

SAVE THE SAND SUMMARY TRANSLATED



Project title	Save the Sand
Project ID	5375
Crediting period	01-January-2026 to 31-December-2066
Project lifetime	01-January-2026 to 31-December-2066
(CCB) GHG accounting period	01-January-2026 to 31-December-2066
Original date of issue	20-January-2026
Most recent date of issue	Not applicable
Version	Version 1
VCS Standard version	Version 4.7
CCB Standards version	Version 3.1
Project location	South Africa, Mpumalanga Province
Project proponent(s)	Sand Catchment Pty Ltd. Richard Laburn richie@savethesand.com +27828213968
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History of CCB status	Not applicable

<p>Gold Level criteria</p>	<p>Climate Gold Level</p> <p>The project activities contribute to the restoration of ecosystem function through improved microclimates and soil conditions, enhanced biodiversity and increased habitat connectivity.</p> <p>Community Gold Level</p> <p>The project activities are expected to provide employment opportunities, training and extension services, with particular emphasis on women, youth and marginalized groups. Additionally, agroforestry activities are anticipated to increase household food security by diversifying crop production and promoting climate-smart agricultural practices. Collectively, these benefits will strengthen livelihoods, improve resilience to climate change and support long-term community well-being.</p>
<p>Expected verification schedule</p>	<p>Not applicable.</p>
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1 SUMMARY OF PROJECT BENEFITS

Save the Sand is a carbon project that will generate emission removals (ERs) by planting a combination of native and non-native fruit- and nut-bearing trees on residential land, croplands and selected restoration areas across the Sabie and Sand River catchments in Mpumalanga province, South Africa. Beyond carbon benefits, the project contributes to the restoration of ecosystem function through improved microclimates and soil conditions, enhanced biodiversity and increased habitat connectivity. Communities will benefit from new and sustained employment opportunities, enterprise development, training and extension services, with particular emphasis on women, youth and marginalized groups. Project activities are also anticipated to increase household food security by diversifying crop production and promoting climate-smart agroforestry practices. Collectively, these benefits will strengthen livelihoods, improve resilience to climate change and support long-term community well-being.

1.1 Unique Project Benefits

Outcome or impact estimated by the end of the project lifetime	Section reference
Restored ecosystem functions through increased soil fertility, improved water regulation and enhanced microclimates.	3.4.3
Enhanced habitat connectivity supporting wildlife and biodiversity in restored areas.	5.2.1
Greater resilience of farming systems to climate variability through the adoption of climate-smart practices, including agroforestry and improved water use.	3.3.3; 3.4.3
Sustained household food security through year-round availability of tree products and improved dietary diversity.	4.5.2
Household income diversification and the development of local enterprises through fruit and nut sales and processing.	4.2.1; 4.5.2

1.2 Standardized Benefit Metrics

Category	Metric	Estimated by the end of project lifetime	Section reference
GHG emission reductions or carbon dioxide removals	Net estimated removals in the project area, measured against the without-project scenario	~7.5 million tonnes of carbon dioxide equivalent (CO _{2e}) in the first set of project activity instances (PAIs)	3.2.4
	Net estimated reductions in the project area, measured against the without-project scenario	Not applicable	N/A
Forest ¹ cover	For Reduced emissions from deforestation and forest degradation	Not applicable	N/A

¹ Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO, or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (VCS Program Definitions)

	(REDD ²) projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario		
	For Afforestation, reforestation and revegetation (ARR) ³ projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	~40,000 hectares (ha) for the first set of PAIs	3.3.2
Improved land management	Number of hectares of existing production forest land in which Improved Forest Management (IFM) ⁴ practices are expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	N/A
	Number of hectares of non-forest land in which improved land management practices are expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	N/A
Training	Total number of community members who are expected to have improved skills and/or knowledge resulting from training provided as part of project activities	~240,000 for the first set of PAIs	4.2.1; 4.5.2
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	~132,000 for the first set of PAIs	4.2.1; 4.5.2
Employment	Total number of people expected to be employed in project activities ⁵ , expressed as number of full-time employees ⁶	Between 2026 and 2030 the project is expected to employ ~200–460 people. After 2030 the project is expected to employ 10–30 people.	4.2.1; 4.5.2
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	Approximately half of the workers employed are expected to be women. As a result, the project is expected to employ ~100–230 women between	4.2.1; 4.5.2

² Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (VCS Program Definitions)

³ Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (VCS Program Definitions)

⁴ Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood, and fuelwood (VCS Program Definitions)

⁵ Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.

⁶ Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102]; [17.28])

		2026 and 2030. After 2030, the project is expected to employ 5–15 women.	
Livelihoods	Total number of people expected to have improved livelihoods ⁷ or income generated as a result of project activities	~240,000 for the first set of PAIs	4.2.1; 4.5.2
	Number of women expected to have improved livelihoods or income generated as a result of project activities	~132,000 for the first set of PAIs	4.2.1; 4.5.2
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	N/A
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	N/A
Education	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	~480,000 for the first set of PAIs	4.5.2
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	~264,000 for the first set of PAIs	4.5.2
Water	Total number of people who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	N/A
	Number of women who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	N/A

⁷ Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. The Sustainable Livelihood Approach to Poverty Reduction. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

Well-being	Total number of community members whose well-being ⁸ is expected to improve as a result of project activities	~480,000 for the first set of PAIs	4.2.1; 4.5.2
	Number of women whose well-being is expected to improve as a result of project activities	~264,000 for the first set of PAIs	4.2.1; 4.5.2
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation ⁹ , measured against the without-project scenario	~40,000 ha for the first set of PAIs	5.2.1
	Expected number of globally Critically Endangered or Endangered species ¹⁰ benefiting from reduced threats as a result of project activities ¹¹ , measured against the without-project scenario	1 – Pepperbark tree (<i>Warburgia salutaris</i>)	5.2.4

2 PROJECT DETAILS

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Summary Description of the Project (VCS, 3.2, 3.6, 3.10, 3.11, 3.13, 3.14; CCB, G1.2)

The project zone comprises the Sabie and Sand River catchments in the Ehlanzeni District Municipality (EDM) of Mpumalanga Province, South Africa. Covering ~630,000 hectares (ha), these catchments contain diverse ecosystems from the savanna, grassland and forest biomes that support numerous plant and animal species. The region also forms part of the declared Maputuland-Pondoland-Albany Global Biodiversity Hotspot¹² and the UNESCO-designated Kruger to Canyons Biosphere Reserve¹³, and it overlaps with recognized Key Biodiversity Areas (KBAs)¹⁴. Several protected areas occur within and adjacent to the

⁸ Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g., Training, Employment, Livelihoods, Health, Education and Water) and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.

⁹ Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g., enhancing the status of endangered species

¹⁰ Per IUCN's Red List of Threatened Species

¹¹ In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

¹² Critical Ecosystem Partnership Fund. 2025. Maputuland-Pondoland-Albany. Available at: <https://www.cepf.net/our-work/biodiversity-hotspots/maputaland-pondoland-albany>. Accessed on 29 August 2025.

¹³ The department of Forestry, Fisheries and the Environment. 2025. Kruger to Canyons Biosphere Reserve. Available at: <https://www.dffe.gov.za/kruger-canyons-biosphere-reserve>. Accessed on 29 August 2025.

¹⁴ South African National Biodiversity Institute. 2025. Key Biodiversity Areas in South Africa. Available at: <https://www.sanbi.org/biodiversity/building-knowledge/biodiversity-monitoring-assessment/key-biodiversity-areas-in-south-africa/>. Accessed on 29 August 2025.

project area, which support conservation, agriculture, tourism and other land uses that sustain the livelihoods of ~2.3 million people¹⁵.

Planned activities include agroforestry in croplands and residential areas such as homesteads, schools, public spaces and other communal lands, as well as reforestation in degraded forests, riparian zones and tree planting along roadsides where possible. Agroforestry in croplands will involve planting up to 100 trees/ha using a mix of native and non-native fruit- and nut-bearing species. Similarly, residential planting will establish a combination of fruit, nut and native species at densities of up to 50 trees/ha. Reforestation with native tree species in communal open areas and along riverbanks is expected to stabilize soils, restore riparian buffers and increase habitat connectivity. These activities are not linked to a jurisdictional Reducing Emissions from Deforestation and forest Degradation, plus the conservation, sustainable management and enhancement of forest carbon stocks (REDD+) program, as none currently exist in South Africa. The project activities are designed to enhance: i) carbon sequestration through tree planting; ii) ecosystem resilience by stabilizing soils, improving water regulation and moderating local microclimates; iii) biodiversity conservation by restoring habitats and improving connectivity; and iv) local livelihoods through food provision, employment and small enterprise opportunities. In doing so, the project addresses the pressures of unsustainable agricultural practices, creates alternative livelihoods to reduce extractive resource use and increases resilience to the impacts of climate change. These pressures have contributed to vegetation loss, soil erosion and declines in water quality and availability, with cascading consequences for ecosystems, biodiversity and community livelihoods.

The project has been designed using the Verified Carbon Standard (VCS) Methodology VM0047 version 1.1 for Afforestation, Reforestation and Revegetation (ARR)¹⁶. A census-based approach is applied to residential areas and croplands. An area-based approach will be applied in reforestation areas where the census-based approach is not feasible. Using a VCS-grouped approach, the project will begin with small-scale initial Project Activity Instances (PAIs) that are representative of the planned activities. These initial PAIs will be used to refine project design, implementation and monitoring and will be used to build community support before scaling up. Over the 40-year project duration, the first set of PAIs in residential areas (30,000 ha) and croplands (10,000 ha) is expected to remove ~7.5 million tonnes of CO₂-equivalent (tCO₂e). Estimates for removals from reforestation will be included in an updated Project Design Document (PDD) when these activities are added. The project is also expected to deliver additional community and biodiversity benefits, and the Project Proponent will seek combined Climate, Community and Biodiversity (CCB) Standard certification, with Gold Level Status expected for Climate and Community benefits. The planned activities are expected to achieve this by reducing pressure on natural resources, conserving the environment and supporting sustainable economic development and community ownership.

2.1.2 Audit History (VCS, 4.1)

The project is currently listed on the Verra registry as ‘Under development’ and validation has not yet taken place. Contracting a Validation and Verification Body (VVB) to validate both the VCS and CCB components is still in progress; therefore, no audit history is available.

2.1.3 Sectoral Scope and Project Type (VCS, 3.2)

Sectoral scope	14: Agriculture, Forestry and Other Land Use (AFOLU)
AFOLU project category	Afforestation, Reforestation and Revegetation (ARR)

¹⁵ Ehlanzeni District Municipality (EDM). 2024. Ehlanzeni District Municipality’s final Integrated Development Plan and budget 2024/25 review. Ehlanzeni District Municipality. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2024/05/Final-IDP-Budget-2024-25-22-May-2024.pdf>.

¹⁶ Verra. 2025. VM0047 Afforestation, Reforestation and Revegetation. VCS Methodology. Version 1.1. Retrieved from: https://verra.org/wp-content/uploads/2025/05/VM0047-v1.1_Final.pdf

Project activity type

Afforestation in the form of agroforestry and targeted reforestation

2.1.4 Project Eligibility (VCS, 3.1, 3.6, 3.8, 3.18, 4.1; CCB Program Rules, 4.2.4, 4.6.4)

This section presents the eligibility of the proposed activities in accordance with the VCS and CCB standards, which set the requirements for participation, including the scope of activities, general requirements and criteria for project design. The table below outlines compliance with the scope requirements of the VCS Standard v4.7¹⁷ and the CCB Program Rules v3.1¹⁸.

VCS scope requirements	
Requirement (VCS Standard v4.7)	Project compliance
<p>2.1.1 The scope of the VCS Program includes:</p> <ul style="list-style-type: none"> i) The seven Kyoto Protocol greenhouse gases (GHGs). ii) Ozone-depleting substances (ODS). iii) Project activities supported by a methodology that is approved by the VCS Program. iv) Project activities supported by a methodology approved by an approved GHG program, unless explicitly excluded (see the Verra website for exclusions¹⁹). v) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the Jurisdictional and Nested REDD+ (JNR) Requirements. 	<p>Eligibility for the VCS is satisfied on two counts. Point i) is met because the project accounts for emissions and removals of carbon dioxide (CO₂), and emissions from nitrous oxide (N₂O) and methane (CH₄), which are three of the seven Kyoto Protocol greenhouse gases. Point iv) is met because the project has been prepared using the approved VCS Methodology: VM0047.</p>
<p>2.1.2 The scope of the VCS Program excludes projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction.</p>	<p>No GHG emissions will be intentionally generated for later reduction or removal. Land clearing, biomass burning and other emission-causing practices will be excluded to avoid inflating the baseline, which is established from pre-project data.</p>
<p>2.1.3 The VCS Program excludes project activities listed in Table 1 of the VCS standard under the circumstances indicated.</p>	<p>The project activities are not excluded by the VCS version 4.7 and are therefore eligible within the scope of the VCS Program.</p>
CCB Scope requirements	
Requirement (CCB Program Rules v3.1)	Project compliance
<p>2.3 The CCB Program covers land-based projects that generate net positive climate, community and biodiversity benefits. Eligible activities include projects that reduce GHG emissions and projects that remove CO₂. The scope does not include the generation of credits for GHG emission reductions and removals, carbon footprint assessments or carbon neutrality claims.</p>	<p>The project's activities are land-based (tree planting) and designed to deliver measurable climate mitigation, community development and biodiversity co-benefits. The Project Proponent will not claim GHG credits directly with the CCB Standards but uses the VCS Program for carbon accounting.</p>

¹⁷ Verra. 2024. VCS Standard. v4.7. Retrieved from: <https://verra.org/wp-content/uploads/2024/04/VCS-Standard-v4.7-FINAL-4.15.24.pdf>

¹⁸ Verra. 2017. CCB Program Rules. v3.1. Retrieved from: <https://verra.org/wp-content/uploads/2024/07/CCB-Program-Rules-v3.1.pdf>

¹⁹ Verra. ND. Program Methodology. VCS Program Standards. Retrieved from: <https://verra.org/program-methodology/vcs-program-standard/vcs-program-methodologies-active/>

<p>3.2 Project proponents must use a recognized GHG program (currently only the VCS). These programs must apply defensible methodologies, require independent auditing and maintain public transparency.</p>	<p>The Project Proponent will register the project with the VCS Program, which is the only GHG program currently recognized by the CCB Standards.</p>
<p>3.5 Project proponents must prepare a PDD and Monitoring Report (MR) using official CCB or combined CCB+VCS templates. These must detail design, implementation and outcomes.</p>	<p>Compliance is demonstrated through the use of the official CCB & VCS Project Description Template and Monitoring Report Template.</p>

The table below presents compliance with the VCS Standard v4.7 general, AFOLU and project design requirements. Each requirement is paired with supporting evidence to demonstrate alignment with the applicable rules and methodologies.

VCS General requirements	
Requirement (VCS Standard v4.7)	Project compliance
<p>3.1.1 Projects shall meet all applicable rules and requirements set out by the VCS Program. Projects shall be guided by the International Organization for Standardization (ISO) 14064-2 principles set out in Section 2.2.1 of the VCS Standard v4.7.</p>	<p>The project complies with all applicable VCS Program rules and requirements, applying the ISO 14064-2 principles throughout design, monitoring and reporting. Relevant GHG sources, sinks and reservoirs have been identified and appropriate methodologies selected to ensure relevance. All material emissions and removals are accounted for, ensuring completeness and procedures are applied consistently to enable valid comparisons. Data collection and calculation methods minimize bias and uncertainty to ensure accuracy, while transparent documentation allows stakeholders to make informed assessments. Conservative assumptions and parameters are applied to avoid overestimation of emission reductions or removals.</p>
<p>3.1.2 Projects shall apply methodologies eligible under the VCS Program. Methodologies shall be applied in full, including the full application of any tools or modules referred to by a methodology, noting the exception set out in Section 3.14.1 of the VCS Standard v4.7.</p>	<p>VCS Methodology VM0047 for ARR v1.1, Module VMD0054 v1.0²⁰, Tool VT008 v1.0²¹ and the AFOLU Non-Permanence Risk Tool v4.2²² have been applied to the project design, all of which are eligible in accordance with the VCS Program.</p>
<p>3.1.3 Projects shall apply the latest version of the applicable methodology in all cases unless a grace period applies to the project as set out in 3.22 of the VCS Standard v4.7. Projects shall update to the latest version of the methodology when reassessing the baseline or renewing a crediting period.</p>	<p>The latest version of the VM0047 Methodology (v1.1, effective 14 May 2025) has been applied to the project design.</p>

²⁰ Verra. 2023. VCS Module. VMD0054. Module for Estimating Leakage from ARR Activities. Version 1.0. Retrieved from: https://verra.org/wp-content/uploads/2023/09/VMD0054_ARR-Leakage-Module_v1.0.pdf

²¹ Verra. 2024. VCS Tool. VT0008. Additionality Assessment. Version 1.0. Retrieved from: <https://verra.org/wp-content/uploads/2024/10/VT0008-Additionality-Assessment-v1.0.pdf>

²² Verra. 2024. Non-Permanence Risk Tool. v4.2. Retrieved from: <https://verra.org/wp-content/uploads/2023/10/AFOLU-Non-Permanence-Risk-Tool-v4.2-last-updated-May-3-2024.pdf>

<p>3.1.4 Projects and the implementation of project activities shall not lead to the violation of any applicable law, regardless of whether or not the law is enforced.</p>	<p>Compliance with all relevant local and national laws, as set out in Section 2.5 of this PDD, will be maintained throughout the project. Ongoing consultations with legal experts and government bodies will ensure continued alignment with applicable legislation over the project duration.</p>
<p>VCS AFOLU requirements</p>	
<p>Requirement (VCS Standard v4.7)</p>	<p>Project compliance</p>
<p>3.2.1 There are currently six AFOLU project categories eligible under the VCS Program, as defined in Appendix 1 of the VCS Standard v4.7. These include: i) ARR; ii) Agricultural Land Management (ALM); iii) Improved Forest Management (IFM); iv) REDD; v) Avoided Conversion of Grasslands and Shrublands (ACoGS); and vi) Wetland Restoration and Conservation (WRC). Further specification with respect to eligible activities which may be included within methodologies approved under the VCS Program can be found in the VCS Methodology Requirements²³.</p>	<p>The project design satisfies the eligibility criteria for an ARR project in the AFOLU category.</p>
<p>3.2.2 Where projects are located within a jurisdiction covered by a jurisdictional REDD+ program, project proponents shall follow the requirements in the VCS Standard v4.7 and the requirements related to nested projects set out in the Jurisdictional and Nested REDD+ Requirements.</p>	<p>The project is not within a jurisdiction covered by a jurisdictional REDD+ program.</p>
<p>3.2.3 Where an implementation partner is acting in partnership with the project proponent, the implementation partner shall be identified in the PDD. The implementation partner shall identify its roles and responsibilities with respect to the project, including but not limited to implementation, management and monitoring of the project, over the project crediting period.</p>	<p>Details of the Project Proponent and implementation partners are provided in Sections 2.1.7 and 2.1.8 of this PDD. The respective roles and responsibilities — including those related to implementation management and monitoring over the crediting period — are described in Section 2.4.1.</p>
<p>3.2.8 Where ARR, ALM, IFM or REDD project activities occur on wetlands, the project shall adhere to both the respective project category requirements and the WRC requirements, unless the expected emissions from the soil organic carbon pool or change in the soil organic carbon pool in the project scenario is deemed below de minimis or can be conservatively excluded as set out in the VCS Methodology Requirements, in which case the project shall not be subject to the WRC requirements.</p>	<p>No project activities are planned for wetlands.</p>
<p>3.2.10 Projects shall prepare a non-permanence risk report in accordance with the <i>AFOLU Non-Permanence Risk Tool</i> at validation and verification. The non-permanence risk report shall be prepared using the <i>AFOLU Non-Permanence</i></p>	<p>The non-permanence risk assessment has been conducted in accordance with version 4.2 of the Non-Permanence Risk Tool and will be submitted through VERRA's Digital AFOLU Non-Permanence Risk Tool</p>

²³ Verra. 2023. VCS Methodology Requirements. v4.4. Retrieved from: <https://verra.org/wp-content/uploads/2023/08/VCS-Methodology-Requirements-v4.4-updated-4-Oct-2023.pdf>

<p><i>Risk Assessment Calculator</i> and shall be included as an appendix to the project description or monitoring report, as applicable, or provided as a stand-alone document.</p>	<p>portal on the Project Hub platform. The corresponding AFOLU Non-Permanence Risk Report is provided as a standalone Annex to the PDD.</p>
<p>3.2.11 Projects shall have a minimum of 40-year project longevity.</p>	<p>The project has a crediting period of 40 years and a longevity of 100 years.</p>
<p>3.2.24 The permanence of carbon stocks shall be monitored for a minimum of 40 years.</p>	<p>Monitoring of carbon stocks will be maintained for 100 years, consistent with the project's longevity.</p>
<p>3.2.28 Where ARR and IFM projects meet or exceed the harvesting activity definition, the long-term average shall be applied. The stratification of the sample plots shall be proportionally representative of areas with and without harvesting activity. Projects with harvesting activities shall calculate the long-term average for the area of each stratum and cover the entire project area.</p>	<p>Not applicable. As per the VCS Program Definitions v4.5²⁴, harvesting is defined as activities that result in a reduction of more than 20% of carbon stocks within five years from the onset of the reduction. The project will only involve fruit harvesting and periodic pruning of non-native fruit trees, undertaken in line with best practices for fruit production. These activities will not exceed the 20% threshold and therefore do not constitute harvesting.</p>
<p>3.2.29 ARR and IFM projects with harvesting activities shall not be issued GHG credits above the long-term average GHG benefit maintained by the project.</p>	<p>Not applicable, as noted in the justification for 3.2.28 above. The project involves fruit harvesting and periodic pruning of non-native fruit trees, undertaken in line with best practices for fruit production. These activities will not exceed the 20% threshold and therefore do not constitute harvesting.</p>
<p>3.2.30 Where ARR or IFM projects include harvesting, the loss of carbon due to harvesting shall be included in the quantification of project emissions. The maximum number of GHG credits available to projects shall not exceed the long-term average GHG benefit. The GHG benefit of a project is the difference between the project scenario and the baseline scenario of carbon stocks stored in the selected carbon pools and adjusted for any project emissions of N₂O, CH₄ and fossil-derived CO₂ and leakage emissions.</p>	<p>Not applicable, as stated in the justification for 3.2.28 above. Project activities are limited to fruit harvesting and periodic pruning of non-native fruit trees, undertaken in accordance with best practices for fruit production. These activities will not exceed the 20% threshold and therefore do not constitute harvesting.</p>
<p>VCS Project Design requirements</p>	
<p>Requirement (VCS Standard v4.7)</p>	<p>Project compliance</p>
<p>3.6.1 Projects may include multiple project activities where the methodology applied to the project allows more than one project activity and/or where projects apply more than one methodology.</p>	<p>Not applicable. Only one project activity is considered, ARR.</p>
<p>3.6.4 Both grouped and non-grouped projects can have multiple PAIs.</p>	<p>The project is a grouped project and will have several PAIs. The eligibility requirements for these are addressed in Section 2.1.6 of this PDD.</p>

²⁴ Verra. 2024. VCS Program Definitions. V4.2. Retrieved from: <https://verra.org/wp-content/uploads/2024/08/VCS-Program-Definitions-v4.2.pdf>

The table below outlines compliance with the VCS v4.7 requirements for stakeholder engagement, consultation and Free, Prior and Informed Consent (FPIC), ensuring affected stakeholders are identified, consulted and protected through transparent processes, grievance mechanisms and respect for rights.

VCS Stakeholder engagement and consultation requirements	
Requirement (VCS Standard v4.7)	Project compliance
<p>3.18.1 The project proponent shall conduct a thorough assessment of the stakeholders who will be impacted by the project activities.</p>	<p>A stakeholder analysis has been conducted, and the stakeholders are described in Sections 2.3, 2.4 and Appendix 1.</p>
<p>3.18.2 The project proponent shall conduct a stakeholder consultation before implementation of project activities. Such consultations shall be done in a manner that is inclusive, culturally appropriate and respectful of local knowledge.</p>	<p>Consultations were held with traditional authorities, community members and other local stakeholders prior to implementation. Sessions followed customary protocols, used local languages and ensured respect for traditional knowledge. The process – including the formal FPIC procedure – is described in Section 2.3 and 2.5.7, and the FPIC Report is provided as an Annex to this PDD.</p>
<p>3.18.3 The project proponent shall take due account of all input received during the stakeholder consultation and through ongoing communications. The input from stakeholders may require updates to the project design, which shall be reported as a project description deviation. Where the project proponent does not update the project design, the project proponent shall justify why updates are not appropriate. The project proponent shall demonstrate to the VVB what action it has taken in respect of the stakeholder consultation as part of validation and in respect of ongoing communications as part of each subsequent verification.</p>	<p>Feedback from consultations and ongoing communication was recorded and reviewed. Suggestions were incorporated where aligned with project objectives, while others were documented with clear justifications for non-inclusion (See Section 2.3.5).</p>
<p>3.18.4 The project proponent shall develop a grievance redress procedure to address disputes with stakeholders that may arise during project planning and implementation, including regarding benefit sharing and all other safeguard and stakeholder engagement requirements mentioned in Sections 3.18 and 3.19, respectively. The procedure shall include processes for receiving, hearing, responding and attempting to resolve grievances within a reasonable time period, considering culturally appropriate conflict resolution methods. The procedure and documentation of disputes resolved through the procedure shall be made publicly available.</p>	<p>A grievance redress mechanism has been established with steps for submission, review, resolution and follow-up. It uses culturally appropriate conflict resolution approaches and ensures transparency and accessibility. Details are outlined in Section 2.3.10.</p>
<p>3.18.5 The project proponent shall establish mechanisms for ongoing communication with stakeholders to allow stakeholders to raise concerns about potential negative impacts during project implementation.</p>	<p>Communication mechanisms include community meetings, liaison officers, digital platforms such as the WhatsApp chatbot, email and project website and local media. These channels provide opportunities to raise concerns and receive feedback in accessible formats. The framework is described in Section 2.3.10.</p>

VCS Free, Prior and Informed Consent (FPIC) requirements	
Requirement (VCS Standard v4.7)	Project compliance
<p>3.18.7 The project proponent shall respect stakeholders' rights to participate in and consent to consultation as part of project design and implementation.</p>	<p>All groups – including women, youth and vulnerable households – participated in consultations, which were designed to be inclusive and culturally appropriate. Feedback-informed project design will continue to guide adaptive management throughout implementation (See Section 2.3.5).</p>
<p>3.18.8 The project may affect property rights only if free, prior and informed consent is obtained from those concerned, including Indigenous Peoples (IPs), local communities (LCs) and customary rights holders, and a transparent agreement is reached that includes provisions for just and fair compensation. In the event there are any ongoing or unresolved conflicts over property rights, usage, or resources, the project shall undertake no activity that could exacerbate the conflict or influence the outcome of an unresolved dispute.</p>	<p>FPIC was obtained from local communities and customary rights holders through transparent and culturally appropriate processes. Stakeholders received clear information on project scope, potential impacts and benefits before giving consent. Safeguards ensure project activities are paused or adapted if property or resource disputes arise, preventing any exacerbation of ongoing land conflicts (see Section 2.5.7 and FPIC Report provided as an Annex to this PDD).</p>

The validation process will follow the procedures set out by the VCS Program. A 30-day public comment period will commence once the project is listed as under validation. Following this period, an opening meeting with the VVB and a subsequent site visit will be conducted. The validation report and validation statement will both be submitted within one year of the initiation of the public comment period. The project is also expected to meet all relevant deadlines: i) the pipeline listing process was initiated on 31 December 2024, within the required three-year period of the project start date (1 November 2025); and ii) validation will be completed within five years of the start date, with the process of reviewing and selecting a VVB already under way to ensure completion before 1 November 2033.

