops, can see the harvest period

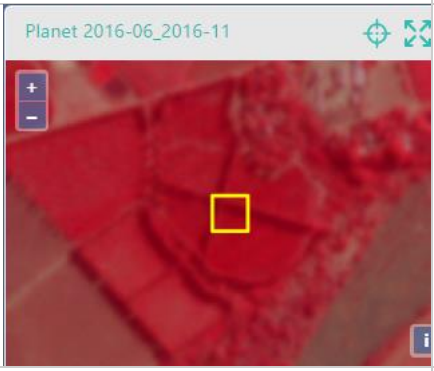
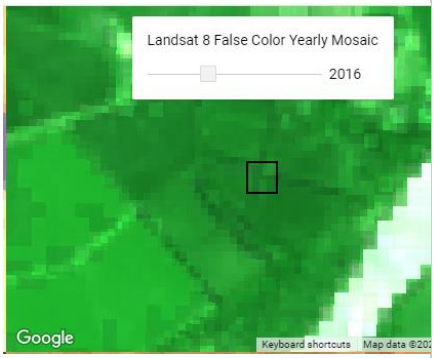
Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2017	Last 12 months	2018

Land Use Category Level 2: Perennial Crops

Land Use Category Level 3: Citrus or Macadamia

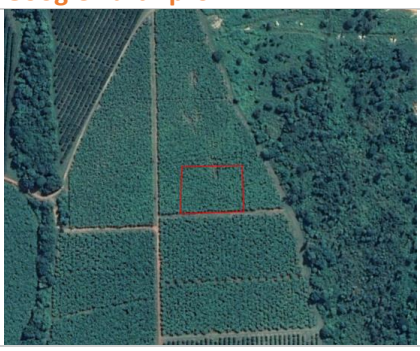
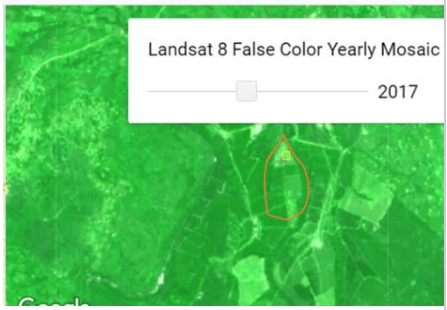
Colour	False colour: dark red True colours: dark green
Shape	Round shapes in straight lines
Size	
Texture	Smooth
Context	Clear round shapes of the canopies of the trees in line with paths for machines to go through. Mostly Highveld and Middleveld. Can be surrounded by trees to limit the field.

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		

2016	2017	2016
		
2016	2016	2018

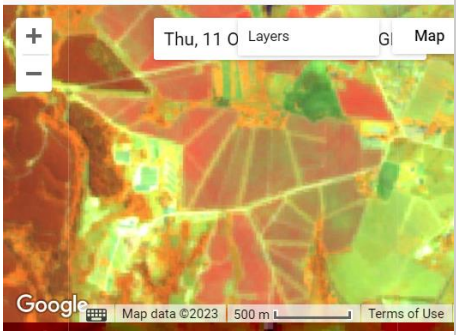
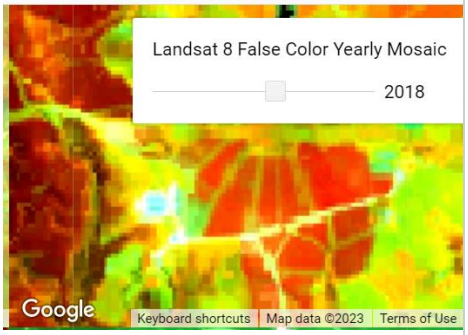
Land Use Category Level 3: Banana

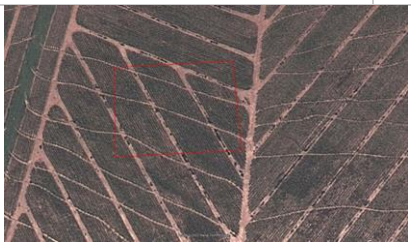
Colour	True colour: Lighter green than for citrus and macadamia and pineapple
Shape	
Size	
Texture	Smooth but straight lines are less clear than for Macadamia and citrus
Context	The palms of the banana trees are lighter in colours. The palms can be seen in some images. The trees are smaller than other