2.1.5 Transfer Project Eligibility (VCS, 3.23, Appendix 2)

The Project Proponent does not seek to transfer between GHG programs.

2.1.6 Project Design (VCS, 3.6)

Indicate if the project has been designed as:

- Single location or installation
- Multiple locations or project activity instances (but not a grouped project)
- Grouped project

Save the Sand is a grouped project, which allows the project area to be expanded across the entire project boundaries through the inclusion of new PAIs after validation. Formal inclusion of new PAIs will occur at each verification event. The project boundaries are those of the Sabie and Sand River Catchments within the Ehlanzeni District Municipality, Mpumalanga, South Africa (See Figure 1). The first set of PAIs includes agroforestry in croplands and residential areas within the ~169,000 ha of customary land, governed by traditional authorities. Figure 1 provides a map of the catchments and traditional authority boundaries.

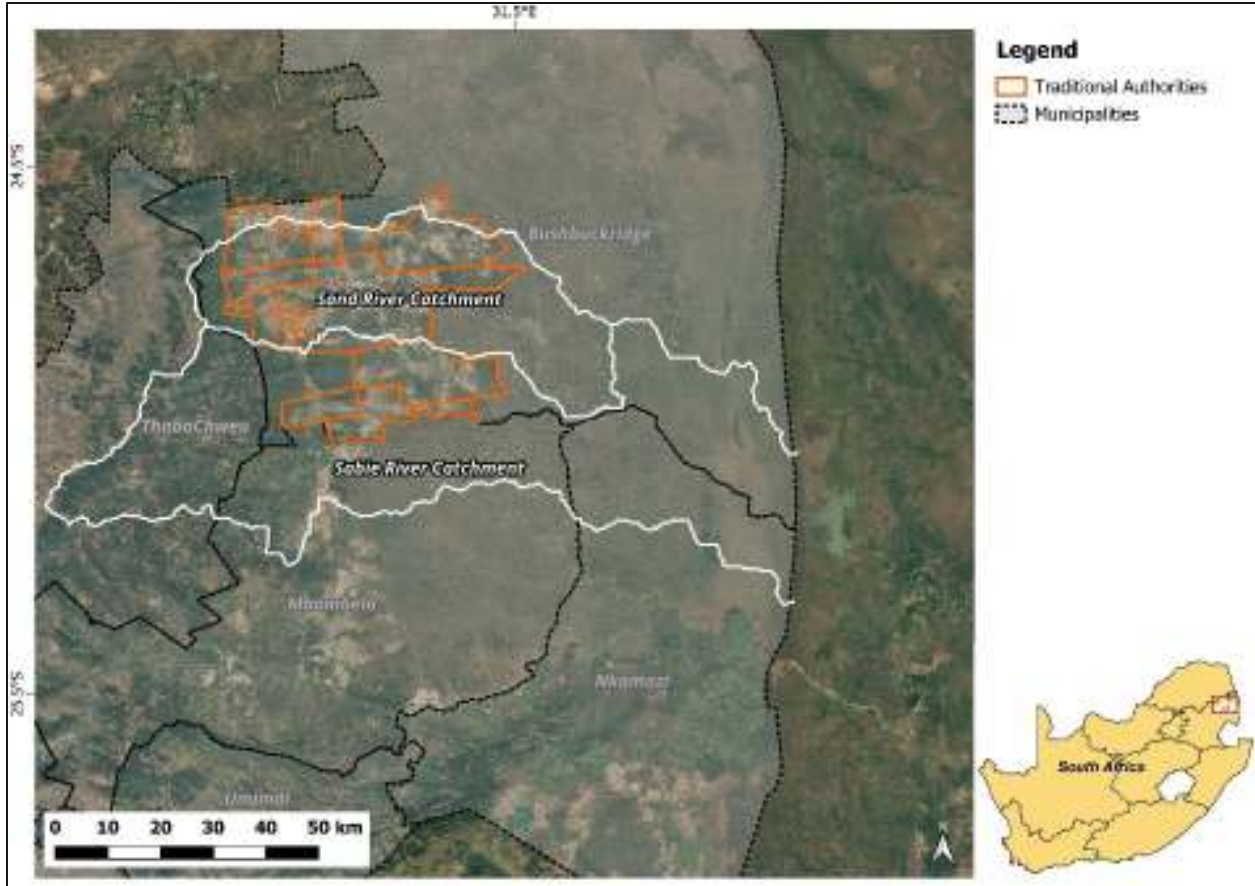


Figure 1. Map of the overall project boundaries and those of the first set of project activity instances.

For future PAIs, agroforestry project activities are planned to expand into the remainder of the Sabie and Sand River catchments and potential reforestation outside of croplands and residential areas will also be included where eligible. The PAI modelled in this PDD consists of 10,000 ha of cropland and 30,000 ha of residential areas within the traditional authority boundaries.

2.1.6.1 Eligibility Criteria for Grouped Projects (VCS, 3.6; CCB, G1.14)

The table below sets out compliance with the eligibility conditions for grouped projects as per the VCS Standard v4.7.

Grouped Project Eligibility Criteria (VCS Standard v4.7)	Project Compliance
<p>3.6.10 Grouped projects shall specify one or more clearly defined geographic areas within which PAIs may be developed. Such geographic areas shall be specified using geodetic polygons. Geographic areas with no initial PAIs shall not be included in the project unless it can be demonstrated that the same (or at least as conservative) baseline scenario and rationale for the demonstration of additionality applies to such an area as a geographic area that does include initial PAIs.</p>	<p>The ~630,000-ha grouped project area – comprising the Sabie and Sand River catchments in Mpumalanga Province, South Africa – encompasses all PAIs. Within these catchments, the project's agroforestry activities will focus on existing cropland and residential areas. Reforestation will be focused on smaller degraded sites, such as riparian areas damaged by sand mining, that will be identified and delineated on a site-by-site basis during implementation.</p> <p>Geographic boundaries are provided (Figure 1) and KML files and geodetic co-ordinates supplement this PDD.</p>

<p>3.6.11 The baseline scenario and demonstration of additionality are based on initial PAIs. The initial PAIs are those included in the project description at validation and shall include all PAIs currently implemented on the issue date of the project description. The initial PAIs may also include any instances of the project activity that have been planned and developed to a sufficient level of detail to enable their assessment at validation.</p>	<p>The baseline scenarios and demonstration of additionality for the first set of PAIs have been provided in Sections 3.1.4 and 3.1.5.</p>
<p>3.6.12 As with non-grouped projects, grouped projects may incorporate multiple project activities. Where a grouped project includes multiple project activities, the project description shall designate which project activities may occur in each geographic area.</p>	<p>There will only be one project activity: ARR.</p>
<p>3.6.13 The baseline scenario for a project activity shall be determined for each designated geographic area in accordance with the methodology applied to the project. Where a single baseline scenario cannot be determined for a project activity over a geographic area, the geographic area shall be redefined or divided so that a single baseline scenario can be determined for the revised geographic area or areas.</p>	<p>The baseline scenario for the project activity of each area has been determined and is provided in Section 3.1.5.</p>
<p>3.6.14 The additionality of the initial PAIs shall be demonstrated for each designated geographic area in accordance with the methodology applied to the project. Where the additionality of the initial PAIs within a particular geographic area cannot be demonstrated for the entirety of that geographic area, the geographic area shall be redefined or divided such that the additionality of the instances occurring in the revised geographic area, or areas, can be demonstrated.</p>	<p>Additionality, for the focus PAIs, has been assessed using the Regulatory Surplus, Investment Analysis and common practice demonstrations as required by VM0047 for the census-based approach. This is presented in Section 3.1.5.</p> <p>If any ARR activities are implemented using the area-based approach, the common practice analysis will be replaced by the Performance Benchmark analysis.</p>
<p>3.6.15 Where factors relevant to determining the baseline scenario or demonstration of additionality require assessment across a given area, the area shall be, at a minimum, the grouped project geographic area. Examples of such factors include, inter alia, customary practice; laws, statutes, regulatory frameworks, or policies relevant to demonstrating regulatory surplus; determination of regional grid emission factors; and historical deforestation and degradation rates.</p>	<p>The Project Proponent has assessed all factors relevant to the baseline scenario and demonstrates additionality across the full grouped project geographic area.</p> <p>Customary practices of land use, including prevailing agricultural and tree planting activities, have been evaluated to establish the baseline conditions. Applicable laws, statutes, regulatory frameworks and policies were reviewed to confirm regulatory surplus across the area. Regional grid emission factors have been applied consistently at the grouped project scale to ensure accuracy in baseline emissions. Historical deforestation and degradation rates were analyzed using spatial datasets and verified sources, covering the entire grouped project area, to ensure that the baseline reflects actual regional trends. This information is presented in Sections 3.1.4 and 3.1.5.</p>

The Project Proponent has established a set of eligibility criteria for the inclusion of new PAIs to align with the requirements of VCS Standard v4.7 and the VM0047 v1.1 Methodology. These eligibility criteria are listed in the table below.

New PAI Eligibility Criteria (VCS Standard v4.7)	Project Compliance
<p>3.6.16.1. New PAIs shall meet the applicability conditions set out in the methodology applied to the project.</p>	<p>All new PAIs will meet the applicability conditions described in Section 3.1.2 of this PDD.</p>
<p>3.6.16.2. New PAIs shall use the technologies or measures specified in the project description.</p>	<p>All new PAIs will follow the technology and measures outlined in Section 2.1.17 of this PDD. Including:</p> <ul style="list-style-type: none"> • being subject to the same project execution protocols described in this PDD submitted for validation; • being subject to the same strategies to engage with landowners and other stakeholders; • integrating with the project’s training initiatives and tree-growing nurseries; • being designated as one of the approved land-use types (cropland, residential or, where applicable, roadside verges, school grounds, riparian buffers or specific degraded area for reforestation); and • following site-specific designs that ensure compatibility with landowner preferences while maintaining compliance with project design standards.
<p>3.6.16.3. New PAIs shall apply the technologies or measures in the same manner as specified in the project description.</p>	<p>All new PAIs will adopt one or more activities listed below according to how their land is designated. These activities include:</p> <ul style="list-style-type: none"> • agroforestry in croplands using alley cropping and boundary planting; • agroforestry in residential areas such as planting in home gardens, public spaces, schools and roadsides; and • reforestation of degraded areas on a site-by-site basis, as is applicable, for example, in degraded riparian areas. <p>Planting densities will be consistent with the project design, including up to 100 trees/ha in croplands and up to 50 trees/ha in residential areas. All new PAIs will apply the technology and measures in the same manner as outlined in Section 2.1.17 of this PDD.</p>
<p>3.6.16.4 New PAIs are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.</p>	<p>All new PAIs will be subject to the baseline scenario described in Section 3.1.4 of this PDD.</p>
<p>3.6.16.5. New PAIs have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For</p>	<p>All new PAIs will have similar barriers to additionality as the PAIs, including financial, infrastructure and</p>

<p>example, the new PAIs have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances or face the same investment, technological and/or other barriers as the initial instances.</p>	<p>knowledge barriers. See Section 3.1.5 of this PDD for more details.</p>
<p>3.6.17.1 New PAIs shall occur within one of the designated geographic areas specified in the project description.</p>	<p>New PAIs are designated to occur in the Sabie and Sand River catchments as outlined in Section 2.1.16 of this PDD.</p>
<p>3.6.17.2 New PAIs shall conform to at least one complete set of eligibility criteria for the inclusion of new PAIs.</p>	<p>All new PAIs will be evaluated against this table of eligibility criteria.</p>
<p>3.6.17.3 New PAIs shall be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate conformance.</p>	<p>Supporting evidence, including records of stakeholder engagement and references to relevant provisions, will be submitted at the time of PAI validation during verification.</p>
<p>3.6.17.4 New PAIs shall have evidence of project ownership from the start date of each PAI.</p>	<p>All new PAIs will demonstrate evidence of ownership from the start date. Eligible lands should:</p> <ul style="list-style-type: none"> • be documented through agreements described in Section 2.1.19 of this PDD; • have established stakeholder and tree custodian agreements; • occur on private, customary, government or Community Property Association (CPA)-owned land; • have no competing land claims; and • have no unresolved disputes. <p>Areas with ongoing disputes will only be included once disputes are resolved.</p> <p>Any instances added to traditional authorities will be required to have:</p> <ul style="list-style-type: none"> • Ownership and use rights, evidenced through Memoranda of Understanding (MOUs) or attestation forms signed by traditional authorities, together with contractual agreements with Permission to Occupy (PTO) holders or equivalent land-rights holders. • Evidence of agreements with traditional authorities (e.g., chiefs or kings) will also be required to ensure recognition of customary tenure and reduce the risk of disputes.
<p>3.6.17.5. New PAIs shall have a start date that is the same as or later than the grouped project start date.</p>	<p>New PAIs will have a start date of 1 November 2025 or later. This is specified in Section 2.1.10 of this PDD.</p>
<p>3.6.17.6 New PAIs shall only be eligible for crediting from the start date of the instance or the verification period in which they were added.</p>	<p>New PAIs will comply with this condition.</p>

3.6.17.7 New PAIs shall not be or have been enrolled in another VCS project.

Before being added to the project, each new PAI will undergo review to confirm it has not been enrolled in another VCS project.

2.1.7 Project Proponent (VCS, 3.7; CCB, G1.1)

Organization name	Sand Catchment Pty Ltd.
Contact person	Richard Laburn
Title	CEO
Address	4 Fairlands Village, White River, Mpumalanga, 1240, South Africa
Telephone	+27828213968
Email	richie@savethesand.com

2.1.8 Other Entities Involved in the Project

Organization name	C4 EcoSolutions (Pty) Ltd.
Role in the project	Technical and implementation partner
Contact person	Robbert Duker
Title	Dr
Address	River Park, Birkdale 1, Mowbray, Cape Town, 7700
Telephone	021 712 0282
Email	info@c4es.co.za

Organization name	The Ten Trees Project
Role in the project	Community engagement, training and implementation partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the Protection of Personal Information (POPI) Act 4 of 2013 ²⁵ . These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-

²⁵ The Republic of South Africa. 2025. Protection of Personal Information Act 4 of 2013. The South African Government. Available at: <https://www.gov.za/documents/protection-personal-information-act>. Accessed on 29 September 2025.

Telephone	-
Email	-

Organization name	Root and Ground
Role in the project	Propagation, training and implementation partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	Good Work Foundation (GWF)
Role in the project	Community engagement and training partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	Lotus Impact Foundation
Role in the project	Community engagement and training partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-

Address	-
Telephone	-
Email	-

Organization name	Farmer Empowerment, Agricultural Development and Transformation in South Africa (FEADT-SA)
Role in the project	Training and implementation partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	South African National Parks (SANParks)
Role in the project	Conservation partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	Kruger to Canyons Biosphere Reserve
Role in the project	Conservation partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant

	stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	Bushbuckridge Local Municipality (BLM)
Role in the project	Government partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	Department of Forestry Fisheries and the Environment (DFFE)
Role in the project	Government partner
Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

Organization name	Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA)
Role in the project	Government and propagation partner

Contact person	Personal details have been omitted from this public version of the PDD in accordance with the POPI Act 4 of 2013. These details will be made available to the auditors and relevant stakeholders upon request and added to this section once agreements have been formalized.
Title	-
Address	-
Telephone	-
Email	-

2.1.9 Project Ownership (VCS, 3.2, 3.7, 3.10; CCB, G5.8)

Within the project zone, land tenure is mixed, with most land governed by customary tenure as well as additional areas in CPA ownership, government management and private ownership. The VCS recognizes multiple definitions of ownership. For this project, the most applicable is the definition based on enforceable agreements with landholders or rightsholders.

*'The document(s) demonstrating the entity's right to all and any GHG emission reductions or removals generated by the project or program during the crediting period or verification period, as the case may be.'*²⁶

This definition also applies to the CCB Standard, which extends it to include community and biodiversity benefits.

The Project Proponent, Sand Catchment Pty Ltd., is a registered company established in accordance with South African law and is the sole authority to implement the project and claim Verified Carbon Units (VCUs) on behalf of participating landowners and communities. Project ownership will be secured through agreements tailored to each tenure type: i) customary land: memoranda of understanding (MoUs) and endorsement letters with traditional leaders, as well as agreements with persons allocated PTOs or leasing land; ii) CPA-owned land: agreements with CPAs, endorsed by their elected committees; iii) government-managed land: agreements with the relevant municipal or provincial authorities; and iv) privately-owned land: contracts with landowners or land users.

Carbon rights are not explicitly defined in South African legislation but are derived from forest resource property rights in accordance with the National Forests Act 84 of 1998²⁷. This act stipulates that individuals planting trees on land they have the right to use, retain ownership of those trees and their products. This interpretation provides a legal basis for recognizing carbon rights as a form of property right that can be contractually transferred. Accordingly, individuals, associations or organizations with land-use rights in the above tenure categories who choose to participate in the project will be required to enter into legally binding agreements with the Project Proponent. These agreements formalize their registration as tree custodians²⁸ and define the transfer of carbon rights, ensuring that all participation in the project is both voluntary and contractually secured.

In return, the tree custodians retain access to training, nursery development, planting and maintenance support, as well as long-term mentorship and benefits for protecting and monitoring the trees. These contractual agreements ensure that the Project Proponent holds clear and exclusive rights to claim and

²⁶ Verra. 2022. VCS Program Definitions. v4.2. Retrieved from: <https://verra.org/wp-content/uploads/2024/08/VCS-Program-Definitions-v4.2.pdf>

²⁷ Republic of South Africa. 1998. National Forest Act. Government Gazette. Retrieved from: https://www.gov.za/sites/default/files/gcis_document/201409/a84-98.pdf

²⁸ Individuals, households or community groups who own and maintain project trees.

manage the GHG removals generated by the project, while landowners and communities remain central beneficiaries of the project’s livelihoods and biodiversity initiatives.

2.1.10 Project Start Date (VCS, 3.8)

Project start date	01 January 2026
Justification	The start date coincides with the start date of ARR activities.

2.1.11 Benefits Assessment and Project Crediting Period (VCS, 3.9; CCB, G1.9)

Crediting period	The crediting period is 40 years, which aligns with the AFOLU Non-Permanence Risk Tool v4.2 extension of the project’s longevity period.
Start date of first or fixed crediting period	01-Janurary-2026 to 31-December-2066
CCB benefits assessment period	01-Janurary-2026 to 31-December-2066

2.1.12 Differences in Assessment/Project Crediting Periods (CCB, G1.9)

The assessment periods are consistent across all dimensions, including GHG emissions accounting, climate adaptive capacity and resilience, community and biodiversity.

2.1.13 Project Scale and Estimated Reductions or Removals (VCS, 3.10)

Indicate the estimated annual GHG emission reductions or CO₂ removals (ERRs) of the project:

- < 300,000 tCO₂e/year (project)
- ≥ 300,000 tCO₂e/year (large project)

The table below provides the estimated annual removals (tCO₂e) for the first set of PAIs, as described in Section 2.1.6, over the 40-year crediting period. The total estimated ERRs for this period amount to 7,545,086 tCO₂e, with an average annual removal of 184,026 tCO₂e.

Calendar year of crediting period	Estimated removals (tCO ₂ e)
01-January-2026 to 31-December-2026 ²⁹	26
01-January-2027 to 31-December-2027	420
01-January-2028 to 31-December-2028	2,173
01-January-2029 to 31-December-2029	7,282

²⁹ Note that the year 2026 represents the zeroth year, also known as the time of planting, where the associated ERRs are related to the carbon sequestered during growth of the tree sapling in the nursery.

01-January-2030 to 31-December-2030	18,246
01-January-2031 to 31-December-2031	37,556
01-January-2032 to 31-December-2032	65,108
01-January-2033 to 31-December-2033	97,795
01-January-2034 to 31-December-2034	132,014
01-January-2035 to 31-December-2035	165,654
01-January-2036 to 31-December-2036	197,695
01-January-2037 to 31-December-2037	227,236
01-January-2038 to 31-December-2038	252,244
01-January-2039 to 31-December-2039	271,334
01-January-2040 to 31-December-2040	282,844
01-January-2041 to 31-December-2041	287,609
01-January-2042 to 31-December-2042	286,655
01-January-2043 to 31-December-2043	284,293
01-January-2044 to 31-December-2044	279,719
01-January-2045 to 31-December-2045	274,484
01-January-2046 to 31-December-2046	268,761
01-January-2047 to 31-December-2047	263,288
01-January-2048 to 31-December-2048	256,996
01-January-2049 to 31-December-2049	250,378
01-January-2050 to 31-December-2050	243,861
01-January-2051 to 31-December-2051	237,839
01-January-2052 to 31-December-2052	230,818
01-January-2053 to 31-December-2053	224,257
01-January-2054 to 31-December-2054	218,507

01-January-2055 to 31-December-2055	212,552
01-January-2056 to 31-December-2056	206,759
01-January-2057 to 31-December-2057	200,593
01-January-2058 to 31-December-2058	194,243
01-January-2059 to 31-December-2059	188,146
01-January-2060 to 31-December-2060	182,558
01-January-2061 to 31-December-2061	177,562
01-January-2062 to 31-December-2062	173,286
01-January-2063 to 31-December-2063	168,403
01-January-2064 to 31-December-2064	163,498
01-January-2065 to 01-November-2065	158,705
01-January-2066 to 01-November-2066	153,689
Total estimated ERRs during the first or fixed crediting period	7,545,086
Total number of years	40
Average annual ERRs	184,026

2.1.14 Physical Parameters (CCB, G1.3)

The physical characteristics of the Sabie and Sand River catchments – including topography, soils, climate, hydrology and vegetation – are outlined below (see Sections 2.1.1 and 2.1.6 for details on the project area’s location).

Topography

The Sabie and Sand River catchments comprise two areas east of the prominent Mpumalanga Escarpment³⁰: i) the western Middleveld has steep, high-lying mountains of the Drakensberg Range that descend eastwards from ~2,000 m into an undulating and incised landscape; and ii) the eastern Lowveld that extends to the low-lying Lebombo hills. Figure 2 provides a map of the elevation across the Sabie and Sand River catchments. The Middleveld area is characterized by broad valleys and ridges that support agriculture and human settlement³¹. The valleys were formed by long-term erosion and river activity and feature deep river channels that were incised in recent (in the past 100,000 years) periods of tectonic

³⁰ River Eco-status Monitoring Programme (REMP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant’s River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/crocsabieolif_01_toc.html. Accessed on 26 September 2025.

³¹ Jansen H. 1997. The Geology of the Country around Pretoria. An explanation of SHEETS 2527DA, DB, DC, DD AND 2528CA, CB, CC, CD. Retrieved from: <https://resources.bgs.ac.uk/sadcreports/rsa1977jansengeologyofpretoria.pdf>

uplift³². These riverine systems facilitate water flow into major reservoirs and sustain diverse aquatic ecosystems³³. Wetlands and floodplains adjacent to these rivers are prioritized for biodiversity conservation and water management, acting as natural filters and providing habitats for numerous species³⁴. The Lowveld areas are characterized by flat rolling terrain that supports cultivation that generally requires irrigation³⁵. Additionally, these lowveld areas are considered erosional environments and are situated on extensive depositional flood plains³⁶.

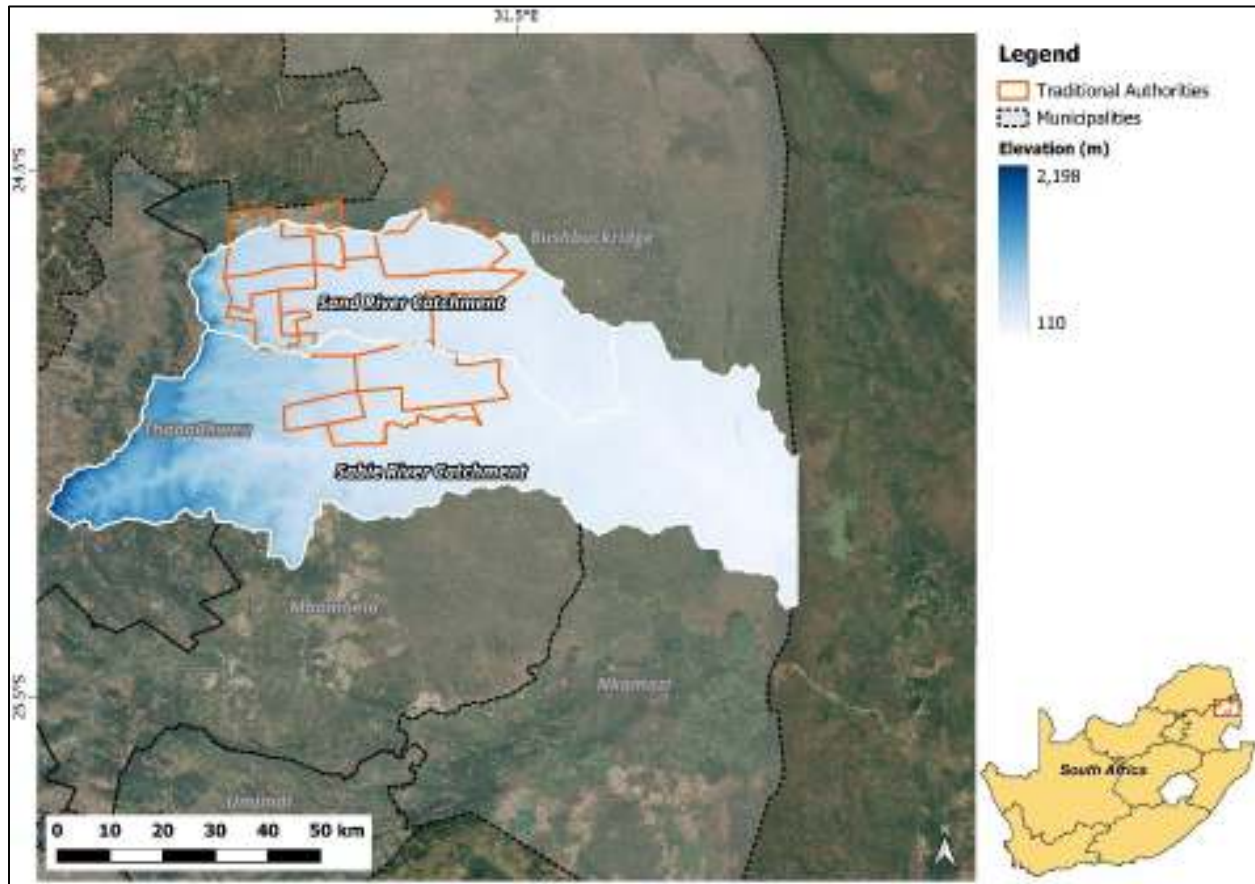


Figure 2. The elevation across the Sabie and Sand River catchments.

Geological formations affect soil composition and both surface water patterns and groundwater movement. The Sabie and Sand River catchments’ bedrock geology comprises three litho-stratigraphic units: i) the Archaean basement granite-gneiss complex in the eastern lowlands; ii) the early Proterozoic Transvaal

³² *Ibid.*

³³ Riddell ES, Govender D, Botha J, Sithole H, Petersen RM & Shikwambana P. 2019. Pollution impacts on the aquatic ecosystems of the Kruger National Park, South Africa. *Scientific African*, 6:e00195.

³⁴ River Eco-status Monitoring Programme (REMP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant’s River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/crocsabieolif_01_toc.html. Accessed on 26 September 2025.

³⁵ *Ibid.*

³⁶ Fleminger D. n.d. Mountains in the Lowveld. SouthAfrica.co.za. Available at: <https://southafrica.co.za/mountains-lowveld>

sequence of sedimentary rocks in the western mountainous headwaters; and iii) the younger Permian to Jurassic Karoo sequence of sedimentary and volcanic rocks found in patches across the catchment^{37,38,39}.

Soils

The geological diversity of the Sabie and Sand River catchments creates a range of soil types, each influencing land use, agriculture and ecosystem health. Three main soil types are noted: i) sandy; ii) rocky; and iii) clay⁴⁰, outlined below.

- **Deep, well-drained sandy soils** are prevalent in the eastern lowlands and along riverbanks. These leached soils are typically low in nutrients and organic matter. Although they support native woodland vegetation adapted to low-nutrient conditions, proper management for agricultural use is required to prevent erosion and infertility⁴¹.
- **Relatively shallow and rocky soils** are prevalent along most ridgelines and upper slopes. Although these soils are occasionally fertile – depending on the rock type – they generally do not support large-scale agriculture⁴².
- **Clay-rich soils** are generally found in pockets along deeper, flat-bottomed valleys. Although relatively fertile, these soils frequently require amendments to improve drainage and prevent waterlogging or compaction. They are often used for crops that are well-suited for consistently moist conditions⁴³.

³⁷ Knight J and Evans M. 2022. Characterizing the geomorphic dynamics of river systems: An example of the Sabie River, South Africa. *Koedoe*, 64, 1, 1–6

³⁸ O'Keefe J. 1985. The conservation status of the Sabie and Groot Letaba rivers within the Kruger National Park. Rhodes University, Grahamstown.

³⁹ Heritage GL and Moon BP. 2000. The contemporary geomorphology of the Sabie River in the Kruger National Park. *Koedoe*, 43, 1, 5–35.

⁴⁰ FAO. 2023. IPCC soil categories derived from the HWSO 2.0 database. GAEZ v4 Data Portal. Available at: <https://gaez.fao.org>. Accessed on 26 September 2025.

⁴¹ Department of Water Affairs. 2011. *The Groundwater Dictionary* (2nd ed.). Available at: [Groundwater Dictionary \(dws.gov.za\)](http://dws.gov.za). Accessed on 26 September 2025.

⁴² Department of Water Affairs. 2011. *The Groundwater Dictionary* (2nd ed.). Available at: [Groundwater Dictionary \(dws.gov.za\)](http://dws.gov.za). Accessed on 26 September 2025.

⁴³ *Ibid.*

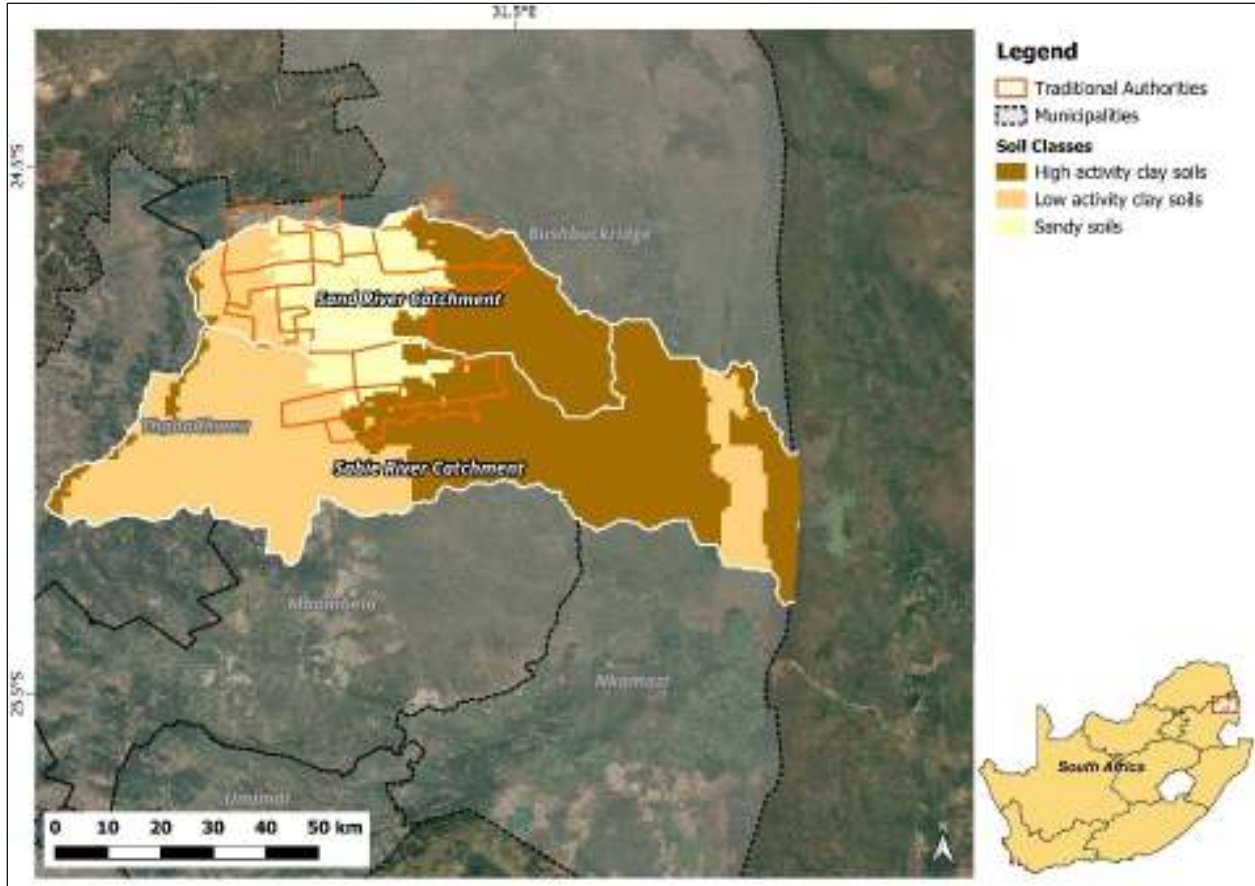


Figure 3. Classification of soils within the Sabie and Sand River catchments.

Figure 3 provides a map of the distribution of soil types across the Sabie and Sand River catchments. These soil types likely influence land use patterns across the catchments by determining vegetation types, crop production and grazing patterns⁴⁴. As a result, tree species selection for project activities will be informed by local soil conditions to ensure adequate suitability based on soil fertility, depth and drainage.

Climate

Temperature variation in the Sabie and Sand River Catchments corresponds with topography. The western highveld regions are cooler, with mean annual temperatures of 16°C. By contrast, the eastern lowveld is warmer, with mean annual temperatures of 22°C⁴⁵. Seasonal temperature extremes are considerable, with summer temperatures in the lowveld peaking at 40°C, while winter temperatures in the highlands

⁴⁴ Janecke BB. 2020. Vegetation structure and spatial heterogeneity in the Granite Supersite, Kruger National Park. Koedoe. 62(2).

⁴⁵ South African River Health Programme (SARHP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant's River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/state_of_crocsabieolif_01/sabie_eco.html. Accessed on 22 August 2024.

occasionally drop below freezing⁴⁶. Figure 4 provides a map of the distribution of average annual temperatures across the Sabie and Sand River catchments⁴⁷.

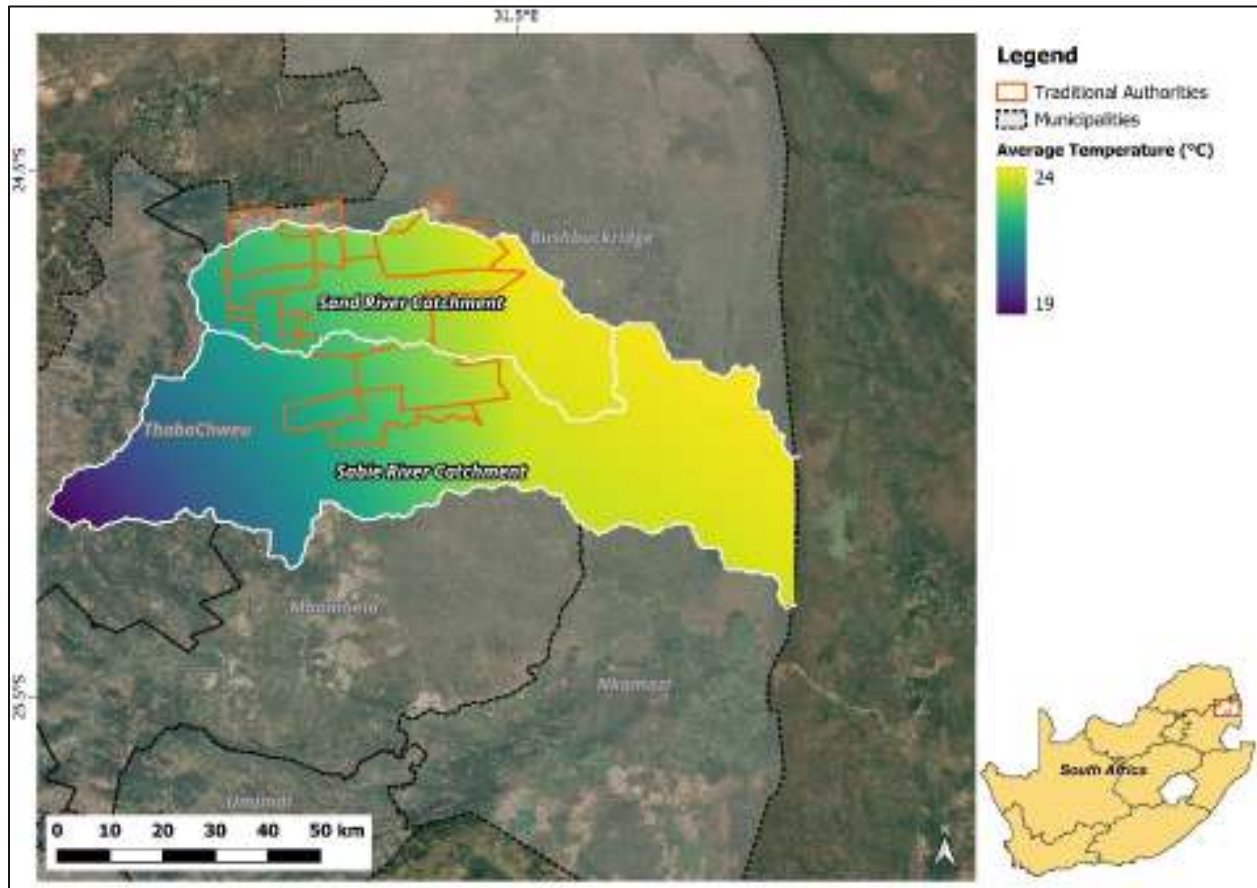


Figure 4. Average annual temperature across the Sabie and Sand River catchments.

Rainfall patterns across the catchments also vary by topography; higher elevations in the western regions receive annual rainfall of ~2,000 mm and the eastern lowlands are drier, receiving ~600 mm per year. This rainfall is predominantly seasonal, occurring during summer months (November to March) and causing variation in river flow throughout the year⁴⁸. Figure 5 provides a rainfall map of the Sabie and Sand River catchments, showing this variation in rainfall.

⁴⁶ South African River Health Programme (SARHP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant's River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/state_of_crocsabieolif_01/sabie_eco.html. Accessed on 22 August 2024.

⁴⁷ Abatzoglou JT, Dobrowski S, Parks SA, Hegewisch KC. 2018, Terraclimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958-2015, Scientific Data 5:170191, doi:10.1038/sdata.2017.191.

⁴⁸ Abatzoglou JT, Dobrowski S, Parks SA, Hegewisch KC. 2018, Terraclimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958-2015, Scientific Data 5:170191, doi:10.1038/sdata.2017.191.

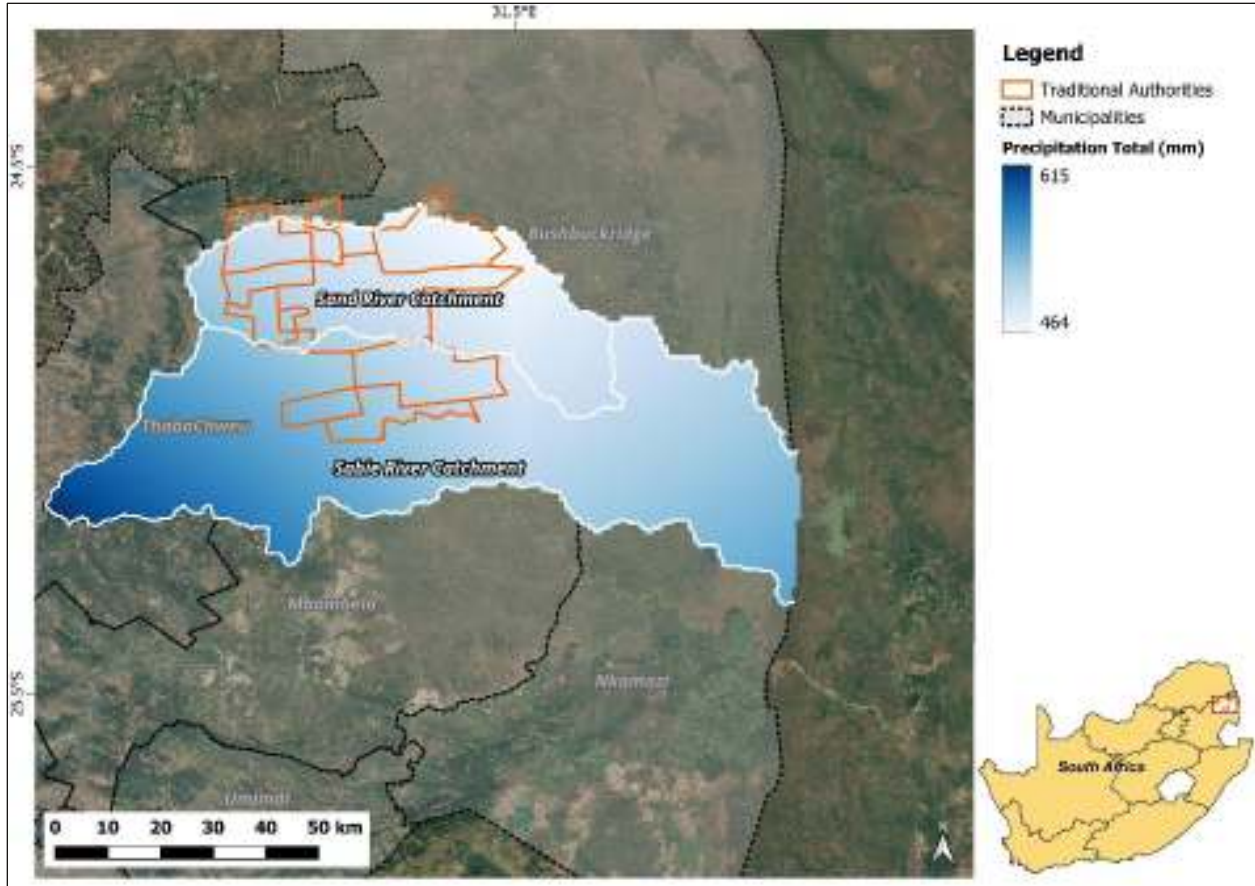


Figure 5. Total annual rainfall in mm across the Sabie and Sand River catchments.

Analysis of 45 years of CHIRPS data (1981–2025) for the Sabie and Sand River Catchments shows a mean annual precipitation of 747 mm, with a coefficient of variation of 22%⁴⁹. This indicates considerable interannual variability, contributing to the episodic drought and flood patterns observed in the catchment (Figure 6). Annual evaporation rates average at 1,700 mm, particularly in the lower reaches of the catchment and regularly surpass annual rainfall.

⁴⁹ Funk C. et al. 2022. The climate hazards infrared precipitation with stations—a new environmental record for monitoring extremes. *Scientific Data*, 2, 150066.

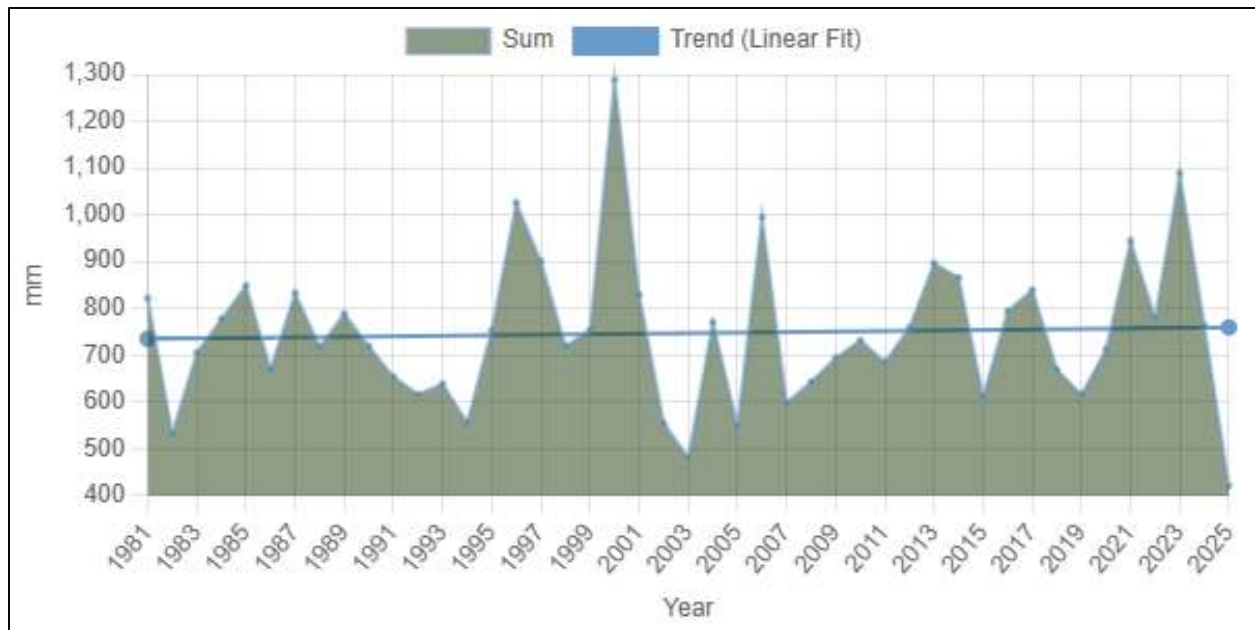


Figure 6. Annual precipitation of the Sabie and Sand Catchment area.

Hydrology

The Sabie and Sand River catchments – characterized by a mean annual run-off of ~760 million cubic meters (m³)⁵⁰ – form part of the larger Inkomati-Usuthu Water Management Area (IUWMA), one of nine water management areas in South Africa established by the National Water Act of 1998⁵¹. The Sabie River is a perennial river with a variable average discharge ranging from ~2 m³/s in winter to ~50 m³/s in summer, with flood peak discharges of up to ~400 m³/s in the middle and lower reaches of the catchment^{52,53}. The Sabie River originates in the Drakensberg Escarpment near Graskop and flows eastward for 175 km through the Kruger National Park (KNP) west of Lillydale before joining the Inkomati River and flowing into the Corumana Dam in Mozambique, ultimately ending in the Indian Ocean. The Sand River is an episodic river that flows into the Sabie River near Skukuza in the KNP^{54,55}. The courses of the Sabie and Sand Rivers are visible in Figure 7 below.

⁵⁰ South African River Health Programme (SARHP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant's River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/state_of_crocsabielif_01/sabie_eco.html. Accessed on 22 August 2024.

⁵¹ Department of Water and Sanitation (South Africa). 2016. National Water Act, 1998 (Act No. 36 of 1998): the new nine water management areas of South Africa. (Notice 1056). Government Gazette, 40269, 169.

⁵² Heritage GL and Moon BP. 2000. The contemporary geomorphology of the Sabie River in the Kruger National Park. *Koedoe*, 43, 1, 5–35.

⁵³ Knight J and Evans M. 2022. Characterising the geomorphic dynamics of river systems: An example of the Sabie River, South Africa. *Koedoe*, 64, 1, 1–6.

⁵⁴ South African River Health Programme (SARHP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant's River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/state_of_crocsabielif_01/sabie_eco.html. Accessed on: 22 August 2024.

⁵⁵ Knight J and Evans M. 2022. Characterising the geomorphic dynamics of river systems: An example of the Sabie River, South Africa. *Koedoe*, 64, 1, 1–6.

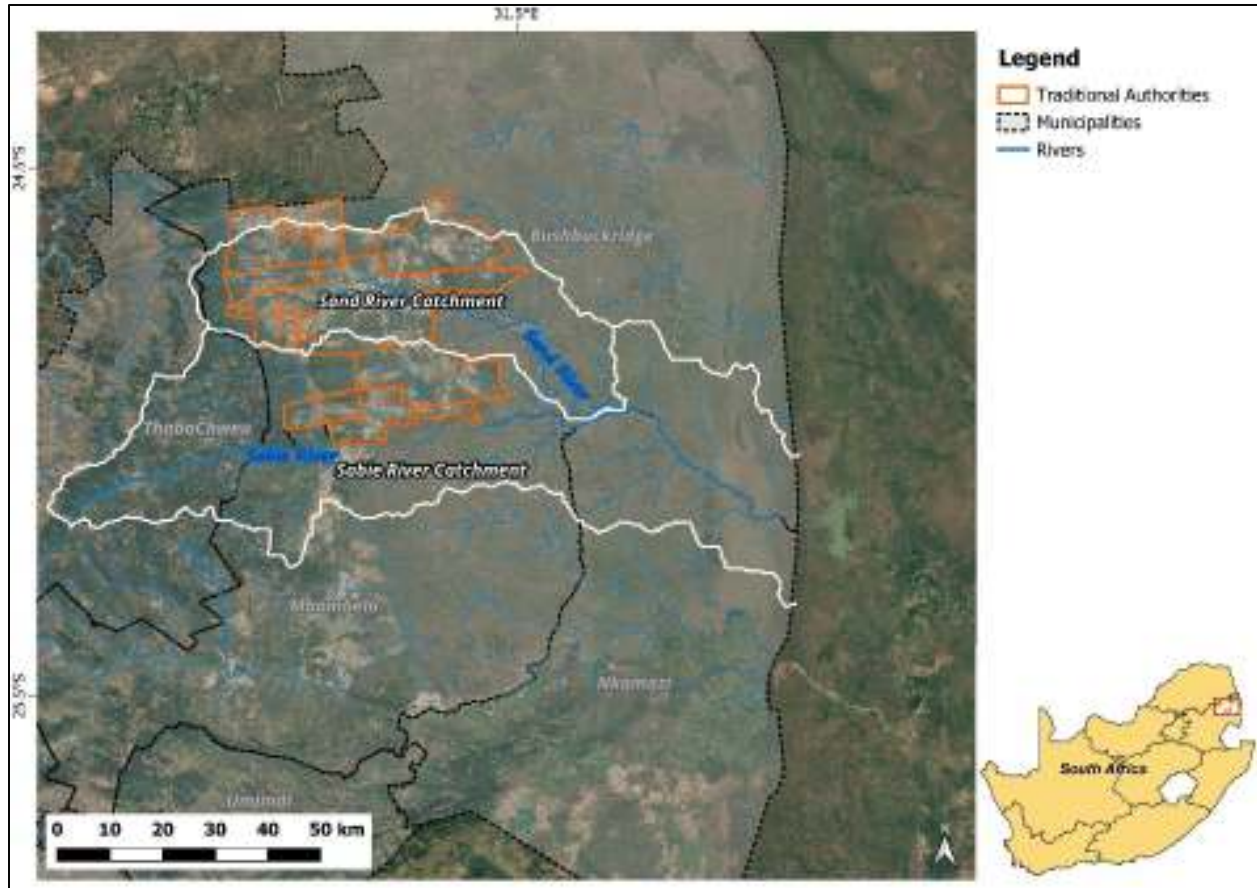


Figure 7. River network in the Sabie and Sand River catchments.

The water resources within the catchments are also influenced by geology. While the Basement Complex yields minimal groundwater, the dolomitic areas of the Transvaal Sequence contain most of the aquifers that make up the area’s limited groundwater-bearing capacity⁵⁶. Varied geology also affects river channel morphology, as resistant rock types create rapids and gorges, while softer rocks enable wider floodplains^{57,58,59}. The limited groundwater capacity, combined with variable rainfall patterns, results in periods of water scarcity. Most water users are concentrated along rivers, leading to possible unregulated or illegal water abstraction⁶⁰. This practice prevents water from reaching the lower reaches of the catchments, which already receive limited rainfall⁶¹. To manage these varying water resources, several

⁵⁶ Pollard S. et al. 2008. Towards a socio-ecological systems view of the Sand River Catchment, South Africa: An exploratory analysis. Report Number TT364/08. Water Research Commission, Pretoria, South Africa.

⁵⁷ Knight J & Evans M. 2022. Characterising the geomorphic dynamics of river systems: An example of the Sabie River, South Africa. *Koedoe*, 64, 1, 1–6.

⁵⁸ Parsons M. et al. 2006. The biotic and abiotic legacy of a large infrequent flood disturbance in the Sabie River, South Africa. *River Research and Applications*, 22, 2, 187–201.

⁵⁹ Heritage GL & Moon BP. 2000. The contemporary geomorphology of the Sabie River in the Kruger National Park. *Koedoe*, 43, 1, 5–35.

⁶⁰ Pollard S & du Toit D. 2008. Integrated water resource management in complex systems: How the catchment management strategies seek to achieve sustainability and equity in water resources in South Africa. *Water SA*, 34, 6, 671–680.