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2019 (Ngonini)	Last 12 months	2017

Land Use Category Level 3: Pineapple

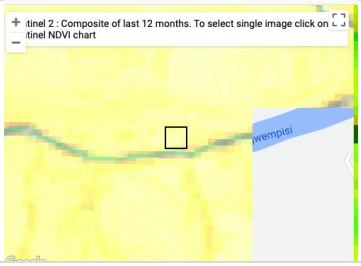
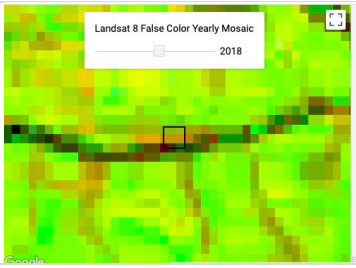
Colour	False colours: bright pink True colours: dark green
Shape	
Size	
Texture	Smooth with straight lines
Context	Intensive agriculture with clear access paths and crop lines. There are also small paths through the crops that are clearly visible when the field is getting prepared for planting. The crop is intense dark green.

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2018	2018	2018

 visible access path through the crop

Land Use Category Level 2: Agroforestry

Mixed land uses with trees, crops and livestock. The trees provide a micro-climate that improves the crop development and stabilises the soil with nutrients and stability (roots). This practice is not well developed for the moment and new practices need to be further developed. (National Forest Policy, 2002, p. 28)

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2018	Last 12 months	2018

Land Use Category Level 1: Grassland

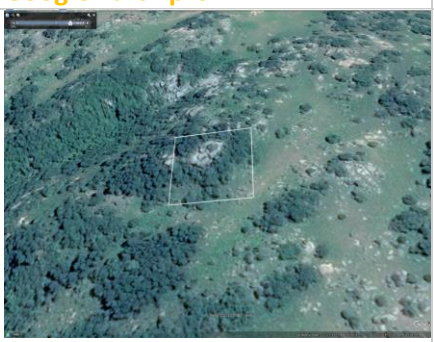
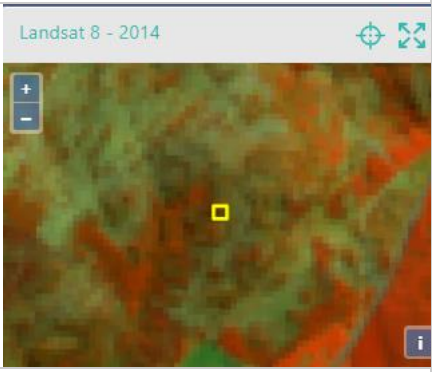
Land Use Category Level 2: Bushveld

Colour	False colour: mix of brown-red and green
Texture	Rough, mix of small trees and bushes with grass
Context	Elevation between 200-800m. <5 canopy height with bush/thicket communities, natural ecosystem close to human settlement.

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2020	2020	2018

Land Use Category Level 2: High Mountain grasslands

Colour	False colours: orange-red with some green-grey visible
Shape	Not uniform (patch of trees) with some areas that are more uniform (open grass)
Size	
Texture	Lots of tonal variation
Context	Elevation is more 800m Small trees with <5m canopy height with mostly open grasslands and some rocks in the Highveld region. Areas where pasture and path can be observed

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2013	2016	2014

Land Use Category Level 1: Wetland

Land Use Category Level 2: Natural water bodies

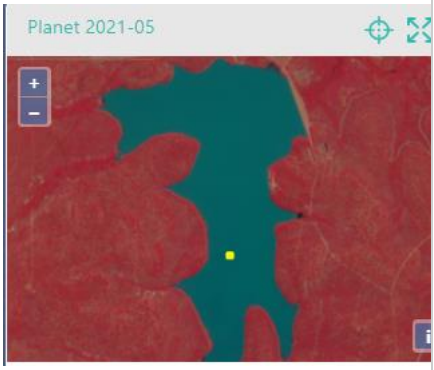
Context	Lakes, rivers, this includes all the flooded grass that surrounds the rivers, where no agriculture is possible because the soil is too damp.