⁶¹ DWA (Department of Water Affairs). 2010. Comprehensive Reserve determination study for selected water resources (rivers, groundwater and wetlands) in the Inkomati Water Management Area, Mpumalanga. Sabie and Crocodile systems: EcoSpecs report. In: Louw MD & Koekemoer S (eds). Department of Water Affairs, Pretoria, South Africa.

important water infrastructure features have been implemented, presented in the table below^{62,63}. The Inyaka Dam is the largest, providing water to the BLM⁶⁴. Da Gama Dam primarily serves forestry and commercial farming, while two additional dams are used for agricultural irrigation⁶⁵. Other important water sources include the Dingleydale, Allendale, New Forest and Hoxani dams and irrigation schemes.

Dam	Capacity (m ³)
Inyaka Dam	124 million
Da Gama Dam	14 million
Orinoco Dam	2 million
Casteel Dam	1 million

Vegetation

The Sabie and Sand River catchments contain three biomes – savanna, grassland and forest – distributed along east–west gradients of topography and climate. The montane grasslands and forests of the western highlands grade into savanna in the lowlands, each contributing to the region’s ecological diversity and biodiversity significance^{66,67,68,69}. Figure 8 provides a map of the vegetation types in the Sabie and Sand River catchments. The savanna biome – making up the largest portion of both catchments – is characterized by a continuous grassy understory interspersed by an open canopy of trees and shrubs and encompasses the three bioregions below.

- **Granite Lowveld (SVI 3⁷⁰) ~335,000 ha:** Features tall shrubland to moderately dense low woodland, with species such as silver clusterleaf (*Terminalia sericea*) and red bushwillow (*Combretum apiculatum*). The ground layer includes herringbone grass (*Pogonarthria squarrosa*) and blue-seed grass (*Tricholaena monachne*).
- **Gabro Grassy Bushveld (SVI 6) ~22,000 ha:** An open savanna with dense grass cover and scattered trees such as knob thorn (*Senegalia nigrescens*) and marula (*Sclerocarya birrea* subsp. *caffra*). Common grass includes red grass (*Themeda triandra*) and common finger grass (*Digitaria eriantha*).
- **Legogote Sour Bushveld (SVI 9) ~115,000 ha:** Dense woodland dominated by mobola-plum (*Parinari curatellifolia*) and red bauhinia (*Bauhinia galpinii*), with tall trees such as kiaat (*Pterocarpus angolensis*).

⁶² Tlou T. 2011. Bushbuckridge Local Municipality: First order Reconciliation Strategy for the Inyaka Regional Water Supply Scheme Area. Department of Water Affairs, South Africa. Contract: WP 9712.

⁶³ Pollard S and Walker P. 2000. Catchment management and water supply and sanitation in the Sand River Catchment, South Africa: description and issues. WHIRL Project Working Paper 1 (draft). Natural Resources Institute, Chatham, United Kingdom.

⁶⁴ Tlou T. 2011. Bushbuckridge Local Municipality: First order Reconciliation Strategy for the Inyaka Regional Water Supply Scheme Area. Department of Water Affairs, South Africa. Contract: WP 9712.

⁶⁵ Pollard S and Walker P. 2000. Catchment management and water supply and sanitation in the Sand River Catchment, South Africa: description and issues. WHIRL Project Working Paper 1 (draft). Natural Resources Institute, Chatham, United Kingdom.

⁶⁶ Department of Water and Sanitation (South Africa). 2016. National Water Act, 1998 (Act No. 36 of 1998): the new nine water management areas of South Africa. (Notice 1056). Government Gazette, 40269, 169.

⁶⁷ Mucina L and Rutherford MC (eds). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

⁶⁸ Van Wyk B. 2013. Field guide to trees of southern Africa. Penguin Random House, South Africa.

⁶⁹ Van Oudtshoorn F. 2012. Guide to grasses of southern Africa. Briza Publications, Pretoria.

⁷⁰ Code denotes vegetation type classification as per Mucina L & Rutherford MC. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

The grassland biome is dominated by grasses and herbaceous plants with few trees and is prone to fires. This biome includes the three bioregions below.

- **Northern Escarpment Dolomite Grassland (Gm22) ~16,000 ha:** Features a diverse shrub layer including Protea species such as common sugarbush (*Protea caffra*). Dominant grasses include red grass (*Themeda triandra*) and Natal red-top (*Melinis repens*).
- **Northern Escarpment Quartzite Sourveld (Gm23) ~22,000 ha:** A rocky landscape with short, closed grassland rich in forb species. Notable plants include krantz aloe (*Aloe arborescens*) and common russet grass (*Loudetia simplex*).
- **Northern Escarpment Afromontane Fynbos (Gm24) ~132 ha:** Dominated by sclerophyllous shrubs and herbs, including *A. arborescens* and forest beechwood (*Faurea galpini*).

Tall evergreen afro-temperate forests characterize the Forest Biome, represented by the Northern Mistbelt Forest (FOz4)⁷¹. Canopy trees in this biome include real yellowwood (*Podocarpus latifolius*), forest bushwillow (*Combretum kraussi*) and forest waterberry (*Syzigium gerrardii*).

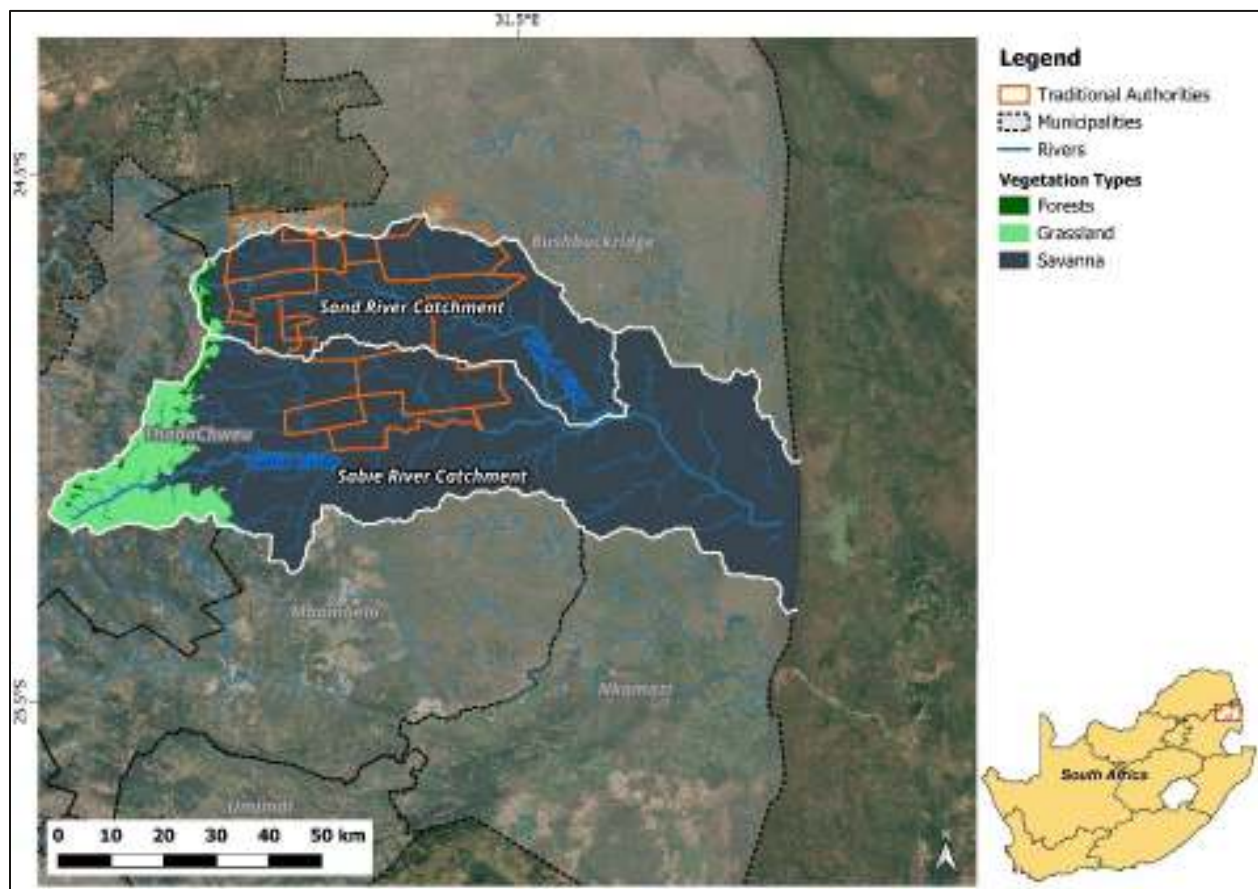


Figure 8. The vegetation types of the Sabie and Sand River catchments.

A large portion of the Sabie and Sand River catchments is categorized as Key Biodiversity Areas (KBAs) and also contains ecosystems that are considered rare, threatened or endangered (RTE). Figure 9 and Figure 10 below portray maps of the distribution of the KBAs and RTE ecosystems.

⁷¹ Mucina L, Geldenhuys CJ, Rutherford MC, Powrie LW, Lötter MC & Von Maltitz GP. 2006. Afrotemperate, subtropical and azonal forests. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia*, 19, 584–614.

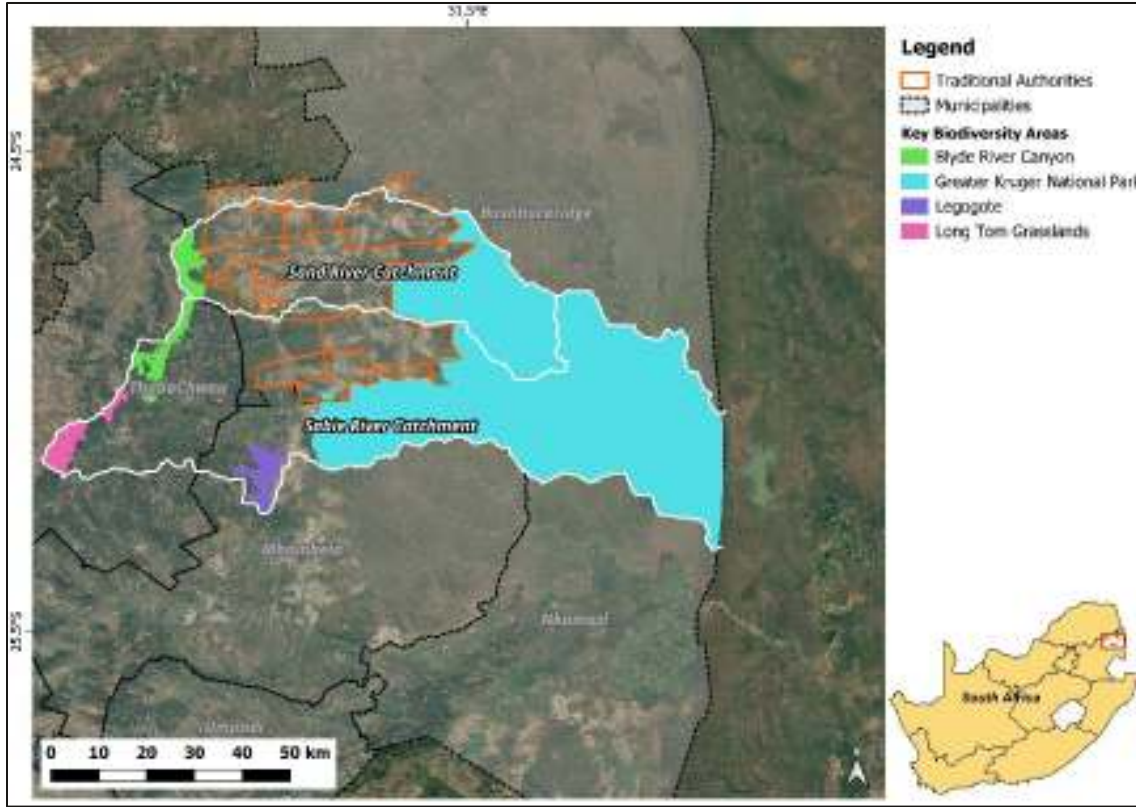


Figure 9. Map of the Key Biodiversity Areas (KBAs) in the Sabie and Sand River catchments.

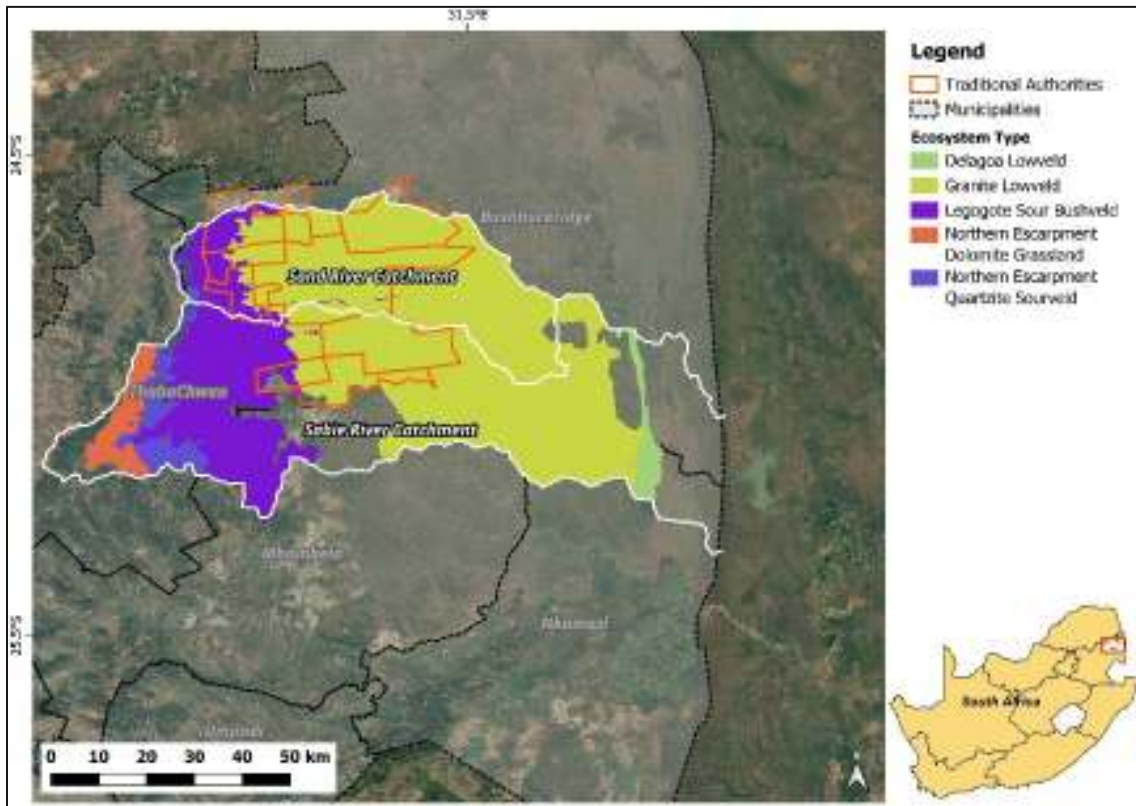


Figure 10. Map of the rare, threatened and endangered (RTE) ecosystems in the Sabie and Sand River catchments.

2.1.15 Social Parameters (VCS, 3.18; CCB, G1.3)

The Sabie and Sand River catchments are situated in the EDM, Mpumalanga. EDM comprises four local municipalities: i) Bushbuckridge; ii) Thaba Chweu; iii) the City of Mbombela; and iv) Nkomazi (see Figure 11 below). These municipalities include settlement types ranging from small to medium-sized towns and clustered villages to dispersed homesteads located along road networks, rivers and agricultural land. The project area also encompasses extensive communal rangelands and formally protected areas.

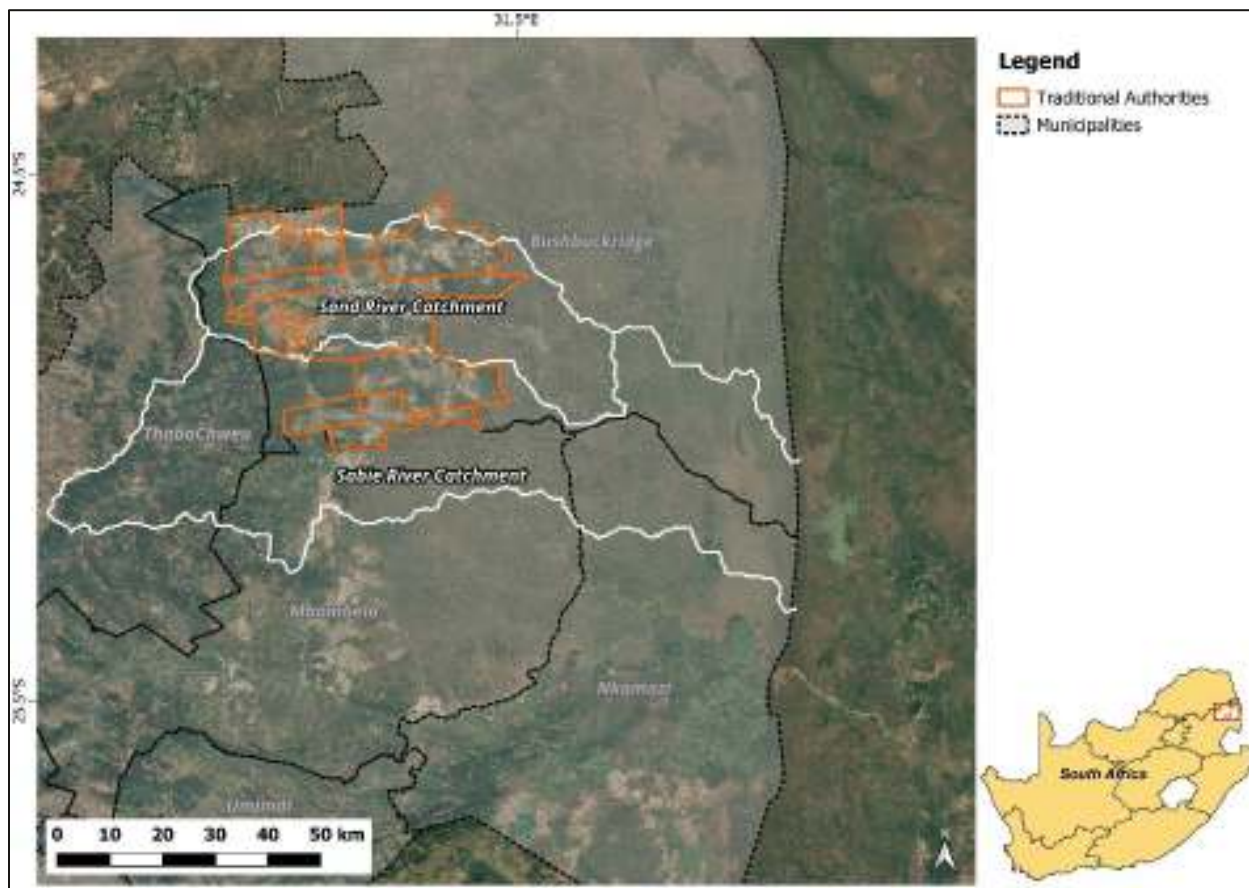


Figure 11. The administrative boundaries of the local municipalities in the Ehlanzeni District Municipality and how the Sabie and Sand River catchments and traditional authorities overlap.

Land use in the project zone links directly to community livelihoods, natural resources and the local economy. Most households engage in subsistence and small-scale commercial farming. Common crops include maize, peanuts, cowpeas, pumpkins, beans, vegetables and fruit trees such as mango, avocado, papaya and citrus^{72,73}. Households also keep livestock, particularly cattle, goats and chickens, with smaller numbers of sheep and pigs. These animals provide food, income and cultural value⁷⁴ and are typically grazed in communal areas. Woodlands and riverine areas supply fuelwood, wild foods and medicinal plants that are necessary for both household well-being and cultural practices⁷⁵. Figure 12 below shows the Sand

⁷² Ragie FH, Olivier DW, Hunter LM, Erasmus BFN, Vogel C, Collinson M & Twine W. 2020. A portfolio perspective of rural livelihoods in Bushbuckridge, South Africa. *South African Journal of Science* 116, 9–10.

⁷³ As per observation.

⁷⁴ Ragie FH. 2016. Relationships between household resource dependence, socio-economic factors, and livelihood strategies: A case study from Bushbuckridge, South Africa. Master's dissertation. University of the Witwatersrand, Johannesburg.

⁷⁵ Pollard S, Biggs H & Du Toit DR. 2014. A systemic framework for context-based decision making in natural resource management: reflections on an integrative assessment of water and livelihood security outcomes following policy reform in South Africa. *Ecology and Society*, 19, 2, 63.

and Sabie River catchments, with landcover classes mapped according to the South African National Land Cover (SANLC) dataset⁷⁶. The Sabie and Sand River catchments also include extensive managed and conservation lands, comprising the KNP, private reserves such as Sabi Sands, Manyeleti and Timbavati and community-owned reserves such as the Bushbuckridge Nature Reserve. These protected areas (Figure 13) support biodiversity conservation and provide employment and income through ecotourism. A 2022 assessment of the Greater Kruger region found that the sector contributed ~ZAR2.6 billion (~US\$143 million⁷⁷) to the South African gross domestic product for 2016/7, of which ~ZAR1.17 billion went to salaries for the ~10,400 jobs sustained in guiding, hospitality and conservation management⁷⁸. Forestry in the western and highland areas, together with trade, informal enterprises and limited mining and manufacturing, further contribute to the local economy. However, agriculture and conservation remain the most prominent livelihoods⁷⁹.

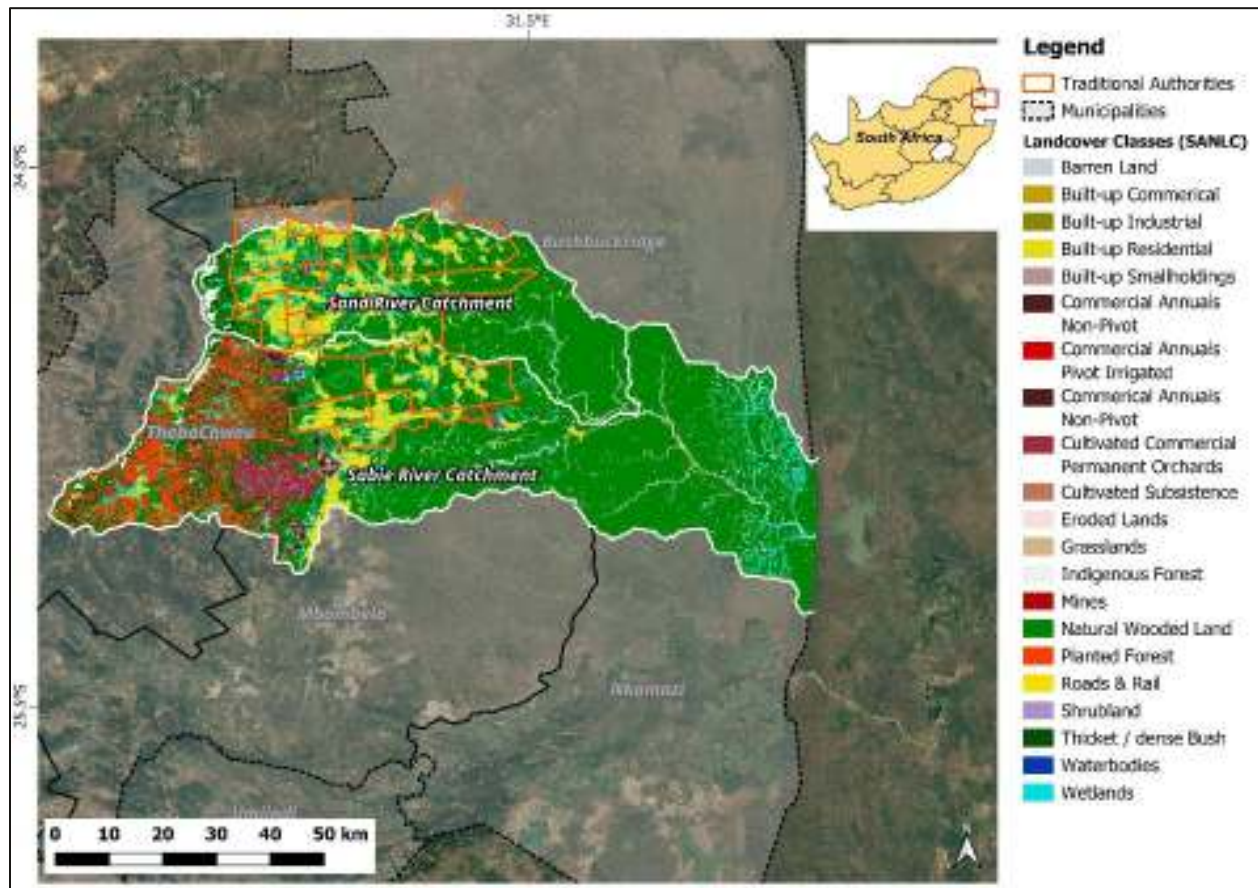


Figure 12. Land Use and Land Cover (LULC) map of the Sabie and Sand River catchments.

⁷⁶ Thompson M. 2019. South African National Land-Cover 2018 Report & Accuracy Assessment (Version 004). GeoTerraImage for the Department of Environment, Forestry and Fisheries, Republic of South Africa.

⁷⁷ As per exchange rates at time of writing (22 September 2025).

⁷⁸ Chidakel A, Eb C & Child B. 2020. The comparative financial and economic performance of protected areas in the Greater Kruger National Park, South Africa: functional diversity and resilience in the socio-economics of a landscape-scale reserve network. *Journal of Sustainable Tourism*, 28, 8, 1100-1119.

⁷⁹ South African Department of Forestry, Fisheries and the Environment. 2024. SA National Land-Cover Datasets. Available at: https://egis.environment.gov.za/sa_national_land_cover_datasets. Accessed on 22 August 2024.

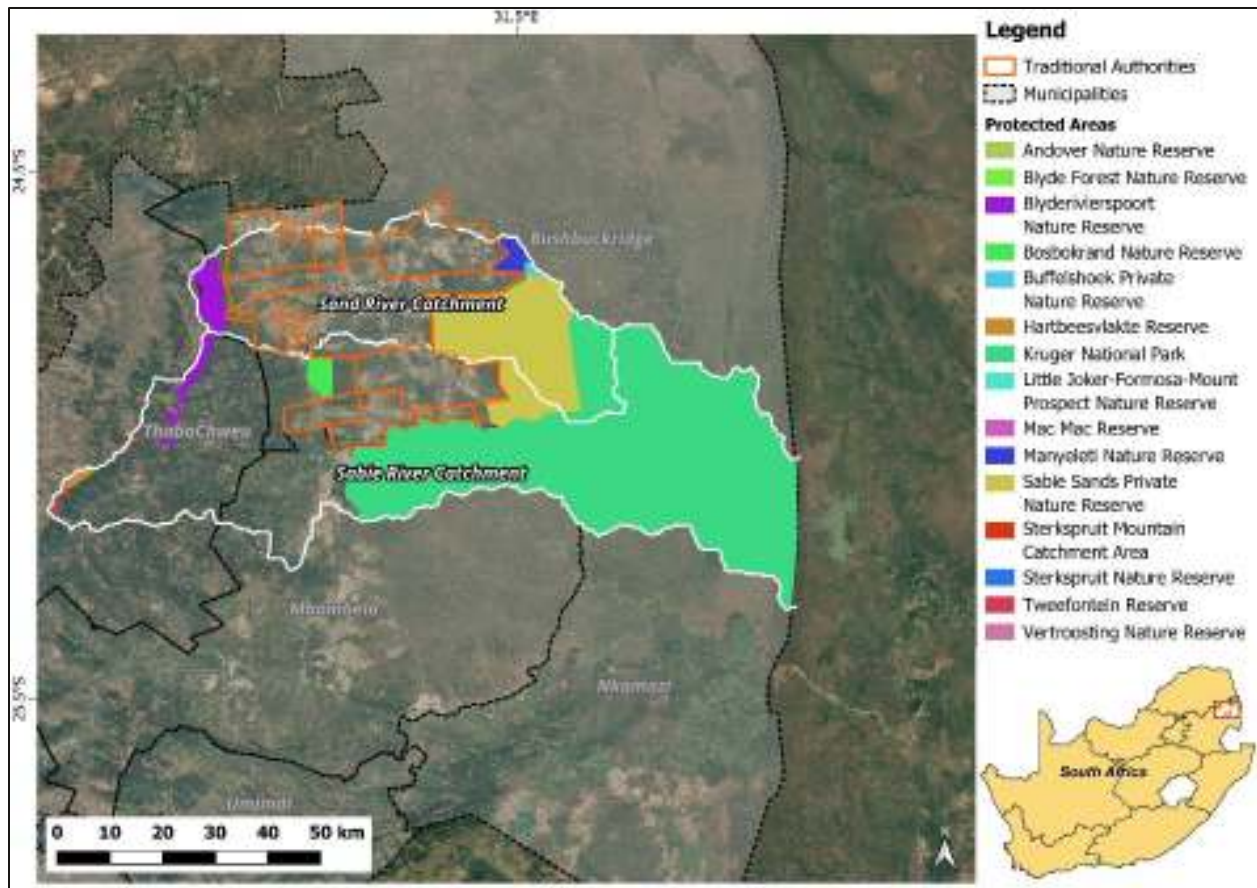


Figure 13. The protected areas within the Sabie and Sand River catchments.

As mentioned, the project zone⁸⁰ consists of the Sabie and Sand River catchments and includes portions of all four municipalities. However, the first phase of implementation will focus on BLM, which encompasses the largest portion. BLM has extensive rural landscapes, a large population density and a strong reliance on land-based livelihoods⁸¹. These conditions make BLM an appropriate entry point for initial activities before scaling across the wider district. Main centers include: i) Bushbuckridge town; ii) Mkhuhlu; iii) Thulamahashe; iv) Acornhoek; v) Mafemani; vi) Maviljan; and vii) Shatale (see Figure 14 below). These towns are service and trade hubs, providing markets, employment opportunities and administrative functions for surrounding rural settlements. In outlying areas, communities rely on a mix of subsistence and small-scale commercial agriculture, informal trade and wage labor. These activities are generally linked to opportunities in neighboring towns, nature reserves and conservation areas. Future phases of the project may extend into the City of Mbombela, reaching as far south as Logogote and westwards into Thaba Chweu, including Graskop and Sabie. The project zone also overlaps with Nkomazi and extends eastwards to Skukuza in the KNP. These areas provide opportunities for further engagement in land-based livelihoods, forestry, agriculture, tourism and conservation.

⁸⁰ 'Project zone' is defined as the area encompassing the project area in which project activities that directly affect land and associated resources, including activities such as those related to provision of alternative livelihoods and community development, are implemented. For grouped projects, the project zone also includes all potential project areas (i.e., all potential new land areas in which project activities that aim to generate net climate benefits may be implemented in the future after the initial validation).

⁸¹ Ragie FH, Olivier DW, Hunter LM, Erasmus BFN, Vogel C, Collinson M & Twine W. 2020. A portfolio perspective of rural livelihoods in Bushbuckridge, South Africa. *South African Journal of Science*, 116, 9–10.

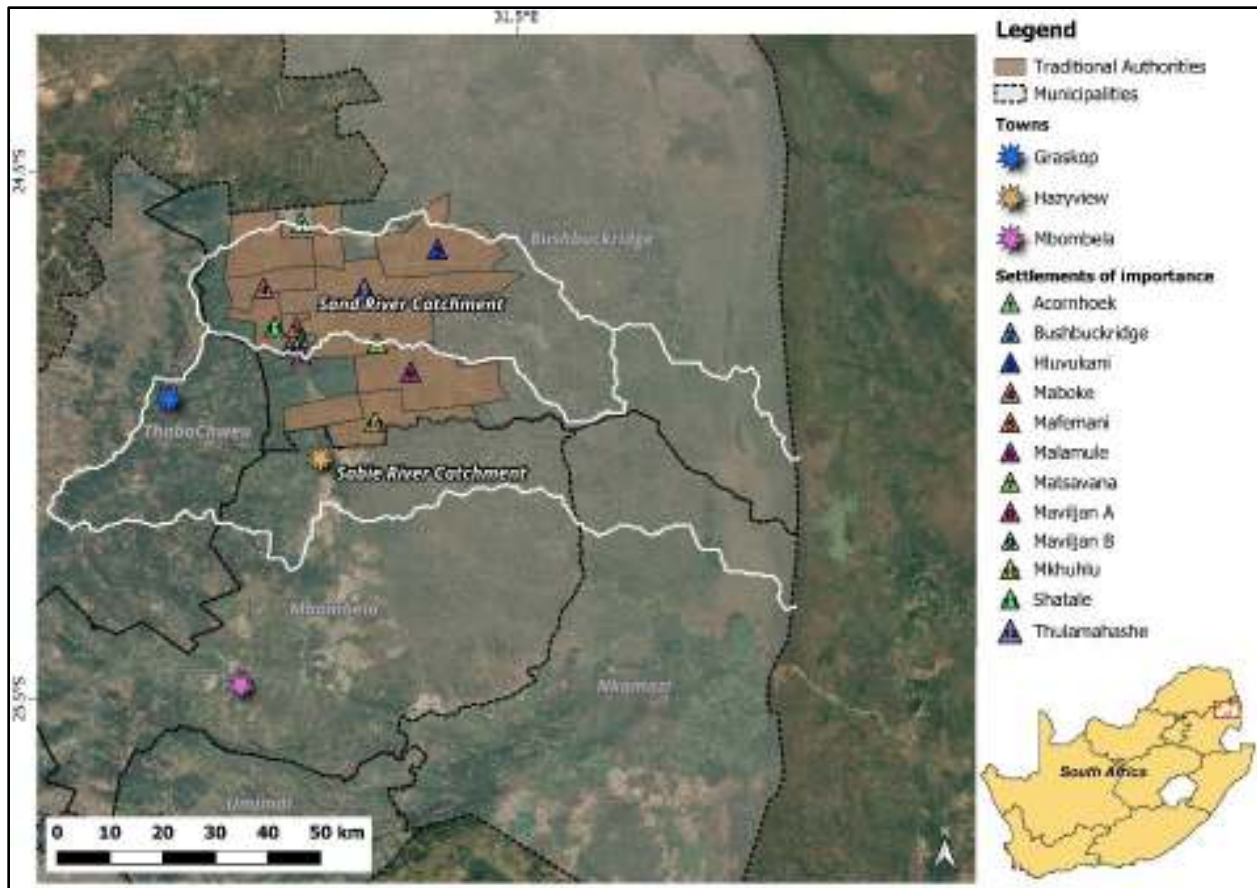


Figure 14. Project zone, first project activity instance areas and main communities.

The population of BLM is predominantly Black African (99%)⁸². Cultural groups include Shangaan (vaTsonga), Mapulana and amaSwati. Mozambican Shangaan communities also settled in the area during the 1975–1989 Mozambican civil war⁸³. Xitsonga is the most widely spoken language (59%), followed by Sepedi (25%). Smaller groups speak SiSwati, Sesotho and isiZulu⁸⁴. Women constitute 54% of the population and 53% of households are female-headed. A large proportion of residents are youth and dependents, with 42% below the age of 19⁸⁵. Educational attainment is limited across the project zone. In EDM, 14% of adults have no formal schooling, while only 8% have tertiary qualifications⁸⁶. In BLM, adult literacy stands at 66% and 5% of adults have a tertiary education⁸⁷. Average annual household income in BLM is ~R36,000 (~US\$5,000)⁸⁸. Moreover, ~290,000 people relied on social grants in 2024⁸⁹.

⁸² OpenUp. 2024. Bushbuckridge Local Municipality: Population and demographics. Wazimap. Available at: <https://next.wazimap.co.za/?geo=MP325#category-38>. Accessed on 26 September 2025.

⁸³ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Available at: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁸⁴ OpenUp. 2024. Bushbuckridge Local Municipality: Population and demographics. Wazimap. Available at: <https://next.wazimap.co.za/?geo=MP325#category-38>. Accessed on 26 September 2025.

⁸⁵ *Ibid.*

⁸⁶ Statistics South Africa. 2023. Municipal Fact Sheet. Census 2022. Retrieved from: https://census.statssa.gov.za/assets/documents/2022/Census_2022_Municipal_factsheet-Web.pdf

⁸⁷ Republic of South Africa National Treasury. 2021. Municipal Socio-Economic Profiles. Retrieved from: https://lg.treasury.gov.za/ibi_apps/rs/ibfs/WFC/Repository/Public/Municipal_Socio-Economic_Profiles/Profiles/Municipal_Profiles/Mpumalanga/Bushbuckridge.pdf.

⁸⁸ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁸⁹ *Ibid.*

Unemployment rates are substantial in EDM (38%)⁹⁰, with youth unemployment reaching 65% in Bushbuckridge⁹¹. Formal employment is concentrated in community services, trade, private households, agriculture and construction. Informal trade and subsistence farming further supplement household income. Employment opportunities are also linked to the tourism and conservation sectors through the Kruger to Canyons (K2C) Biosphere Reserve and surrounding reserves. Public health indicators highlight multiple vulnerabilities, including the burden of HIV⁹², tuberculosis⁹³, malnutrition⁹⁴ and maternal and child health concerns. These health challenges reduce household labor capacity, increase health-related expenditure and heighten reliance on social support systems. Combined with low income and educational attainment, these health pressures are reflected in Human Development Index (HDI) values of 0.60 in Ehlanzeni (2022)⁹⁵ and 0.55 in Bushbuckridge (2019)⁹⁶, both below the national average of 0.741 (2023)⁹⁷.

2.1.16 Project Zone Map and Project Location (VCS, 3.11, 3.18; CCB, G1.4-7, G1.13, CM1.2, B1.2)

The project zone, as previously detailed, includes the Sabie and Sand River catchments in the EDM, Mpumalanga Province – with geodetic coordinates of (30.6125, -25.3292) to (32.3292, -24.5750). PAIs will occur anywhere within the borders of the project zone. The first set of PAIs focuses on agroforestry and is planned in croplands and residential areas within ~169,000 ha of customary land, as shown in Figure 15. This customary land is divided into ten traditional authorities, each comprising several communities and this makes up the project area for the initial PAIs. The locations of principal communities within the catchment are shown in Figure 14 of Section 2.1.15. Three stakeholder types are identified, as discussed in Section 2.3: i) communities; ii) community groups; and iii) other stakeholders. Impacts on communities and community groups are expected to extend to the project zone boundaries. Several stakeholders are located outside the project area who will provide technical, policy, development and implementation support and as such, their locations are therefore not specified. As this is a grouped project, areas south and west of the customary land – including those extending to the south-west of Graskop and south of Hazyview – together with protected areas, are considered for future PAIs. Reforestation, riverbank restoration and roadside planting will be considered on a site-specific basis, where appropriate. No spatially identifiable off-site climate or biodiversity impact areas have been detected outside the project zone boundaries and the absence of off-site impacts will be confirmed at implementation and during monitoring.

⁹⁰ Ehlanzeni District Municipality. 2024. Draft Integrated Development Plan and Budget Review 2024/25. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2024/04/Draft-IDP-Budget-2024-25-30-March-2024-3.pdf>

⁹¹ Bushbuckridge Local Municipality. 2024. Annual Report 2023–2024. Retrieved from: https://lg.treasury.gov.za/supportingdocs/MP325/MP325_Annual%20Report%20Final_2024_Y_20250313T142217Z_cmmnyathi.pdf.

⁹² Bushbuckridge Local Municipality. 2023. Draft Integrated Development Plan 2022–2023. Retrieved from: <https://www.bushbuckridge.gov.za/images/files/2023/07/06/347/DRAFT-IDP-BLM-2022-23.pdf>.

⁹³ Mashimbye L. 2009. Tuberculosis (TB) treatment outcomes in adult TB patients attending a rural HIV clinic in South Africa (Bushbuckridge). Research Thesis. The University of Witwatersrand.

⁹⁴ Pongweni T. 2025. Learners in Bushbuckridge are ‘taking turns to eat’ as families struggle to feed them. Daily Maverick. Available at: <https://www.dailymaverick.co.za/article/2025-03-23-learners-in-bushbuckridge-are-taking-turns-to-eat-as-families-struggle-to-feed-them>. Accessed on 27 August 2025.

⁹⁵ Ehlanzeni District Municipality. 2024. Draft Integrated Development Plan and Budget Review 2024/25. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2024/04/Draft-IDP-Budget-2024-25-30-March-2024-3.pdf>

⁹⁶ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁹⁷ UNDP. 2024. Human Development Report. Breaking the gridlock: Reimagining cooperation in a polarised world (PDF). United Nations Development Programme. Available at: https://en.wikipedia.org/wiki/List_of_African_countries_by_Human_Development_Index?utm_source=chatgpt.com#cite_note-2022_components-1. Accessed on 27 August 2025.

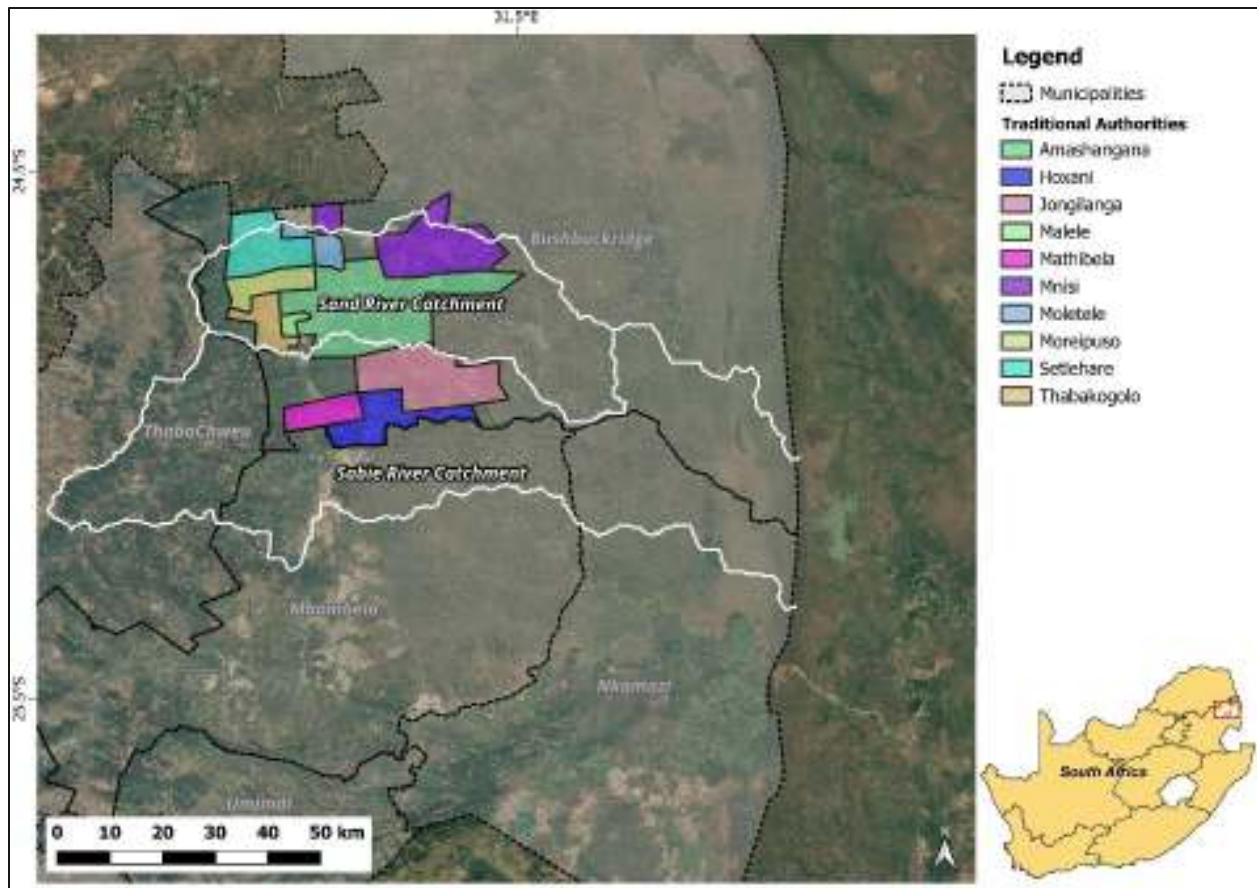


Figure 15. The ten traditional authorities making up the project areas for the first set of project activity instances (PAIs).

2.1.17 Project Activities and Theory of Change (VCS, 3.6; CCB, G1.8)

The project activities are grouped into four complementary streams: i) agroforestry in croplands and residential areas; ii) reforestation in selected degraded areas; iii) capacity building for climate-smart land use and community empowerment; and iv) development of value chains and digital tools for sustainable livelihoods and MRV. Agroforestry will cover 40,000 ha in the initial set of PAIs, with planting densities of 50 and 100 trees/ha for residential and cropland areas, respectively, while reforestation design will be tailored to site-specific degradation. Complementary to tree planting, a training program will engage landowners and community members, covering permaculture, sustainable land management, agroforestry techniques, biodiversity conservation, climate change adaptation, financial literacy and sustainable agricultural practices. To support livelihood diversification, the Project Proponent will establish functional community nurseries, train communities in sustainable harvesting of non-timber forest products and promote the processing of fruit, nuts and medicinal plants into oils, flours and other marketable goods. Digital platforms, mobile applications and dashboards will facilitate monitoring, reporting, verification (MRV) and market integration.

The expected outputs include more than 2.5 million trees planted and maintained across agroforestry and reforested landscapes, trained farmers and community members, functional nurseries, established value chains and operational digital tools. These outputs will generate medium-term outcomes such as improved soil fertility and water retention, diversified household income, enhanced food security, increased ecological connectivity and strengthened community capacity for climate-smart practices. In the long term, the project will deliver sustained carbon removals, resilient livelihoods and improved biodiversity conservation. Monitoring and adaptive management will track indicators including tree growth and survival, carbon stocks, biodiversity and socio-economic outcomes, ensuring activities remain aligned with intended

climate, community and biodiversity impacts. Appendix 2 provides a table where the project activities and theory of change are provided in more detail.

2.1.18 Sustainable Development Contributions (VCS, 3.17)

The project activity of tree planting in cropland and residential areas within the Sabie and Sand River catchments, as well as complementary activities including training and improved market access for crops and tree products, align with South Africa’s commitment to the United Nations Sustainable Development Goals (SDGs). The country has integrated the SDGs into its National Development Plan (NDP)⁹⁸ and updated its Nationally Determined Contribution (NDC) to comply with the Paris Agreement. The table below provides a list of the SDGs to which the project activities contribute, a description of the contribution and how the project intends to monitor or report these.

Sustainable Development Goal	Alignment with South African policy	Project contribution
Goal 1: End poverty in all its forms everywhere.	NDP Chapter 11: Social Protection.	Local paid jobs will be created through project activities, including nurseries, tree planting and monitoring. This advances SDG 1 and supports NDP Chapter 11 on strengthening household resilience.
Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.	NDP Chapter 10: Promoting health and Chapter 6: An integrated and inclusive rural economy.	Agroforestry on ~10,000 ha of croplands (100 trees/ha) and ~30,000 ha of residential areas (50 trees/ha) add locally available fruit and nuts, while soil stabilization and enhanced soil quality and improved water infiltration support more reliable water regulation for crops. Together, these actions diversify and stabilize food supply in rural settlements, contributing to SDG 2 and the NDP Chapter 6/10 focus on productive, healthy rural livelihoods.
Goal 3: Ensure healthy lives and promote well-being for all at all ages.	NDP Chapter 8: Transforming human settlement and the national space economy.	Residential trees at homesteads, schools and public spaces moderate local microclimates by providing shade and reducing heat. These improvements contribute to the environmental determinants of health, advance SDG 3 and align with NDP Chapter 8 aims for safer, more livable settlement environments.
Goal 4: Ensure inclusive and equitable quality of education and promote lifelong learning opportunities for all.	NDP Chapter 9: Improving education, training and innovation.	Training will be provided for landholders in sustainable land management, agroforestry, biodiversity conservation, climate adaptation and basic enterprise skills. Practical components cover community nursery operations and sustainable Non-Timber Forest Products harvesting and processing. This approach expands access to vocational and lifelong learning in restoration and nature-based livelihoods, advancing SDG 4 and aligning with NDP Chapter 9.
Goal 5: Achieve gender equality and empower all women and girls.	NDP Chapter 9: Improving education, training and innovation.	Gender equality is promoted across the implementation of the project by: i) facilitating equitable recruitment and participation of women in planting, maintenance and local decision-making; ii) improving access to vocational training; iii) increasing the number of female farmers with access to climate-smart practices such as permaculture; and iv) applying inclusive, safe working practices that reduce gender-equitable participation barriers. In doing so, it advances SDG 5 and aligns with NDP Chapter 9 on inclusion.

⁹⁸ National Planning Commission. 2014. National Development Plan 2030. Our future – make it work. Retrieved from: https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf

Sustainable Development Goal	Alignment with South African policy	Project contribution
Goal 6: Ensure availability and sustainable management of water and sanitation for all.	NDP Chapter 6: An integrated and inclusive rural economy	Project activities are expected to improve water availability and quality through catchment restoration. This will strengthen household and agricultural access to clean water by reducing sedimentation in rivers. Furthermore, project activities in the Sabie and Sand River catchments will promote efficient water use for rural communities and support ecosystem services for downstream users.
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.	NDP Chapter 3: Economy and employment.	Project activities will generate local employment over the 40-year timeframe through planting, maintenance and monitoring. Additionally, project participants are able to sell fruit, nuts and medicinal products to generate additional income.
Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.	NDP Chapter 4: Economic infrastructure	The project proponent will develop local infrastructure through community nurseries, enabling diversified rural industries. This is expected to strengthen resilience of agricultural systems by introducing climate-smart practices and technologies, fostering innovation and inclusive industrialization.
Goal 13: Take urgent action to combat climate change and its impacts.	NDP Chapter 5: Ensuring environmental sustainability and equitable transition to a low-carbon economy.	The project follows VCS VM0047 and is expected to remove ~7 MtCO ₂ e over 40 years. These activities are not linked to jurisdictional REDD+ and are expected to deliver measurable mitigation and resilience co-benefits in line with SDG 13 and NDP Chapter 5.
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss.	NDP Chapter 5: Ensuring environmental sustainability and equitable transition to a low-carbon economy.	Reforestation with native species restores habitats and improves connectivity within the Maputoland-Pondoland-Albany Biodiversity Hotspot/Key Biodiversity Area and Kruger to Canyons Biosphere Reserve landscape — directly advancing SDG 15 and NDP Chapter 5 on preventing land degradation and conserving biodiversity.

2.1.19 Implementation Schedule (CCB, G1.9)

The table below outlines the expected dates and milestones for the project’s development and implementation, including stakeholder engagement, planting activities, training, monitoring, verification and long-term project management.

Date	Milestone(s) in the project’s development and implementation
Q4 2025	<ul style="list-style-type: none"> Start Phase Two of the Stakeholder Engagement and FPIC processes List the PDD as under validation to begin the public comment period Contract a VVB Finalize Terms of Reference (ToR) with implementing and training partners Establish project-related jobs and advertise the positions Conduct baseline assessments for the climate, community and biodiversity indicators
1 Jan 2026	<ul style="list-style-type: none"> Start pilot planting in selected croplands, residential areas and other appropriate sites (this relates to trees already propagated by Root and Ground and those donated by SANParks)

	<ul style="list-style-type: none"> • Test planting techniques and train initial participants
Q1 2026	<ul style="list-style-type: none"> • Continued Stakeholder Engagement and FPIC processes • Continued onboarding of project participants • Refine training material specific to propagation and nursing trees and permaculture and agroforestry techniques • Present training workshops for project participants and employees, as needed
2024-2030	<ul style="list-style-type: none"> • Large-scale propagation of trees • Continued site assessments of additional planting areas – outside of croplands and residential areas • Continued establishment of community nurseries and recruiting or contracting of propagation partners
2026-2029	<ul style="list-style-type: none"> • Continued Stakeholder Engagement and FPIC processes • Continued onboarding of project participants • Large-scale planting of one million trees across 10,000 ha of croplands and associated training for employees and project participants
2026-2030	<ul style="list-style-type: none"> • Continued Stakeholder Engagement and FPIC processes • Continued onboarding of project participants • Large-scale planting of 1.5 million trees across 30,000 ha of residential areas and associated training for employees and project participants
2026 onwards (annual)	<ul style="list-style-type: none"> • Monitoring of tree growth, survival, soil fertility, water retention, biodiversity indicators and socio-economic outcomes • Adaptive management applied
2027	<ul style="list-style-type: none"> • Assessment of pilot and early planting survival rates
2028	<ul style="list-style-type: none"> • Midpoint review of implementation • Adjustments to species selection, planting methods and training programs as needed • Continued Stakeholder Engagement and FPIC processes
2030	<ul style="list-style-type: none"> • Verification of initial monitoring results • Validation of early climate, community and biodiversity benefits • Continued Stakeholder Engagement and FPIC processes • Define additional PAIs and update the PDD
2031-2065	<ul style="list-style-type: none"> • Continuation of monitoring every 5 years for verification and annually for internal adaptive management • Annual Stakeholder Engagement and FPIC processes • Expand into the remainder of the Sabie and Sand River catchments with subsequent PAIs with updates to the PDD at every verification or every 5 years • Establishment of local enterprises and training programs on sustainable harvesting and product processing
2066	<ul style="list-style-type: none"> • Final monitoring and verification cycle • Project evaluation against long-term climate, community and biodiversity goals • Plan for continued monitoring for the 100-year project longevity

2.1.20 Risks to the Project (CCB, G1.10)

The table below identifies the potential risks that may affect the delivery of climate, community and biodiversity benefits, along with their potential impacts and the mitigation measures designed to address them.