Google Earth pro

2018

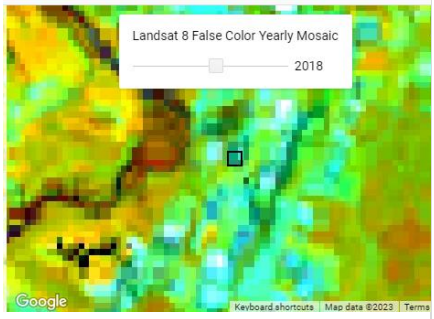
Land Use Category Level 2: Artificial Water bodies

Colour	False colour: dark blue-green. True colour: white
Shape	At least one side is straight line – where we can see that is is human-made The other side of the reservoir can have smoother lines.
Size	Example below –> 3km top-down
Texture	Smooth
Context	Dams and reservoir for irrigation/animals, off streams. Human-made

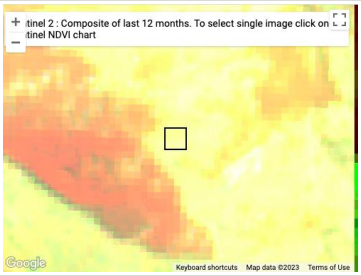
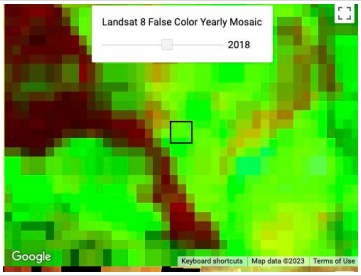
Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2021	2021	2018

Land Use Category Level 1: Settlement

Land Use Category Level 2: Settlements

Google Earth pro	Sentinel 2 or Planet NICFI	Landsat
		
2018	2018	2018

Land Use Category Level 1: Other lands

Bing load	Sentinel 2 or Planet NICFI	Landsat
		
	Last 12 months	2018

Annex II.5 Disturbances

Disturbances are punctual events that affect the land, in particular some of the carbon pools present on these lands. According to the IPCC, there are two types of disturbances; 1. Natural disturbances that happen without any human intervention, for example hurricanes or storms, 2. Anthropogenic disturbances that are created by some specific management practices can be controlled or not, for example fires. This also includes what is called degradation under REDD+, activities that will degrade the stock of carbon in a specific land use. This event can be punctual (fire) or permanent (infrastructure).

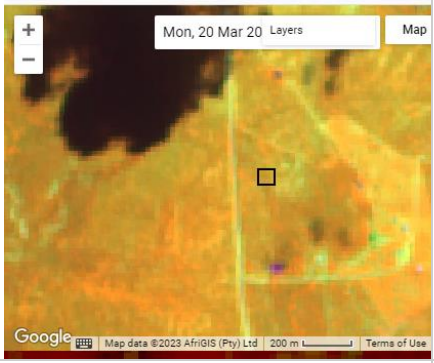
In Eswatini the following disturbances have been identified, these disturbances can be observed on forestland as presented in the table below:

Disturbances		Anthropogenic							Anthropogenic /Natural	Natural	
		Agriculture	Grazing	Infrastructure	Planned Logging (SFM)	Unplanned Logging	Mining	Fire Breaks	Fire	Storm/flood	Pest
Forest	Montane and Highland	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
	Wattle Forest	Yes	Yes	Yes	Yes			Yes	Yes	Yes	
	Plantations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Moister Savannah Forest	Yes	Yes	Yes		Yes			Yes	Yes	
	Dryer Acacia Savannah Forest	Yes	Yes	Yes		Yes			Yes	Yes	
	Riparian	Yes	Yes	Yes		Yes	Yes		Yes	Yes	
	Woodlots	Yes	Yes	Yes	Yes				Yes	Yes	
Croplands									Yes	Yes	
Grasslands									Yes	Yes	
Wetlands									Yes	Yes	
Settlements									Yes	Yes	
Otherlands									Yes	Yes	

Agriculture on Forestland

Some trees are cut down to leave space for the crops but at least 10% of the plot is still covered by trees. The croplands can be seen extending (NB: if the cropland is already there at the beginning of the period and doesn't move this is NOT a disturbance, this is a multi-use plot where priority is given to forestland). The vegetation disappears clearly on Landsat and Sentinel 2 images.

Google earth pro	
	
2009	2019



March 2017

Nov 2017

Grazing on Forestland

In Eswatini, livestock are left to pasture on open grassland at high and low altitudes. Sometimes we can find livestock on forestlands. This can be seen in rural areas close to settlements and croplands.