Identified Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed and designed to mitigate the risk
Irrigation and water scarcity	Local water stress during sapling establishment could affect long-term tree survival and reduce climate and livelihood benefits.	<ul style="list-style-type: none"> • Use of native drought-tolerant species such as knob thorn (<i>Senegalia nigrescens</i>) and marula (<i>Sclerocarya birrea</i>) • Training on water-efficient practices such as mulching, soil preparation and pit planting
Land tenure uncertainty	Overlapping land rights and governance systems could undermine project legitimacy, implementation and credit issuance.	<ul style="list-style-type: none"> • Risks addressed through FPIC consultations and guided by a Rapid Land Tenure Assessment (RaTA) • Implementation limited to areas with recognized land ownership and consent aligned with legal due diligence and local governance norms
Governance overlaps	Parallel mandates of municipal and traditional authorities may cause delays, institutional conflict and reduced decision-making coherence	<ul style="list-style-type: none"> • Engagement with both systems through joint meetings, project briefings and governance workshops • Activities proceed only with approval from both authorities • Formal endorsements secured from municipalities and traditional leaders
Stakeholder disengagement	Disengagement may occur if stakeholders expect short-term employment rather than long-term livelihood benefits, undermining project participation and outcomes.	<ul style="list-style-type: none"> • Consultations framed participation around long-term, land-based livelihoods • Examples were given of gradual benefits such as soil health and fruit and nut harvesting • Carbon finance presented as performance-based • Training emphasized to reinforce non-cash value • Lessons from other projects used to align expectations
Low participation from vulnerable groups	Limited participation of women, youth, elders and informal land users could undermine inclusivity and weaken representativeness of consent and engagement.	<ul style="list-style-type: none"> • Household visits and targeted sessions held with underrepresented groups • Consultation materials translated and adapted for accessibility • Participation tracked with disaggregated records • FPIC implemented as a phased process to allow inclusive engagement and validation of feedback.
Information clarity	Limited understanding of carbon project mechanisms could result in ill-informed consent and weaken participation.	<ul style="list-style-type: none"> • Communication materials translated, simplified and visualized • Piloted through focus groups to test clarity • WhatsApp chatbot introduced with FAQs, anonymous queries and upcoming audio features • Information shared iteratively in multiple accessible formats.
Representation and power imbalances	Dominant voices in meetings may marginalize women, youth, elders and informal land users, limiting inclusivity and skewing engagement outcomes.	<ul style="list-style-type: none"> • Separate sessions held with underrepresented groups • Facilitators trained to manage local power dynamics • Use of rotating spokespersons, breakout discussions and anonymous feedback tools • GWF, one of the training and implementing partners, promotes inclusion through women-led networks and digital platforms • Ongoing feedback mechanisms (community meetings, WhatsApp chatbot, community liaisons, GWF platforms) ensure continuous input.

2.1.21 Benefit Permanence (CCB, G1.11)

The project is designed to ensure that its climate, community and biodiversity benefits extend beyond the crediting period. Stakeholder engagement with traditional authorities, landowners and land users during project design, implementation and monitoring ensures that project management is integrated within existing community structures. Legally binding agreements will commit land users, landowners and traditional authorities to conserving project-related trees after credit issuance. This commitment is supported by ecological, community, economic and institutional measures outlined in the sections below.

Ecological permanence will be achieved by integrating long-term tree cover into farming and settlement areas. Tree planting in croplands, residential areas and degraded sites will shift land management towards agroforestry and restoration-based practices. These practices will ensure continued carbon storage, soil protection and livelihood benefits beyond the project crediting period. All tree species selected are either native or adapted to regional climate conditions, as detailed in Appendix 5. The inclusion of High Conservation Value (HCV) species – many protected by law once planted – ensures that tree cover is durable, ecologically appropriate and safeguarded by regulatory frameworks. Project activities will also enhance soil fertility, reduce erosion and improve land management practices to build resilience in agricultural and natural systems. Project plantings are designed to strengthen ecological corridors and improve connectivity between fragmented habitats, establishing landscape-scale linkages that will persist beyond active intervention.

Community permanence is strengthened by integrating traditional ecological knowledge into project design, including species selection, planting techniques and resource use. Developing these practices enhances cultural ownership and ensures that tree management and protection are sustained across generations. Complementary training programs will equip communities with skills in agroforestry, value addition and market access. Integrating these skills locally will enable landowners and farmers to maintain tree-based systems independently and generate long-term income. This will support the continued protection of planted areas beyond the crediting period. Training will prioritize youth and women's groups, supported by knowledge management and extension systems, to ensure intergenerational ownership and continuity of benefits. Localized manuals, demonstration plots and extension services will institutionalize the skills gained. A handover strategy for community- and institution-led monitoring will ensure that benefits are tracked and adaptive management continues after project closure.

Economic permanence is promoted through the development of diversified livelihood opportunities that provide sustained financial incentives to maintain and protect trees. Multiple income streams, including carbon revenues, fruit production and value-added agroforestry products, will secure long-term benefits for residents and farmers. Project activities will also stimulate the establishment of community-led enterprises, particularly for processing tree products such as oils, jams and medicinal extracts. These enterprises will create long-term economic value chains that depend on sustained tree management, reinforcing the permanence of project benefits.

Institutional permanence will be ensured through partnerships established by the Project Proponent with several technical institutions. These partnerships integrate the project within long-term policy and conservation frameworks and provide ongoing technical support beyond the crediting period. By aligning project activities with established governance and conservation structures, the permanence of climate, community and biodiversity benefits is reinforced.

2.1.22 Financial Sustainability (CCB, G1.12)

A full financial model will be made available to auditors and relevant stakeholders upon request. The model provides evidence of projected revenues from GHG emissions removals and demonstrates that the projected flow of funds will be sufficient for project implementation and to achieve the expected climate, community and biodiversity benefits.

2.2 Without-project Land Use Scenario and Additionality

2.2.1 Conditions Prior to Project Initiation and Land Use Scenarios without the Project (VCS, 3.13; CCB, G2.1)

The conditions existing prior to project initiation are the same as those described in Sections 2.1.14, 2.1.15, 3.5.1, 4.1 and 5.1, where ecosystem type, current and historical land use and environmental conditions have been outlined. Summaries of these sections are provided below. The baseline scenario corresponds to the conditions described in Section and should be considered the reference scenario against which project impacts are assessed. Project activities have not been designed or implemented to generate GHG emissions for the purpose of their subsequent reduction or removal.

Ecosystem type

The project zone encompasses savanna, grassland and forest biomes that support diverse flora and fauna, with several species listed as RTE^{99,100,101} (see Appendix 5: Rare, Threatened or Endangered Species in the Project Zone). The area also lies within the Maputoland-Pondoland-Albany Biodiversity Hotspot¹⁰² and overlaps with the Kruger to Canyons Biosphere Reserve¹⁰³. The area's vegetation reflects the complex environmental gradients in the region, comprising savannas, escarpment grasslands and afro-temperate forests that together maintain ecological connectivity and biodiversity^{104,105} (see Figure 8; Section 2.1.14). The area's vegetation reflects the complex environmental gradients in the region, comprising savannas, escarpment grasslands and afro-temperate forests that together maintain ecological connectivity and biodiversity^{106,107} (see Figure 8; Section 2.1.14).

Current and historical land-use

Land use within the project zone includes commercial plantations, communal rangelands, subsistence and commercial farming, riverine and conservation areas such as KNP, private reserves and community-owned reserves. Historically, livelihoods have depended on crop cultivation, livestock production and harvesting of fuelwood and wild resources^{108,109}. More recently, conservation and ecotourism have become important contributors to employment, with ~10,000 jobs sustained in protected areas in the Greater Kruger¹¹⁰. Forestry, trade, informal enterprises and limited mining and manufacturing further

⁹⁹ The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. 2016. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

¹⁰⁰ Child MF, et al. 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

¹⁰¹ Raimondo D, et al. 2009. Red List of South African Plants. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

¹⁰² Critical Ecosystem Partnership Fund. 2025. Maputoland-Pondoland-Albany. Available at: <https://www.cepf.net/our-work/biodiversity-hotspots/maputoland-pondoland-albany>. Accessed on 29 August 2025.

¹⁰³ The department of Forestry, Fisheries and the Environment. 2025. Kruger to Canyons Biosphere Reserve. Available at: <https://www.dffe.gov.za/kruger-canyons-biosphere-reserve>. Accessed on 29 August 2025.

¹⁰⁴ Department of Water and Sanitation (South Africa). 2016. National Water Act, 1998 (Act No. 36 of 1998): the new nine water management areas of South Africa. (Notice 1056). Government Gazette. 40269,169.

¹⁰⁵ Mucina L, Geldenhuys CJ, Rutherford MC, Powrie LW, Lötter MC & Von Maltitz GP. 2006. Afrotemperate, subtropical and azonal forests. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia*. 19, 584–614.

¹⁰⁶ Department of Water and Sanitation (South Africa). 2016. National Water Act, 1998 (Act No. 36 of 1998): the new nine water management areas of South Africa. (Notice 1056). Government Gazette. 40269,169.

¹⁰⁷ Mucina L, Geldenhuys CJ, Rutherford MC, Powrie LW, Lötter MC & Von Maltitz GP. 2006. Afrotemperate, subtropical and azonal forests. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia*. 19, 584–614.

¹⁰⁸ Ragie FH, et al. 2020. A portfolio perspective of rural livelihoods in Bushbuckridge, South Africa. *South African Journal of Science*. 116, 9–10.

¹⁰⁹ As per observation.

¹¹⁰ Chidakel A, Eb C & Child B. 2020. The comparative financial and economic performance of protected areas in the Greater Kruger National Park, South Africa: functional diversity and resilience in the socio-economics of a landscape-scale reserve network. *Journal of Sustainable Tourism*. 28, 8, 1100–1119.

diversify the local economy; however, agriculture and conservation remain the most prominent livelihoods¹¹¹.

Present and prior environmental conditions in the project area

The Sabie and Sand River catchments extend from the Mpumalanga Escarpment into the Lowveld, encompassing steep ridges, broad valleys and low-lying plains^{112,113}. Soils vary from shallow rocky substrates on ridges to more fertile clays in valleys, while sandy soils dominate the lowlands^{114,115,116}. The region has a warm, seasonal climate, with a mean annual rainfall of 750 mm that ranges between ~600 mm in the lowlands and ~2,000 mm on the escarpment^{117,118}. River systems, including the perennial Sabie and the more ephemeral Sand Rivers, supply water to downstream users but face pressures from unregulated abstraction and insufficient storage infrastructure.

The project zone was historically dominated by extensive savannas, grasslands and Afro-temperate forests, which together supported rich biodiversity and ecological connectivity. Over the past five decades, however, these natural ecosystems have been largely replaced by urban development, cropland expansion and plantation forestry. In the absence of project activities, existing land use pressures are expected to persist and intensify. Population growth, poverty-driven reliance on natural resources, overgrazing and limited institutional capacity for land management are likely to accelerate soil erosion, resource depletion and habitat fragmentation. The planning frameworks of local governments emphasize poverty reduction and land rehabilitation, but budgetary and institutional constraints restrict implementation at scale. Without coordinated intervention, these drivers will continue to degrade land, constrain livelihood options and reduce adaptive capacity. The implications of these dynamics for climate, community and biodiversity outcomes are described in Section that follows.

2.2.2 Most-Likely Scenario Justification (CCB, G2.1)

Climate

The project zone is likely to be increasingly exposed to climate risks in the absence of planned activities. Regional climate models project increasing temperatures and rainfall variability, with more frequent droughts and extreme rainfall events^{119,120}. Without adaptation measures, households and ecosystems will be increasingly vulnerable to these changes. Soil erosion, reduced groundwater recharge and declining soil fertility are expected to intensify with conditions of heavier downpours and prolonged dry

¹¹¹ South African Department of Forestry, Fisheries and the Environment. 2024. SA National Land-Cover Datasets. Available at: https://egis.environment.gov.za/sa_national_land_cover_datasets. Accessed on 22 August 2024.

¹¹² River Eco-status Monitoring Programme (REMP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant's River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/crocsabieolif_01_toc.html. Accessed on 22 August 2024.

¹¹³ Jansen H. 1997. The Geology of the Country around Pretoria. An explanation of SHEETS 2527DA, DB, DC, DD AND 2528CA, CB, CC, CD. Retrieved from: <https://resources.bgs.ac.uk/sadcreports/rsa1977jansengeologyofpretoria.pdf>

¹¹⁴ Department of Water Affairs. 2011. The Groundwater Dictionary (2nd ed.). Available at: Groundwater Dictionary ([dws.gov.za](https://www.dws.gov.za)). Accessed on 22 August 2024.

¹¹⁵ *Ibid.*

¹¹⁶ *Ibid.*

¹¹⁷ South African River Health Programme (SARHP). 2001. State of the rivers report: Crocodile, Sabie-Sand and Oliphant's River systems. South African Department of Water and Sanitation. Available at: https://www.dws.gov.za/iwqs/rhp/state_of_rivers/state_of_crocsabieolif_01/sabie_eco.html. Accessed on 22 August 2024.

¹¹⁸ *Ibid.*

¹¹⁹ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. Environmental Development. 55, 101216.

¹²⁰ Van Wilgen NJ, Goodall V, Holness S, Chown SL & McGeoch MA. 2016. Rising temperatures and changing rainfall patterns in South Africa's national parks. International Journal of Climatology. 36, 706–721.

spells, reducing agricultural productivity and water security^{121,122}. Fire frequency is projected to increase in drier years, causing vegetation degradation and further loss of ecosystem services¹²³.

The absence of interventions to improve water management, diversify land use and restore degraded areas will constrain adaptive capacity¹²⁴. Communities will remain exposed to increased risks of crop failure, livestock losses and infrastructure damage from floods¹²⁵. The combined effects of heat stress, water scarcity and ecological degradation are likely to increase existing vulnerabilities, reducing resilience against climate shocks and stresses¹²⁶. These dynamics will perpetuate cycles of poverty, displacement and environmental decline¹²⁷. Section 3.4 provides a detailed analysis of the without-project scenario from a climate perspective.

Community

Without the project, communities in the project zone are expected to experience worsening socio-economic conditions. Employment opportunities will remain limited, with households continuing to depend on social grants and migrating to urban areas^{128,129,130}. Limited access to tertiary education and vocational training will likely increase unemployment, particularly among women and young people, reinforcing cycles of poverty and inequality¹³¹. Without the diversification into sustainable livelihoods that is introduced with the project, local communities – and in particular, women and youths – are likely to remain disadvantaged and marginalized due to ongoing exclusion from decision-making processes and economic opportunities.

Climate resilience will be reduced as land degradation, water scarcity and biodiversity loss continue to undermine livelihoods, food security and health^{132,133}. Furthermore, declines in ecosystem services – including fuelwood, wild foods, grazing and water supply – are expected to exacerbate vulnerability to climate shocks, especially for poorer and more remote households. Cultural practices supported by these natural resources could also be negatively affected, with consequences for social well-being and

¹²¹ Kolusu SR. et al. 2019. The El Niño event of 2015–2016: climate anomalies and their impact on groundwater resources in East and Southern Africa. *Hydrology and Earth System Sciences*. 23, 1751–1762.

¹²² Engelbrecht F. et al. 2015. Projections of rapidly rising surface temperatures over Africa under low mitigation. *Environmental Research Letters*. 10, 085004.

¹²³ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. *Environmental Development*. 55, 101216.

¹²⁴ Coldrey KM, Turpie JK, Midgley G, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*. 36, e13941.

¹²⁵ Adeola AM, Kruger A, Makgoale TE & Botai JO. 2022. Observed trends and projections of temperature and precipitation in the Olifants River Catchment in South Africa. *PLOS ONE*, 17, 8, e0271974.

¹²⁶ Dos Santos M. 2024. Climate change, air pollution, and human health in the Kruger to Canyons Biosphere Region, South Africa, and Amazonas, Brazil: A narrative review. *Atmosphere*. 15, 562.

¹²⁷ Urban M. et al. 2018. Surface moisture and vegetation cover analysis for drought monitoring in the southern Kruger National Park using Sentinel-1, Sentinel-2, and Landsat-8. *Remote Sensing*, 10, 1482.

¹²⁸ Department of Cooperative Governance and Traditional Affairs. 2020. Ehlanzeni District: Profile and Analysis, District Development Model. Pretoria: Republic of South Africa. Retrieved from: https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf

¹²⁹ Mpumalanga Provincial Government. 2022. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdfhttps://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2022_Final.pdf.

¹³⁰ Rusere F, Li Q, Hunter L, Collinson M, Ouma S, Twine W & Samimi C. 2025. Relationships between rural migration and perceptions of environmental change: Insights from Bushbuckridge, South Africa. *Journal of Rural Studies*, 119, 103819.

¹³¹ Bushbuckridge Local Municipality. 2016. Draft Integrated Development Plan 2016/17. Retrieved from: <https://cogta.mpg.gov.za/IDP/2016-17%20IDPs/Ehlanzeni/Bushbuckridge2016-17.pdf>

¹³² Coetzer-Hanack KL, Witkowski ETF & Erasmus BFN. 2016. Thresholds of change in a multi-use conservation landscape of South Africa: historical land-cover, future transformation and consequences for environmental decision-making. *Environmental Conservation*, 43, 3, 253–262.

¹³³ Shai KN, Ncama K, Ndhlovu PT, Struwig M & Aremu AO. 2020. An Exploratory Study on the Diverse Uses and Benefits of Locally-Sourced Fruit Species in Three Villages of Mpumalanga Province, South Africa. *Food*, 9, 11, 1581.

traditional practices^{134,135}. Collectively, these dynamics are likely to decrease well-being and increase poverty, social inequality and dependence on external assistance in the absence of the project. See Section 4.4 for further details on the community without-project scenario.

Biodiversity

The project zone has become increasingly fragmented by urban expansion, agriculture and plantations. Although protected areas exist, such as parts of KNP and nearby reserves, the surrounding area is dominated by human-modified land, with limited native tree cover outside these reserves. In the absence of the project, ongoing urbanization and agricultural expansion are expected to intensify, accelerating habitat loss and further decreasing ecological linkages across the landscape. The progressive isolation of natural areas will hinder species dispersal, diminish genetic exchange and exacerbate pressures on remaining biodiversity. While national and municipal frameworks recognize the importance of ecological restoration, enforcement is inadequate and implementation is constrained by limited institutional capacity. A more detailed overview of the without-project scenario from a biodiversity perspective is provided in Section 5.1.

2.2.3 Community and Biodiversity Additionality (CCB, G2.2)

Community

Communities in the Mpumalanga Province are exposed to persistent socio-economic constraints. More than 50% of residents lived in poverty in 2023, while youth unemployment exceeded 45%¹³⁶. Limited access to vocational training, insecure land tenure and weak market linkages continue to restrict household development. These conditions reinforce livelihood insecurity and exposure to environmental impacts. For example, households with limited income often depend on small-scale rainfed agriculture, which is vulnerable to erratic rainfall and declining soil fertility. Existing policies and municipal plans emphasize poverty reduction and land rehabilitation, yet siloed institutions and limited resources prevent implementation at the scale required, given the constrained budgets of local government. The private sector also has limited capacity to absorb the costs of large-scale planting and infrastructure. Land degradation and unemployment, therefore, remain unresolved.

Project activities will counter these pressures by creating employment, training and enterprise opportunities through participation in nursery development, tree planting and maintenance – providing new income sources. Training in agroforestry, climate-smart agriculture and improved natural resource management will strengthen vocational skills and improve livelihoods and resilience in terms of food and income. The Project Proponent will form partnerships with technical organizations to address institutional and technological gaps, while structured training and inclusive governance processes enable participation by smallholders and community members. These activities are designed to create conditions for long-term livelihood improvements that would not occur without external support.

Biodiversity

The project area lies between protected landscapes to the west and east; however, increasing urbanization and agricultural expansion have progressively reduced ecological connectivity between these areas.

Through agroforestry systems in croplands, residential tree planting, and reforestation, the project is expected to improve ecological linkages across the landscape, likely reconnecting fragmented habitats and directly and indirectly improving biodiversity metrics. These connectivity benefits would not occur in the absence of coordinated project interventions, as financial, institutional and governance barriers

¹³⁴ Rusere F, Mkuhlani S, Soropa G, Hunter L, Twine W & Samimi C. 2025. Agrarian transitions in rural Bushbuckridge, Mpumalanga province, South Africa: understanding dynamics and determinants. *Frontiers in Sustainable Food Systems*, 9.

¹³⁵ Mchale MR, Beck SM, Pickett STA, et al. 2018. Democratization of ecosystem services—a radical approach for assessing nature’s benefits in the face of urbanization. *Ecosystem Health and Sustainability*, 4, 5.

¹³⁶ Mpumalanga Department of Economic Development and Tourism. 2025. Socio-Economic Review and Outlook (SERO) for Mpumalanga: March 2025. Economic Analysis Unit, Mbombela. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2025_final-1.pdf.

prevent landholders or government agencies from implementing restoration activities at the required scale.

2.2.4 Benefits to be used as Offsets (CCB, G2.2)

No distinct community or biodiversity benefits are intended to be used as offsets in this project. Accordingly, no claims of additionality are established for such benefits, as the project does not seek to generate or account for them in this context.

2.3 Safeguards and Stakeholder Engagement

2.3.1 Stakeholder Identification (VCS, 3.18, 3.19; CCB G1.5)

Stakeholder identification was guided by the Social Impact Biodiversity Assessment Toolkit (SBIA+)¹³⁷ to map stakeholders by their interest in the project and influence over its outcomes, in line with VCS and CCB Standards. Identified stakeholders include: i) communities in the project area; ii) government departments; iii) non-governmental organizations (NGOs); iv) community liaisons; and v) technical and implementing partners. A list of initial stakeholders was prepared by the Project Proponent, drawing on experience in the project zone and further expanded with input from stakeholder consultations and community liaisons familiar with local social dynamics.

Local communities within the project area were identified as the primary beneficiaries, as they depend on the land and are expected to contribute to tree planting and long-term stewardship. To understand local social dynamics, community liaisons assessed relationships among groups and identified stakeholders for transparent and inclusive engagement. These assessments were informed by consultations undertaken during the Stakeholder Engagement and FPIC processes, which contributed to verifying findings and ensuring activities reflected community perspectives. An influence–interest matrix was then developed to categorize stakeholders based on: i) proximity to the project area and reliance on natural resources; ii) level of interest in project outcomes; iii) potential influence on or exposure to project activities; and iv) expected role in decision-making and implementation.

The stakeholder mapping process will continue throughout project implementation and will be applied whenever new stakeholders are identified or with the introduction of each new PAI. Updates to the stakeholder mapping will be incorporated into the PDD at each verification.

2.3.2 Stakeholder Descriptions (VCS, 3.18, 3.19; CCB, G1.6, G1.13)

Stakeholder descriptions, including how each was identified and their relevance to the project, are provided in Appendix 1 (Stakeholder Description Table). This table presents the stakeholders identified in Section 2.3.1, grouped into three categories.

- **Communities:** identified as local communities residing within or adjacent to the project area who depend on land and natural resources for their livelihoods.
- **Community groups:** demographic subsets – including women, youth, marginalized groups and culturally distinct populations – with differentiated interests, vulnerabilities and influence regarding project outcomes.
- **Other stakeholders:** institutions, private sector actors, academic organizations and regulatory bodies with a formal interest in the project but no direct reliance on local resources.

¹³⁷ Richards M. 2011. Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 2 – Social Impact Assessment Toolbox. Climate, Community & Biodiversity Alliance and Forest Trends with Rainforest Alliance and Fauna & Flora International. Washington, DC. Available at: https://s3.amazonaws.com/CCBA/SBIA_Manual/SBIA_Part_2.pdf

2.3.3 Stakeholder Access to Project Documents (VCS, 3.18, 3.19; CCB, G3.1)

To support transparent and inclusive engagement, the project proponent has developed mechanisms to ensure that stakeholders — particularly local communities — have continued access to project information. These mechanisms account for varying literacy levels, digital access and familiarity with carbon projects. Project documentation, including the project description, monitoring reports and supporting materials such as benefit-sharing frameworks and land-use agreements, will be available throughout the project lifetime. Digital access will be provided through a multilingual WhatsApp chatbot, which will share project summaries, frequently asked questions and milestone updates in local languages and allow users to submit questions and feedback. Documents will also be available on the Save the Sand website and the Verra Registry for stakeholders with internet access. Printed and translated materials will be distributed at community access points such as schools, churches and traditional authority offices, with verbal explanations provided where needed.

2.3.4 Dissemination of Summary Project Documents (VCS, 3.18, 3.19; CCB, G3.1)

During Phase One of the Stakeholder Engagement and FPIC process (see Section 2.3.10 and supporting document: Save the Sand_FPIC Report_June 2025), the project proponent distributed printed and digital project summaries in local languages, along with plain-language presentations for communities and other stakeholders. These summaries outlined project goals, eligibility criteria, expected benefits, potential risks and timelines to enable stakeholder understanding and feedback on the project design. A project prospectus, the draft PDD and additional summaries were also shared with local NGOs, municipalities and other institutional stakeholders. All documents were made available on the Save the Sand website for those with internet access.

As implementation progresses, information such as preliminary monitoring results, new PAIs and updates to the PDD will be shared through several channels: i) the WhatsApp chatbot; ii) annual in-person meetings led by community liaisons; iii) local radio, noticeboards, flyers in schools and churches and community announcements; and iv) liaison visits to remote villages. Updated documents will also be posted on the Save the Sand website and the Verra Registry. All summaries will be prepared in plain language, translated into local languages and provided in accessible formats to ensure stakeholders remain informed and able to respond as the project evolves.

2.3.5 Informational Meetings with Stakeholders (VCS, 3.18, 3.19; CCB, G3.1)

The Save the Sand is an initiative that has been active for several years, during which informal interactions and stakeholder engagements were held with traditional authorities, local governance structures, NGOs, community members and technical partners. From April 2024 to May 2025, these engagements became more structured, with formal meetings introducing the project to traditional authorities, local governance structures and community stakeholders. These consultations were undertaken in line with the VCS and CCB Standards and records have been retained as evidence. The meetings explained project objectives, outlined the FPIC process and opened dialogue on land use, ecological challenges and community priorities.

Communal land in the project zone is governed by ten traditional authorities (see Section 2.1.16), each led by a chief (*hosi/kgosi*) and supported by one or more headmen (*ndunas*). Initial consultations were held with six authorities — Amashangana, Jongilanga, Mnisi, Hoxani, Moletele and Mathibela. Chiefs were first approached through formal presentations on proposed activities, including tree planting, land restoration and carbon revenue opportunities. Following these consultations, permission was granted to engage with headmen, ward councilors and community members. Meetings were announced two weeks in advance through community networks, email, WhatsApp, and word-of-mouth by traditional leaders and liaison officers and announcements at community gatherings and church services.

Between 21 April and 1 May 2025, follow-up meetings were held with community members and representatives from C4 EcoSolutions (Pty) Ltd., community liaisons and local NGOs. Participants included residents, smallholder farmers, healers, youth groups, faith-based organizations and civil society representatives. Meetings took place at traditional authority offices, churches, NGO facilities in Hazyview and the GWF Hazyview campus. Field visits were also conducted to homesteads and farming sites in Thulamahashe, Dingleydale and Lillydale (see Figure 15 in Section 2.1.15).

These meetings were structured as two-way exchanges. Community members shared perspectives on: i) their understanding of nature-based solutions such as tree planting and conservation; ii) needs and priorities regarding project outcomes; iii) interest in participating in the project; and iv) traditional knowledge to inform project design. In turn, the project proponent provided information on:

- the scope and rationale of planting ~2.5 million trees;
- the meaning of and steps of the FPIC process;
- local environmental challenges, including land degradation and water stress;
- socio-economic opportunities associated with land restoration;
- an introduction to the carbon market and how credits are generated; and
- eligibility criteria for voluntary participation in later phases.

Engagements have been held with local government, including BLM and with national authorities such as the Department of Forestry, Fisheries and the Environment (DFFE). Other stakeholders involved in project design, implementation, conservation and natural resource management have also been consulted. Further meetings are planned with the chiefs of the remaining traditional authorities, additional government institutions and private landowners before implementing the PAIs on their land. Consultations with communities and stakeholders will continue during implementation to ensure their perspectives inform project design.

2.3.6 Risks from the Project and No Net Harm (VCS, 3.18, 3.19)

Potential natural and human-induced risks during implementation have been identified, along with mitigation measures to prevent net harm to people, ecosystems and biodiversity. Mitigation is guided by the precautionary principle and risk communication has followed international best practices to ensure stakeholders are well informed. The identified risks are: i) water scarcity; ii) land tenure uncertainty; iii) governance overlaps; iv) stakeholder disengagement; v) exclusion of vulnerable groups; vi) limited information clarity; and vii) local power imbalances. Mitigation measures focus on:

- the use of drought-tolerant, native species;
- training in water-efficient practices;
- FPIC-based land tenure consultations;
- joint engagement with traditional and municipal leaders;
- clear communication on carbon finance;
- locally-informed inclusion strategies; and
- stakeholder engagement processes that prioritize balanced representation.

These identified risks and mitigations are outlined in Appendix 3: Project Risks Table.

2.3.7 Community Costs, Risks, and Benefits (CCB, G3.2)

A participatory, context-specific risk mapping process was used to identify potential costs, risks and benefits to the project. The three tools used to assess risks and inform engagement design are listed below.

- **Rapid Land Tenure Assessment (RaTA):** This tool was used to identify overlapping claims, customary rights and access as well as uncertainty across government, CPA and traditional tenure systems¹³⁸.

¹³⁸ Galudra G. 2010. RaTA: A Rapid Land Tenure Assessment manual for identifying the nature of land tenure conflicts. World Agroforestry Centre.

- **Participatory Rural Appraisal (PRA):** This tool was used to obtain local perspectives on land use, resource access, seasonal challenges and institutional affiliations¹³⁹.
- **Restoration Opportunities Assessment Methodology (ROAM):** This tool was used to frame restoration goals in language and categories relevant to community members¹⁴⁰.

The project proponent has used the outputs of these assessments to identify opportunity costs (such as changes in land use or labor inputs), potential risks (including tenure conflicts and resource competition) and expected benefits (such as livelihood improvements, carbon revenue and ecosystem services). These results will be communicated to communities during Phase Two of the Stakeholder Engagement and FPIC process (see Section 2.3.10). Information will be presented in plain language, translated into local languages and delivered through detailed presentations, the multilingual WhatsApp chatbot and in-person meetings. Communities will be given adequate time to review the information, discuss it internally and raise questions before being asked to make any decisions regarding participation in the project.

2.3.8 Information to Stakeholders on Validation and Verification Process (VCS, 3.18.6, 3.19; CCB, G3.3)

Stakeholders will be informed about the validation and verification process during planned Stakeholder Engagement and FPIC sessions. These sessions will explain the VCS and CCB procedures, from project registration to verification and cover the purpose of validation and verification, the role of the third-party VVB and the expected sequence of activities. Information will be shared before validation and again before each verification event so that stakeholders are aware of upcoming milestones. Timing, venues and communication methods will follow the approach described in Section 2.3.5 on informational meetings, using the same measures set out in Sections 2.3.3 and 2.3.4 on access to and dissemination of project documents. Communication will take place through in-person meetings, printed and translated handouts, the multilingual WhatsApp chatbot, community noticeboards and local radio. These measures will ensure that stakeholders receive information in plain language and local languages and in a timely manner.

To improve accessibility, a dedicated FAQ on validation and verification will be prepared for the WhatsApp chatbot, with responses available in local languages. Training sessions will include modules on these processes, enabling youth, women and community representatives to explain the concepts within their networks. Printed handouts will use plain language and infographics to illustrate the sequence of activities and radio announcements may be recorded and shared via the chatbot where appropriate. Attendance registers and feedback logs will be maintained for all sessions to demonstrate consistent and inclusive information sharing.

2.3.9 Site Visit Information and Opportunities to Communicate with Auditor (VCS, 3.18.6; CCB, G3.3)

The project proponent will notify stakeholders of auditor visits in advance using digital platforms, community meetings and locally appropriate communication channels, with similar methods as those detailed in Sections 2.3.3 and 2.3.4. Community liaisons will support outreach to households in remote areas or areas without internet access and notifications will be shared in local languages to ensure accessibility. To facilitate communication between stakeholders and auditors, the project proponent will engage with traditional authorities and local leaders to provide venues, logistical support and arrangements

¹³⁹ Chambers R. 1994. Participatory rural appraisal (PRA): Challenges, potentials and paradigm. *World Development*, 22, 10, 1437–1454.

¹⁴⁰ IUCN & WRI. 2014. A guide to the Restoration Opportunities Assessment Methodology (ROAM): Assessing Forest landscape restoration opportunities at the national or sub-national level. Working Paper. International Union for Conservation of Nature (IUCN), Gland, Switzerland. Available at: <https://portals.iucn.org/library/sites/library/files/documents/2014-030.pdf>.

so that discussions are held without project staff, unless requested. Furthermore, stakeholders will be encouraged to engage directly with auditors.

The project team will notify stakeholders of auditor visits in advance through a combination of digital platforms, community meetings and locally appropriate communication channels, with similar measures of announcement as those detailed in Sections 2.3.3 and 2.3.4. Community liaisons will support outreach to households in remote or digitally disconnected areas and notifications will be shared in local languages to ensure accessibility. To facilitate direct and independent communication between stakeholders and auditors, the project team will work with traditional authorities and local leaders to provide neutral venues, appropriate logistical support and arrangements that allow discussions to take place in the absence of project staff unless requested. Stakeholders will be encouraged to engage directly with auditors.

2.3.10 Stakeholder Consultations (VCS, 3.18; CCB, G3.4)

Stakeholder Engagement and FPIC consultations are structured in three phases. Phase One (April 2024–September 2025) aimed to: i) obtain written consent from traditional authorities to proceed with community engagement; ii) raise initial awareness of the project among communities and other stakeholders; and iii) establish conditions for informed consent. Phase Two (late 2025–early 2026) will focus on individuals and groups who choose to participate, with objectives of co-developing activity plans, formalizing participation through signed consent forms and land-use agreements and ensuring inclusive decision-making. Phase Three will maintain and reaffirm consent throughout implementation, monitoring and verification, supporting adaptive management and reinforcing consent as a continuous process.

<p>Date of stakeholder consultation</p>	<p>May–April 2025</p>
<p>Stakeholder engagement process</p>	<p>Consultations were held with six Traditional Authorities: i) Amashangana; ii) Jongilanga; iii) Hoxani; iv) Mathibela; v) Mnisi; and vi) Moletele. Each session followed customary protocols and began with a formal project presentation, including FPIC principles, phased implementation and the WhatsApp chatbot registration system. The meetings with each traditional authority have been summarized below.</p> <ul style="list-style-type: none"> • Amashangana (30 March 2025): Meeting with King Nxumalo and council. The project team outlined tree planting and carbon revenue opportunities, presented Airpot-grown seedlings and proposed a pilot nursery to demonstrate propagation methods. A ceremonial tree gift was given to the King as part of customary protocols. Questions focused on how benefits would be distributed and how communities would participate in nurseries. The council expressed interest in receiving further technical presentations. • Jongilanga (31 March & 23 April 2025): Engagements with the Chief, headmen and council. Discussions covered project area mapping, training and monitoring and planting methods suitable for homesteads and fields. Questions were raised on crop compatibility with trees, irrigation access and access to markets. The council requested regular updates, written information packets for households and clarity on how carbon revenues would be managed. • Hoxani (1 & 23 April 2025): Meetings with Bayethe and the Tribal Council. Questions were raised on species choice, including marula, wild plum, mangosteen and acacia and site selection for erosion control. Interest was shown in training through the Good Work Foundation’s Academies. Pilot farmers were identified to test planting models and the council requested follow-up training on soil and water management. • Mathibela (1 & 24 April 2025): Initial and follow-up meetings with the council. Feedback centered on lessons from previous environmental initiatives, species suitability for different soils and potential income streams from fruit and carbon revenues. The Authority provided written endorsement confirming participation and requested clarity on long-term ownership of planted trees.

	<ul style="list-style-type: none"> • Mnisi (25 April 2025): Meeting with headmen and the Tribal Council. The project team presented ecological and socio-economic benefits, explaining employment potential through nurseries and training. No objections were raised and the council expressed general support. Written endorsements were provided, with a request for continued engagement on employment opportunities. • Moletete (29 April 2025): Meeting with the Tribal Council and community representatives. Questions were raised on whether marula roots would damage homes, how to manage cattle browsing young trees in grazing zones, water scarcity and varied soil types across the area. Requests were made for vegetable seeds and short-cycle crops to provide immediate food and income benefits, alongside tree planting. The Council also asked for project support in improving access to markets for farm produce.
<p>Consultation outcome</p>	<p>All Traditional Authorities expressed support for the project and endorsed ongoing FPIC consultations at the community level, formalized with signed endorsement letters confirming their approval. Chiefs and councils agreed to facilitate community mobilization, requested additional technical details and expressed enthusiasm for nurseries, employment and training. Furthermore, the Amashangana King requested expedited pilot implementation projects within areas under his jurisdiction.</p>
<p>Stakeholder input</p>	<p>The traditional councils raised several questions regarding project activities, implementation and outcomes, outlined below.</p> <ul style="list-style-type: none"> • Species & land use: Chiefs and councils asked whether marula and other trees would interfere with crops, grazing areas or homesteads. The project team explained that planting models are flexible, participants will choose species and site selection will avoid conflict with existing land uses. Concerns about focusing exclusively on marula were addressed by confirming that a variety of fruit and native species will be available. • Water & maintenance: Several councils raised concerns about irrigation and access to water. The team responded that mulching, water harvesting and low-input techniques would be promoted and that households would receive training on water-efficient practices. • Equity & benefits: Leaders requested clarity on ownership of trees, fruits and carbon revenue. The project explained that households will own all fruit harvests from their plots, while carbon revenues will be managed by the project to fund training, capacity-building and benefit-sharing mechanisms, to be developed in Phase Two of the FPIC process. • Short-term benefits: Chiefs asked how households could benefit before trees mature. The project team responded that vegetable seeds and short-cycle crops would be considered in pilot phases to provide early food and income security. • Market access: Requests were made to strengthen immediate access to markets and support Bushbuckridge as a hub for trees that are currently being grown. The team explained that partnerships with agricultural organizations are being explored to support aggregation, processing and transport to expedite the process. • Training & employment: Councils emphasized the need for youth and community employment. The project confirmed that nursery participation, planting and maintenance roles would create jobs and that training opportunities would be linked to GWF and other partners. • Cultural aspects: Leaders requested that traditional knowledge be respected and native trees prioritized. The project team confirmed that native, drought-resistant and certain endangered species are the focus and ceremonial gifts of marula trees were presented to all traditional leaders to highlight this.
<p>Date of stakeholder consultation</p>	<p>29 April–19 August 2025</p>

<p>Stakeholder engagement process</p>	<p>Consultations with local stakeholders were held across Bushbuckridge, involving schools, farmers, nurseries, NGOs and local groups, summarized below.</p> <ul style="list-style-type: none"> • Ten Trees Project (29 April 2025): Consultation with permaculture practitioners who shared experiences of small-scale restoration and food security projects. Interest was expressed in carbon markets and scaling land rehabilitation. • Bushbuckridge Farmers Association (7 June 2025, 5 August 2025): Meetings with 170 registered members representing farmers in several traditional authorities. These consultations focused on market access, agro-processing and project partnership. The Association invited the project proponent to join as an affiliate member. • Bushbuckridge Climate Change Awareness Workshop, Lillydale (29 May 2025): Multi-stakeholder event with KNP and local organizations and community representatives. The event focused on climate awareness, tree planting education and river protection. • Bushbuckridge Farmers Meetup (7 June 2025): Included government departments such as the Mpumalanga DARDLEA, local farmers and NGOs such as the Timbavati Foundation, AWARD and Lindalo Inclusive SA. Discussions focused on project partnerships, funding and production quality. • Bushbuckridge Farmers Association monthly meeting (5 August 2025): Follow-up session with Association members, confirming interest in Save the Sand joining formally and providing an invitation for project presentations. • Bushbuckridge Biodiversity Celebration Day, Orhelani High School (15 August 2025): An event with over 200 participants including schools, government, traditional authorities, SANParks, Londoloz, nurseries and waste companies. Activities included climate awareness campaigns, tree planting and river conservation education. • Ten Trees Initiative strategic consultation (15 August 2025): Focused on a formal partnership where the project team discussed integrating the Ten Trees permaculture methods – on training, contracts, native species and women-led participation – into the project. That meeting documented outcomes such as resource-sharing, training-of-trainers programs and alignment with VM0047 standards. • Ntirho Nursery FPIC consultation (19 August 2025): Engagement with nursery members and farmers on participation in propagation. Water access challenges were raised by attendees and support for training was confirmed by the project. • Youth and women’s groups (April–August 2025): Organized through schools, nurseries and DARDLEA’s mobilization framework. Women’s groups were identified as primary participants in nursery development, while youths have the potential to be engaged in tree planting and awareness campaigns. • Faith-based organisations and NGOs (April–August 2025): Involved in mobilizing community attendance and disseminating project information, particularly through churches and local NGOs. • Good Work Foundation (ongoing consultations and partnership): The project team discussed training strategies through GWF Farming Academy, Tourism Academy and Tracker Academy.
<p>Consultation outcome</p>	<p>Strong community interest was recorded across all engagements. Schools, nurseries, youth groups, women’s groups and farmers expressed enthusiasm for tree planting, training and employment. The Farmers Association supported a formal partnership and invited the project proponent to join as a member. Ten Trees shared lessons from its permaculture-based approach and GWF committed to integrating agroforestry training into its Farming Academy. Endorsements and attendance registers confirmed wide community support.</p>

<p>Stakeholder input</p>	<p>Consultations with local stakeholders raised several questions and areas for collaboration, summarized below.</p> <ul style="list-style-type: none"> • Schools and youth: Teachers and learners asked how schools could sustain involvement beyond one-off planting days. The project team discussed the potential to establish Eco Clubs and school nurseries, integrating tree planting into curricula and after-school programs, with technical support provided. • Species selection: Community members requested guidance on which tree species were suitable for home gardens and fields. The project team explained that households would choose from a range of fruit and drought-resistant species to avoid monocultures and ensure compatibility with existing land use. • River protection: Traditional leaders and residents asked how the project would address illegal sand mining and riverbank degradation. The project team responded that targeted riverbank planting would be implemented and partnerships with Bushbuckridge Local Municipality and traditional authorities would integrate restoration with river protection. • Waste management: Local waste companies proposed linking recycling and composting with restoration. The project agreed to co-develop a waste-to-restoration protocol to turn organic waste into nursery inputs and improve community environmental management. • Farmers: Farmers sought clarity on market access, agro-processing and irrigation support. The project explained that partnerships with agricultural organizations would facilitate aggregation, processing and transport, while training would cover mulching, rainwater harvesting and low-input irrigation techniques. As project implementation progresses and trees begin to mature, market access will also form part of the benefit-sharing mechanisms, supported by a network of associated agricultural value chain partners. Participants further proposed positioning Bushbuckridge as a market center for agroforestry products, where aggregation and value addition could take place. • Nurseries: Nursery members raised water scarcity as a considerable barrier to implementation. The project confirmed that training on mulching, rainwater harvesting and low-input irrigation would be provided and that household-level water efficiency would be prioritized nursery operations. • Ten Trees: Participants asked how their food security model could connect with carbon markets. The project team explained that short-cycle crops and permaculture approaches would be integrated into the pilot phase so households could earn early benefits while waiting for fruit and nut trees to mature. It was also agreed that Ten Trees' permaculture training methods would be used to demonstrate water-wise practices and improve household-level water management. • Women's groups: Representatives highlighted the need for direct income opportunities. The project team confirmed that the Phase Two FPIC process would formalize women's participation in nurseries and agroforestry, supported by benefit-sharing agreements. • Livelihoods: Many participants emphasized the need for short-term returns. The project team agreed that methods to distribute vegetable seeds and promote short-cycle crops would be discussed. This would generate household food and income security within the first growing seasons.
<p>Date of stakeholder consultation</p>	<p>1 April–4 September 2025</p>

<p>Stakeholder engagement process</p>	<p>Government consultations and public events were convened with national, provincial and municipal institutions to ensure policy alignment and collaboration. These are summarized below.</p> <ul style="list-style-type: none"> • DFFE (1 April 2025): Consultations were held with the EDM representative. The DFFE outlined its 1 Million Trees program and explained the permit system in the National Forest Act, including the “5-for-1” replacement rule, where each protected tree removed requires planting 5. Discussions included funding sources, departmental nurseries in Mbombela and White River and opportunities to align Save the Sand with school greening projects. • Bushbuckridge Local Municipality Climate Change Awareness Workshop, Lillydale (29 May 2025): Municipal event with government departments, the South African Police Service (SAPS), Kruger National Park, Londolozi Ripple Fund, Swikoxeni Waste Management and health officials. The project team presented tree planting as a climate adaptation measure and restoration tool. Community participation centered on river protection, climate awareness and law enforcement linkages. The Municipality and community groups proposed that Bushbuckridge be developed as a central hub for agroforestry markets, supporting aggregation, processing and distribution of produce from surrounding communities. • SANParks strategic consultation (31 July 2025): Meeting with SANParks, attended also by GWP. Discussion focused on aligning tree planting with conservation targets, addressing irrigation and water scarcity and integrating hydrological baselines into monitoring. The consultation also linked the project with SANParks Vision 2040, which sets out the agency’s long-term restoration and conservation priorities, such as the Mega Living Landscapes Initiative. • Bushbuckridge Municipality Biodiversity Day, Orvhelani High School (15 August 2025): Large multi-stakeholder event with BLM, SANParks, Londolozi and schools. The project team showcased native species, linked its objectives to municipal biodiversity education and facilitated planting demonstrations. SANParks confirmed its commitment of 50,000 trees as part of the 10 Million Trees initiative, aligning them with Save the Sand. • DARDLEA Arbor Day (26 August 2025): Regional Arbor Day hosted with BLM. The project proponent presented FPIC outcomes, demonstrated Air-pot technology and emphasized nursery expansion. DARDLEA called for the mobilization of women, youth and farmers in restoration and committed to aligning the project with provincial strategies. • Provincial Arbor Day Celebration, Oakley Community Hall (4 September 2025): An event hosted by Member of the Executive Council (MEC) of the DARDLEA. Members of the project team were keynote presenters alongside SANParks and the Inkomati-Usuthu Catchment Management Agency (IUCMA). 200 marula trees were planted as a demonstration of the homestead-scale model. Participants included provincial and municipal leaders, SANParks ecologists, IUCMA officers and representatives from the Congress of Traditional Leaders of South Africa (CONTRALESA), providing validation of both government and traditional authority support. • DARDLEA Nurseries and Propagation planning (18 September 2025): Strategic session mapping existing and new nursery capacity in Bushbuckridge. Traditional authorities confirmed land and facilities for nurseries and a phased framework for cooperative management was discussed.
<p>Consultation outcome</p>	<ul style="list-style-type: none"> • DFFE confirmed alignment with the project and agreed to provide a formal endorsement letter. Interest was expressed in co-funding nurseries and integrating school greening. • BLM integrated the project into municipal environmental awareness programs and linked it to climate and biodiversity strategies. • SANParks validated its partnership by committing 50,000 trees and exploring integration into buffer zones and joint nursery initiatives. Additionally, the project team agreed that hydrological baseline monitoring would be assessed. • DARDLEA endorsed the project within its Arbor Day platforms, emphasizing social mobilization and policy integration. Additionally, an agreement was reached on establishing four new regional nurseries with co-financing for fencing, shade-netting and tools. Immediate procurement of stock was agreed to meet short-term demand. Furthermore, traditional authorities endorsed the use of community land for nurseries and integration into DARDLEA’s provincial nursery system was discussed. • Provincial leadership provided considerable support for the project, combining MEC endorsement, government acceptance of sponsored trees and CONTRALESA presence as traditional authority validation.

Stakeholder input	<p>Government stakeholders raised the following questions and proposals, which the project team addressed during the consultations, summarized below.</p> <ul style="list-style-type: none"> • DFFE: Requested alignment with permitting and national targets. Explained the “5-for-1” rule requiring replanting of protected trees. The project team agreed to share methodologies, adapt to licensing requirements and co-develop nurseries and Eco Clubs. • Bushbuckridge Local Municipality: Asked how restoration would reduce climate risks and reduce sand mining. The project team confirmed the focus on riverbank planting, law enforcement partnerships and school-based awareness. • SANParks: Highlighted the potential to link tree planting to buffer zone management and community projects. The project team confirmed SANParks’ 50,000-tree contribution and offered joint nursery coordination. • DARDLEA: Requested women, youth and farmers be included as primary beneficiaries. The project team confirmed this will be formalized in Phase Two FPIC through household agreements and training programs. • Provincial leadership (MEC Arbor Day): Questions were raised on how the project would scale benefits beyond pilot sites. The project team explained the homestead-scale model and highlighted that food security is supported through fruit, nut and intercrop harvests, while employment is generated through nursery work, planting, monitoring and reinvestment of a portion of carbon revenues into community benefit programs. • Waste management (via BLM events): Companies such as Swikoxeni Waste Management proposed linking recycling and composting to support restoration activities. The project team agreed to co-develop a waste-to-restoration protocol, turning organic waste into nursery inputs and implementing community clean-up initiatives.
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The table below provides a summary of comments received during the Stakeholder Engagement and FPIC sessions.

Summary of comment received	When comment was received	Actions taken
Questions about tree species compatibility with crops, grazing areas and homesteads.	Multiple engagement sessions in April 2025	Species selection was clarified during meetings, with an emphasis on drought-tolerant native trees and flexibility for participants to select preferred species from a pre-approved list of species.
Concerns about water requirements and access to irrigation.	Multiple engagement sessions in April 2025	The project design specifies the use of drought-tolerant species and includes training on water-use efficiency and water-harvesting practices.
Requests for short-term benefits such as vegetable seeds and seedlings. Additionally, communities requested market support for trees currently growing to create immediate project benefits.	Stakeholder engagements 22 April to 1 May 2025	Investigation into the potential and viability of such short-term benefits will be incorporated into Phase Two of the Stakeholder Engagement and FPIC process, where pilot planning will occur.
Clarification was requested on land ownership, especially around tree tenure and income from trees.	All community consultations	The project team explained the voluntary nature of participation, that tree ownership remains with participants, while carbon ownership remains with the project proponent. This distinction was

Summary of comment received	When comment was received	Actions taken
		explained to communities to ensure clarity on rights and responsibilities.
Questions on expected timelines for employment opportunities.	Multiple engagement sessions in April 2025	The project team explained the phased implementation process and outlined potential employment opportunities, including nursery work, training roles and planting activities. It was further clarified that these opportunities would be communicated promptly through the appropriate channels.
Requests for the presented project information.	All community consultations	All materials were distributed in English and local languages, with visual aids added to support comprehension. Presentations were shared with traditional councils following initial meetings. Additionally, project summaries were simplified based on community feedback.
Requests for greater municipal coordination on climate adaptation and biodiversity planning.	Bushbuckridge Local Municipality engagements, May–August 2025	The project team integrated its awareness raising activities into BLM's workshops and Biodiversity Day. Municipal officials are committed to aligning project activities with climate adaptation and environmental education strategies.
Suggestions to integrate marula trees with mango and other species to avoid monoculture.	Mathibela and Moletele, April 2025	The project will allow participants to select multiple species from a pre-approved list to avoid monoculture.
Requests to prioritize youth and women in training and employment opportunities.	Good Work Foundation stakeholder engagements April 2025	Training partners will be required to monitor gender and age representation. Targeted training and support for women will be prioritized through mechanisms facilitated by FEADT-SA, GWF and Ten Trees.
Questions on targeted training mechanisms for youth and women, linked to employment opportunities.	Good Work Foundation consultations, April 2025	The project team confirmed that training will be delivered through GWF's Academies. Councils requested enrolment information and GWF training mechanisms were introduced as part of Phase Two FPIC planning.
Questions on whether participants would be fully supported or responsible for tree care.	Hoxani, Jongilanga, Moletele, April 2025	The project team clarified that participants will be primarily responsible for tree care, while the project will provide training and ongoing support throughout the project lifecycle.

Summary of comment received	When comment was received	Actions taken
Concern about tree roots damaging home infrastructure.	Moletele, April 2025	The project team will provide participants with guidance on selecting species suited to household environments.
Interest in using Bushbuckridge as a market center for agroforestry products.	Bushbuckridge Municipality Workshop, May 2025	A plan is being developed to create an agroforestry value chain that incorporates private sector investment and uses existing Agri-hub facilities in the region.
Request for alignment on DFFE's permit and "5-for-1" replacement rules for protected trees.	DFFE consultation, 1 April 2025	The project team agreed to align with permitting requirements and share its nursery methodology.
Request for ongoing updates and community liaison feedback channels.	All traditional authority consultations	The community liaison system will be formalized. All communication platforms will be refined to enable feedback tracking and feedback loops will be incorporated into the communication plan.
Questions sand-mining and river protection measures.	Bushbuckridge Municipality Workshop, May 2025	The project team committed to promote targeted riverbank planting and coordinate with Bushbuckridge Local Municipality and traditional authorities to address illegal sand mining.
Waste companies proposed linking recycling and composting with restoration.	Climate Change Workshop and Biodiversity Day, May–August 2025	The project team agreed to co-develop a waste-to-restoration protocol to provide nursery inputs and support clean-up drives.
Questions on integrating project awareness into education and schools.	School-based engagements, May–August 2025	The project team agreed to facilitate Eco Clubs, support school nurseries and integrate tree planting into school curricula.
Questions on training opportunities.	Chiefs and community consultations, April–August 2025	Training will cover tree planting, nursery management, water-use efficiency and digital monitoring. Additional training opportunities through the Good Work Foundation were introduced.
Requests for replication of the Ten Trees training model, focusing on permaculture and women-led participation	Ten Trees Initiative consultation, 15 August 2025	The project team agreed to integrate lessons from Ten Trees, explore training-of-trainers and link these practices with VM0047 standards.