Infrastructure on Forestland: Expansion of the urban areas or construction of roads are the main elements that can be seen degrading the forests. These disturbances most likely will expand even more in the future and produce a land use change from forestland to settlement.

2019 – before disturbance

2021 – after disturbance

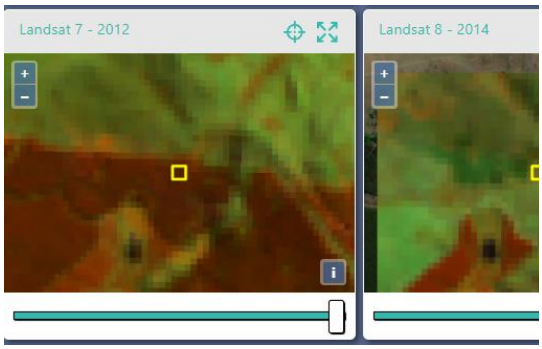
logging: in practice this is not a disturbance but a management practice, however for the exercise, logging was assessed the same way that other disturbances. In this case there was a distinction between planned and unplanned logging. Unplanned logging makes a reference to the wood that is

extracted on the natural forest such as Dryer Acacia Savannah forest, Moister Acacia Savannah Forest, Montane and Highland forest, Riparian forest. The planned logging is for the forest types that have a management practice that plans for logging extraction such as plantations, Wattle and Woodlots. This is clearly visible on managed forest such as Plantations, Wattle forest, Woodlots.

The **firebreaks** are also part of the planned logging and are clearly visible on Plantations. The land is left bare soil with a bit of grass for a few years before we can see the new plantation growing.

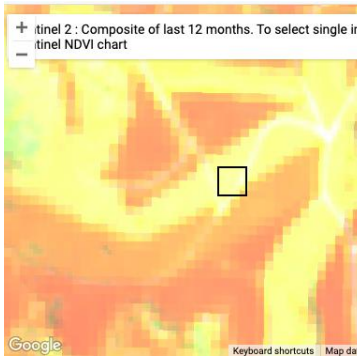
Google earth pro **Sentinel 2 or Planet NICFI** **Landsat 5-7-8**

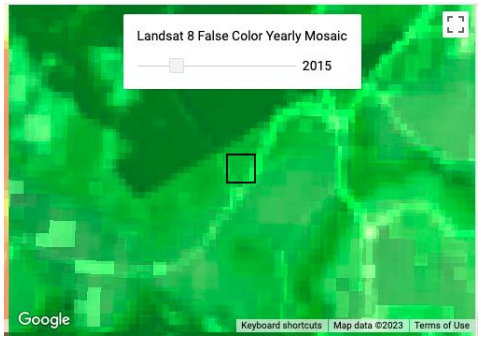
PLANNED LOGGING ON PLANTATION



2011 2013 2012 vs 2013

FIREBREAK





2011 Last 12 months 2015

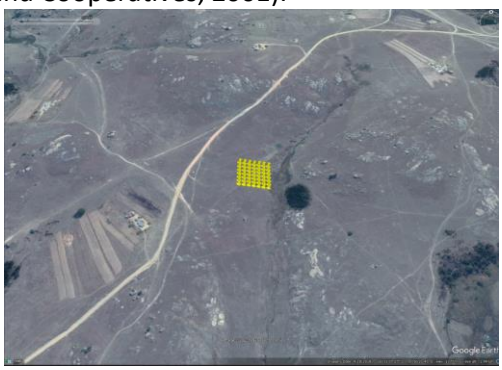
Mining on forest land: extraction of mineral is a common practice in Eswatini.

Before disturbance 2021

After disturbance 2023

Fire: The use of fire in Eswatini is recognized as an efficient tool in the management of natural forests and rangelands. Most of the burning that takes place in the natural woodlands is intended to improve grazing conditions. However, there is evidence that uncontrolled and random fires result in the

destruction of natural forest resources and loss of biodiversity. There is no full understanding of the effects of the fire regimes occurring in Swaziland. Fires tend to favour certain species to the detriment of others and reduce overall diversity. Uncontrolled fires caused by strained social relations between forest companies and neighbouring communities also affect industrial forestry (Minister of Agriculture and Cooperatives, 2001).



Before fire 2018

After fire 2019