Summary of comment received	When comment was received	Actions taken
Questions about scaling the project benefits.	Provincial Arbor Day, 4 September 2025	The project team presented the homestead-scale model, explaining that scaling delivers food security and employment.
Proposals to integrate restoration with watershed protection and catchment management.	Interactions with GWP, 2025	The project team confirmed alignment with water resource protection strategies and agreed to explore co-implementation of water harvesting and riparian planting activities.
Requests for landscape-level alignment with conservation and biodiversity initiatives.	Interactions with K2C Biosphere, 2025	The project team agreed to coordinate species selection and restoration sites with K2C to strengthen ecological corridors and avoid duplication of conservation efforts.
Requests for transition from the Expanded Public Works Programme (EPWP) labor to cooperative ownership of nurseries.	DARDLEA Nurseries and Propagation consultation, 18 September 2025	DARDLEA proposed that EPWP participants transition into registered cooperatives to ensure local ownership and revenue. The project proponent agreed to formalize this model in nursery planning.
Requests for propagation of fruit and medicinal trees alongside native species.	DARDLEA Nurseries and Propagation consultation, 18 September 2025	The project proponent confirmed the inclusion of marula, mango and pepper bark trees in propagation, in addition to drought-tolerant native species.
Requests for transparency in pricing and procurement of seedlings.	DARDLEA Nurseries and Propagation consultation, 18 September 2025	The project proponent committed to establish a bulk purchasing framework to strengthen cooperative bargaining power and ensure fair distribution of seedlings.

2.3.11 Continued Consultation and Adaptive Management (VCS, 3.18; CCB, G3.4)

Ongoing communication will be maintained by community organizations and NGOs through in-person and digital channels to ensure accessibility, cultural appropriateness and responsiveness. These include:

- Community Liaison Officers (CLOs) based within the project area;
- the continued involvement of headmen and traditional leaders;
- regular in-person forums with stakeholders; and
- mobile messaging tools such as the WhatsApp chatbot.

These mechanisms will ensure that project updates, changes and decisions are communicated clearly, while community members have regular opportunities to ask questions, raise concerns or offer suggestions. Printed materials and noticeboards in local languages will complement digital communication methods, ensuring access for those without mobile connectivity. Feedback gathered through these channels will support adaptive management, with input reviewed regularly through feedback logs, liaison

reports and summaries from community meetings. Any concerns raised at the community level will be addressed within 30 days using defined escalation protocols.

Changes to project design or implementation will be communicated in advance through the established channels or through additional channels suggested by stakeholders, where changes are expected to affect them. Quarterly summaries of stakeholder engagement will be compiled and stored in the project database. Findings from consultations will also be incorporated into revisions of the Project Implementation Reports, which track project progress, challenges and adaptive management responses. This approach will keep the project responsive to local priorities and ensure that implementation remains effective, equitable and locally relevant.

2.3.12 Stakeholder Consultation Channels (CCB, G3.5)

All stakeholder consultations were conducted either directly with communities or through recognized representatives. Initial engagements with traditional authorities were arranged by CLOs in line with local customs. Chiefs were consulted first, after which they facilitated introductions to headmen, enabling community-level meetings consistent with traditional governance structures.

Consultations with NGOs such as the GWF and Village-Up¹⁴¹ were also arranged by CLOs. All engagements respected customary protocols and took place in culturally appropriate settings. Participants received information through presentations by the project team. Evidence of these consultations is provided in FPIC meeting registers and the FPIC Phase One presentation. The project has also introduced a grievance redress process, further described in Section 2.3.15.

Ongoing communication will be maintained by community organizations and NGOs, using the following methods: i) community meetings; ii) the WhatsApp chatbot; iii) printed flyers distributed at community spaces and schools; iv) email correspondence; and v) scheduled radio broadcasts. These channels reflect stakeholder preferences identified during initial consultations and accommodate varying levels of literacy and digital access, supporting inclusive consultation throughout the project lifecycle. Stakeholder Engagement and FPIC Phase Two consultations will provide further opportunities for follow-up discussions, clarification and review of benefit-sharing mechanisms and implementation arrangements.

2.3.13 Stakeholder Participation in Decision-Making and Implementation (VCS, 3.18, 3.19; CCB, G3.6)

The project has been designed to enable participation of all community stakeholders in decision-making and implementation. Consultations are designed to include women, youth and the elderly, with separate sessions held where appropriate to respect cultural practices and encourage open dialogue. Furthermore, project liaison officers have been appointed to facilitate engagement across all community groups, which will be supported by women's groups and youth forums. These structures will be used to gain feedback and track concerns, project commitments and implementation outcomes.

2.3.14 Anti-Discrimination Assurance (VCS 3.19; CCB, G3.7)

All implementing partners involved will operate in accordance with formal Human Resource policies that prohibit discrimination and harassment in any form¹⁴². These policies apply to all permanent staff, contractors, liaison officers and seasonal workers. Upon appointment, each staff member will be inducted

¹⁴¹ Village-Up Impact empowers rural South African communities by linking education, skills development and employment to foster sustainable economic growth and improve family livelihoods. Working with the Good Work Foundation to connect program graduates to business partnerships that create jobs, strengthen rural economies and preserve community resilience.

¹⁴² Republic of South Africa. 2022. Employment Equity Act, 1998 (Act 555 Of 1998 As Amended). Pretoria: Government Gazette

into the organization’s code of conduct and anti-discrimination policy^{143, 144, 145, 146, 147}. Individuals will be encouraged to report concerns using the project grievance redress protocols. All allegations of discrimination or harassment will be investigated and addressed following a formal disciplinary code, with consequences that may include dismissal and, where applicable, legal action.

2.3.15 Feedback and Grievance Redress Procedure (VCS, 3.18.4; CCB, G3.8)

Development process	<p>The grievance resolution mechanism was developed by Sand Catchment Pty Ltd. and C4 EcoSolutions (Pty) Ltd. with input from community liaisons familiar with traditional authorities, conflict resolution practices, gender dynamics, vulnerable groups, literacy levels and languages in the project area. A translated version will be shared during stakeholder and community consultation meetings during the Phase Two FPIC process, on the WhatsApp chatbot and on the project website. Stakeholders will have the opportunity to provide feedback and suggest improvements. The mechanism will be revised accordingly to ensure it is contextually appropriate, accessible and responsive to community input.</p>
Grievance redress procedure	<p>The grievance resolution mechanism enables any project participants, employees, stakeholders or members of the public to raise concerns, challenges or grievances related to the workplace, project activities or their engagement with the project team. Grievances will be addressed immediately upon receipt, following established procedures based on the nature and severity of the issue. In addition to case-by-case resolution, all grievances will be reviewed quarterly to identify recurring issues, assess management responses and adapt project practices or safeguards as needed.</p> <p>The following core principles underpin this grievance redress policy:</p> <ul style="list-style-type: none"> • Non-Retaliation: Individuals and communities have the right to raise grievances freely and safely. No person shall face intimidation, discrimination or retaliation for voicing concerns or complaints related to the project. • Local Resolution: Grievances should be resolved as close as possible to the source of the issue. Community-level mechanisms and traditional structures should be prioritized for early resolution wherever appropriate and legitimate. • Timeliness, Fairness and Transparency: All grievances will be addressed in a timely manner, with a clear and impartial process. Responses should be fair, consistent and documented, with outcomes communicated transparently to all parties involved. <p>Grievance records will be documented and retained in accordance with the Protection of Personal Information Act (POPIA)¹⁴⁸ for a minimum of five years. Confidentiality will be upheld throughout the process and the identity of complainants will be protected unless disclosure is legally required or the complainant consents.</p>

¹⁴³ Republic of South Africa. 1995. Labour Relations Act No. 66 of 1995. Pretoria: Government Gazette. Available at: https://www.gov.za/sites/default/files/gcis_document/201409/act66-1995labourrelations.pdf

¹⁴⁴ Republic of South Africa. 1997. Basic Conditions of Employment Act No. 75 of 1997. Pretoria: Government Gazette. Available at: <https://www.gov.za/documents/basic-conditions-employment-act>

¹⁴⁵ International Labour Organization. 1951. C100 – Equal Remuneration Convention (No. 100). Geneva: ILO. Available at: https://normlex.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C100

¹⁴⁶ Republic of South Africa. 1998. Employment Equity Act No. 55 of 1998. Pretoria: Government Gazette. Available at: <https://www.gov.za/documents/employment-equity-act>

¹⁴⁷ International Labour Organization. 1958. C111 – Discrimination (Employment and Occupation) Convention (No. 111). Geneva: ILO. Available at: https://normlex.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C111

¹⁴⁸ Republic of South Africa. 2013. Protection of Personal Information Act 4 of 2013 (POPIA). Pretoria: Government Gazette.

Anonymous submissions will be acknowledged and addressed to the extent possible. In such cases, responses and follow-up actions will be communicated through public channels – such as local noticeboards, community meetings or WhatsApp groups – while maintaining confidentiality and avoiding identification of the complainant.

Affected parties who raise concerns through this grievance mechanism will not be subject to any form of victimization, discrimination or harassment. If any individual believes they are being retaliated against for submitting a grievance, they are encouraged to report the matter to a senior project manager or designated representative. All such claims will be thoroughly investigated and individuals found to have engaged in misconduct may be subject to disciplinary action, including dismissal and legal proceedings, as appropriate.

This grievance policy is intended to address concerns and complaints related to the implementation of the project activities, including social, environmental or procedural issues arising from project activities. It is not intended as an appeal mechanism for formal disciplinary actions under the project's internal disciplinary code.

Parties affected by a grievance or that require assistance may contact the human resources manager or a designated project grievance focal point at any stage of the process for support, clarification, or facilitation.

Step 1 – Informal Process: Raise the grievance with a company representative or manager

Grievances may be raised through any of the following accessible channels:

- verbally, in person, to a project representative or manager;
- through the WhatsApp chatbot;
- on the project website;
- through community hubs such as the GWF;
- at traditional authority offices; and
- through designated CLOs.

Upon receipt, the project team will document and process the grievance and provide a timely response, outlined below.

- Giving affected parties an opportunity to express their concerns.
- Distinguish fact from opinion.
- Providing an explanation or response within five working days.

All grievances – whether resolved or ongoing – will be recorded in the project's internal grievance register for review and monitoring.

Step 2 – Formal Grievance Process

If an affected party is not satisfied with the outcome or explanation provided through the informal grievance process, they may initiate the formal grievance procedure. A grievance form will be made available through the project's feedback channels, including the WhatsApp chatbot or may be completed with the assistance of a project representative, community liaison officer or a non-participating third party. Where possible, relevant contact information will be collected to enable follow-up; however, the privacy of all parties will be respected and any personal data will be stored securely and handled in full compliance with the POPIA.

Depending on the nature and complexity of the grievance, a formal meeting may be convened to allow all relevant parties to present their version of events. This meeting may range from an informal discussion to a structured inquiry. Affected parties have the right to be accompanied by a representative of their choice and

	<p>may request an interpreter if needed. The presence of a neutral third-party mediator may also be requested to ensure impartiality, especially in cases of sensitivity or disagreement. All parties involved will receive written notice of the grievance meeting within five working days of the formal process being initiated.</p> <p>Following the meeting, a written resolution will be issued within ten working days, unless additional time is required for further investigation. Each formal grievance will be documented in a secure grievance register, assigned a unique reference ID for tracking and accessible only to individuals directly responsible for managing the resolution. All records will be handled confidentially and in accordance with applicable data protection regulations.</p> <p>Step 3 – Formal Grievance Resolution</p> <p>Upon completion of the formal grievance review, a designated project representative will issue a written resolution letter and communicate the outcome to all relevant parties within five working days. If project management decides that there has been a fault, non-compliance or a lapse in procedure, the resolution letter will clearly outline the corrective actions to be taken. This includes specifying the responsibilities of the project team and setting realistic timelines to ensure that proper remedial measures are implemented. In cases where the grievance is not upheld, the response will provide a clear and reasoned explanation of the decision, referencing the findings of the investigation and applicable policies or standards.</p> <p>Affected parties will be requested to sign a resolution form to acknowledge receipt of the outcome. If an individual declines to sign, a neutral third party – who has not been involved in the grievance resolution – will act as a witness and sign to confirm that the outcome was delivered to the affected party. All grievance documentation, including the resolution letter and acknowledgement of receipt, will be securely stored in compliance with data protection laws and project confidentiality protocols.</p> <p>This step is the final stage of the internal grievance resolution mechanism. If an affected party remains dissatisfied with the outcome, they will be informed of their right to seek redress through external avenues, including any remedies available under South African law.</p>
<p>Grievance redress procedure</p>	<p>The grievance resolution mechanism enables any project participants, employees, stakeholders or members of the public to raise concerns, challenges or grievances related to the workplace, project activities or their engagement with the project team. Grievances will be addressed immediately upon receipt, following established procedures based on the nature and severity of the issue. In addition to case-by-case resolution, all grievances will be reviewed quarterly to identify recurring issues, assess management responses and adapt project practices or safeguards as needed.</p> <p>The following core principles underpin this grievance redress policy:</p> <ul style="list-style-type: none"> • Non-Retaliation: Individuals and communities have the right to raise grievances freely and safely. No person shall face intimidation, discrimination or retaliation for voicing concerns or complaints related to the project. • Local Resolution: Grievances should be resolved as close as possible to the source of the issue. Community-level mechanisms and traditional structures should be prioritized for early resolution wherever appropriate and legitimate. • Timeliness, Fairness and Transparency: All grievances will be addressed in a timely manner, with a clear and impartial process. Responses should be

fair, consistent and documented, with outcomes communicated transparently to all parties involved.

Grievance records will be documented and retained in accordance with the POPIA¹⁴⁹ for a minimum of five years. Confidentiality will be upheld throughout the process and the identity of complainants will be protected unless disclosure is legally required or the complainant consents.

Anonymous submissions will be acknowledged and addressed to the extent possible. In such cases, responses and follow-up actions will be communicated through public channels – such as local noticeboards, community meetings or WhatsApp groups – while maintaining confidentiality and avoiding identification of the complainant.

Affected parties who raise concerns through this grievance mechanism will not be subject to any form of victimization, discrimination or harassment. If any individual believes they are being retaliated against for submitting a grievance, they are encouraged to report the matter to a senior project manager or designated representative. All such claims will be thoroughly investigated and individuals found to have engaged in misconduct may be subject to disciplinary action, including dismissal and legal proceedings, as appropriate.

This grievance policy is intended to address concerns and complaints related to the implementation of the project activities, including social, environmental or procedural issues arising from project activities. It is not intended as an appeal mechanism for formal disciplinary actions under the project's internal disciplinary code.

Parties affected by grievance or that require assistance may contact the human resources manager or a designated project grievance focal point at any stage of the process for support, clarification, or facilitation.

Step 1 – Informal Process: Raise the grievance with a company representative or manager

Grievances may be raised through any of the following accessible channels:

- verbally, in person, to a project representative or manager;
- through the WhatsApp chatbot;
- on the project website;
- through community hubs such as the Good Work Foundation);
- at traditional authority offices; and
- through designated CLOs

Upon receipt, the project team will document and process the grievance and provide a timely response, outlined below.

- Giving affected parties an opportunity to express their concerns.
- Distinguish fact from opinion.
- Providing an explanation or response within five working days.

All grievances – whether resolved or ongoing – will be recorded in the Project's internal grievance register for review and monitoring.

Step 2 – Formal Grievance Process

¹⁴⁹ Republic of South Africa. 2013. Protection of Personal Information Act 4 of 2013 (POPIA). Pretoria: Government Gazette.

If an affected party is not satisfied with the outcome or explanation provided through the informal grievance process, they may initiate the formal grievance procedure. A grievance form will be made available through the project's feedback channels, including the WhatsApp chatbot or may be completed with the assistance of a project representative, community liaison officer or a non-participating third party. Where possible, relevant contact information will be collected to enable follow-up; however, the privacy of all parties will be respected and any personal data will be stored securely and handled in full compliance with the POPIA.

Depending on the nature and complexity of the grievance, a formal meeting may be convened to allow all relevant parties to present their version of events. This meeting may range from an informal discussion to a structured inquiry. Affected parties have the right to be accompanied by a representative of their choice and may request an interpreter if needed. The presence of a neutral third-party mediator may also be requested to ensure impartiality, especially in cases of sensitivity or disagreement. All parties involved will receive written notice of the grievance meeting within five working days of the formal process being initiated.

Following the meeting, a written resolution will be issued within ten working days, unless additional time is required for further investigation. Each formal grievance will be documented in a secure grievance register, assigned a unique reference ID for tracking and accessible only to individuals directly responsible for managing the resolution. All records will be handled confidentially and in accordance with applicable data protection regulations.

Step 3 – Formal Grievance Resolution

Upon completion of the formal grievance review, a designated project representative will issue a written resolution letter and communicate the outcome to all relevant parties within five working days. If project management decides that there has been a fault, non-compliance or a lapse in procedure, the resolution letter will clearly outline the corrective actions to be taken. This includes specifying the responsibilities of the project team and setting realistic timelines to ensure that proper remedial measures are implemented. In cases where the grievance is not upheld, the response will provide a clear and reasoned explanation of the decision, referencing the findings of the investigation and applicable policies or standards.

Affected parties will be requested to sign a resolution form to acknowledge receipt of the outcome. If an individual declines to sign, a neutral third party – who has not been involved in the grievance resolution – will act as a witness and sign to confirm that the outcome was delivered to the affected party. All grievance documentation, including the resolution letter and acknowledgement of receipt, will be securely stored in compliance with data protection laws and project confidentiality protocols.

This step is the final stage of the internal grievance resolution mechanism. If an affected party remains dissatisfied with the outcome, they will be informed of their right to seek redress through external avenues, including any remedies available under South African law.

2.3.16 Accessibility of the Feedback and Grievance Redress Procedure (VCS, 3.19; CCB, G3.8)

Feedback and grievance redress procedures will be made accessible, transparent and culturally appropriate, in line with VCS and CCB requirements. The procedure is designed to be inclusive of all stakeholder groups, including women, youth, the elderly and persons with disabilities, and to accommodate different levels of literacy and technological access.

Information about the grievance mechanism is publicized regularly through multiple channels tailored to local context and stakeholder needs. These include:

- in-person community meetings and sensitization sessions with chiefs and headmen, facilitated by trained CLOs;
- interactive messages and updates distributed using the WhatsApp chatbot, which is available in relevant local languages;
- the project website, which hosts downloadable grievance forms and outlines the procedure clearly; and
- *all materials related to the grievance process are made available in local languages and are communicated both verbally and in writing to ensure accessibility regardless of literacy levels.*

Grievance submissions may be made anonymously or with assistance from a representative, including through trusted intermediaries such as community liaisons, local elders or non-participating third parties. The grievance mechanism ensures that no individual is excluded due to digital limitations or social barriers, such as language differences, literacy constraints or social hierarchies. All grievances are documented and stored securely in compliance with the POPIA. Formal grievance records are retained in digital format, assigned a unique reference number and tracked through all stages of the resolution process using a confidential and access-controlled grievance register. Personal information is stored only as necessary for resolution and is not disclosed without informed consent. Summaries of grievances and project responses are made publicly available to support transparency and accountability. These are shared via *inter alia*: i) periodic updates on the website; ii) stakeholder monitoring reports submitted to key partners and funders; iii) project newsletters distributed in print and digital form; and iv) regular updates provided at community and stakeholder meetings. All public summaries are anonymized or redacted to protect the identity and privacy of individuals. Sensitive information is excluded unless explicit permission is obtained from the affected party.

To promote continual learning and adaptive management, grievances are reviewed by the project team. Trends and patterns are analyzed to identify root causes, improve engagement strategies and strengthen accountability mechanisms over time. Outcomes of these reviews may inform updates to the grievance procedure and broader stakeholder engagement plans.

2.3.17 Worker Training (VCS, 3.19; CCB, G3.9)

Worker training will consist of capacity-building programs designed to equip individuals employed through project activities – as well as other community participants – with practical, locally applicable skills. The objective of these programs is to build knowledge that directly contributes to the implementation of project activities and supports broader community benefits such as sustainable land management, increased employability and long-term environmental stewardship.

Training objectives and approach

Training efforts are aligned with the project's agroforestry, conservation and carbon sequestration objectives. Programs for training are implemented in collaboration with established partners including the GWF, FEADT-SA and other community-based organizations such as the Ten Trees Project. The four main objectives of the training program are to:

- equip workers with the technical and practical skills needed to implement tree planting interventions such as agroforestry systems, that improve soil fertility, microclimates, biodiversity and long-term carbon storage;
- provide ongoing mentorship and support to strengthen skill retention, ensuring effective application of the agroforestry practices;
- promote environmental awareness and stewardship so that participants understand the links between project activities, biodiversity protection and climate benefits; and
- build institutional and individual capacity to sustain agroforestry practices, conservation outcomes and carbon sequestration benefits beyond the life of the project.

Training Components

Training is delivered through a mix of classroom sessions, on-site demonstrations and peer mentorship, covering the following core areas:

- **Tree planting and care:** species selection, site preparation, planting techniques, seedling protection and irrigation;
- **Nursery management:** propagation techniques, seedling care, composting and pest control;
- **Soil and water conservation:** erosion control, mulching and basic water-smart agriculture;
- **Environmental and occupational health and safety (EOH&S):** use of protective equipment, safe tool handling and accident response; and
- **Monitoring and reporting:** data collection methods for tree survival rates and growth performance.

Additionally, community members are encouraged to attend foundational awareness sessions on climate change adaptation, biodiversity conservation and regenerative agriculture, which form part of the project's broader education and engagement strategy.

Delivery Partnerships

The training program — outlined below — will be delivered in collaboration with local partners to strengthen relevance, continuity and long-term impact.

- Digital literacy and foundational education to support broader skills development.
- Agricultural extension training, with a focus on engaging women and youth in sustainable production practices.
- Specialist partners will lead sessions on community conservation, ecological restoration, permaculture and livelihood planning.

Retention and Continuity Measures

To ensure that local capacity is not lost through staff turnover, the project has adopted several measures to promote knowledge transfer and continuity, as outlined below.

- A stepwise training model in which experienced workers mentor and train new recruits.
- Certification of training attendance and skill acquisition, enabling participants to access future employment opportunities.
- The appointment and support of local training champions within each participating community.
- Documentation and archiving of training curricula and materials for reuse and adaptation at project sites.
- Training efforts are supported by a continuous feedback mechanism that tracks participant progress, evaluates the effectiveness of training content and methods, and informs future program design based on evolving community needs and learning outcomes.

2.3.18 Community Employment Opportunities (VCS, 3.19.13; CCB, G3.10)

All community members — regardless of gender, age, ethnicity or socio-economic status — will have fair and equal access to employment opportunities across the full range of project activities. This includes roles in tree planting, nursery development, maintenance, data collection, training facilitation and, where feasible, supervisory and technical positions.

Equal Access to Employment

Employment opportunities will be publicly advertised and openly accessible to all residents in the project area who meet the minimum role requirements, in line with the Employment Equity Act (No. 55 of 1998)¹⁵⁰. Vacancies will be disseminated through the following channels:

- digital structures such as the project website, the WhatsApp chatbot and online job sites;
- local meetings;

¹⁵⁰ The Republic of South Africa. 1998. Employment Equity Act 55 of 1998. Pretoria: Government Gazette.

- traditional authority structures;
- municipal noticeboards;
- churches;
- schools; and
- community training hubs.

Copies of all job postings and distribution records will be retained by the project team as evidence of open recruitment. All job descriptions will be written in plain language and translated into local languages to ensure interested parties understand the requirements. Selection committees will include both project staff and trusted community liaisons to ensure fairness, inclusivity and local accountability. To ensure accessibility for all, including those without formal qualifications, the project will offer targeted pre-employment orientation or training to eligible community members to build the competencies needed for selection.

Gender Equity and Inclusion

Gender equity will be prioritized to prevent barriers that may limit women's participation. Women – including young women, women-headed households and women in remote areas – will be supported through a range of measures, such as:

- setting targets for women's representation across employment categories, with tracking progress through disaggregated data;
- facilitating women-only information sessions to create safe spaces for expressing interest, raising concerns and identifying constraints to participation;
- offering flexible working arrangements during specific project phases such as nursery operations and maintenance, to accommodate caregiving and household responsibilities; and
- ensuring pay equity, with women receiving the same compensation and benefits as men for equivalent work.

Project partners such as DARDLEA, SANParks, Kruger To Canyons, GWF, Ten Trees and FEADT-SA will form part of the inclusive recruitment and skills development programs, particularly for women, youth, low-income or previously unemployed individuals.

Pay and Working Conditions

All project workers will be paid fair, equitable and transparent wages. Compensation will meet national minimum wage requirements and be benchmarked against local market rates for comparable labor. A policy of equal pay for equal work will apply across all employment categories. Workers will be informed in advance of their roles, responsibilities, rights and conditions of employment. Seasonal or short-term roles, such as those during planting or harvesting cycles, will be allocated through a rotation system to maximize employment opportunities and prevent repeat selection, except where specific skills are required. An employment register will be maintained by implementing partners to track participation by gender, age and other relevant demographics. This will support monitoring of employment equity, help identify barriers to participation and guide adjustments to hiring and training strategies over time.

2.3.19 Occupational Safety Assessment (VCS, 3.19; CCB, G3.12)

A safe and healthy working environment will be prioritized for all individuals engaged in project activities. Recognizing that labor-intensive activity can present occupational hazards, a context-specific Occupational Health and Safety (OHS) framework will be developed and applied, based on national labor laws and relevant International Labor Organization (ILO) conventions, particularly ILO Convention 155 on occupational safety and health.

Identified occupational risks

Project activities primarily involve manual labor, including tree planting, nursery maintenance and land preparation. The following occupational risks have been identified and outlined below.

- Musculoskeletal injuries from repetitive digging, bending and lifting.
- Cuts, punctures and blisters from improper tool use or worn equipment.
- Encounters with wildlife, particularly snakes and insects.
- Heat exhaustion or dehydration, especially during the planting season.
- Limited access to immediate medical care in remote sites.

These risks may vary across sites depending on remoteness, vegetation density, weather conditions and proximity to wildlife habitats.

Risk mitigation measures

To minimize occupational risks, the project will implement the safety measures outlined below.

- **Tool safety and ergonomic training:** All workers will be trained in proper digging techniques, safe lifting practices and correct use of tools. Training will emphasize safe movement and body positioning techniques to reduce the risk of strain injuries.
- **Tool inspection and maintenance:** Tools will be checked regularly for damage and repaired or replaced as needed. Sharp tools will be covered when not in use and carried safely.
- **Protective equipment:** All field workers will receive personal protective equipment (PPE), including gloves, sturdy boots and long trousers to reduce exposure to injuries and wildlife.
- **Wildlife safety training:** Workers will be trained to recognize signs of wildlife presence – such as burrows or nests – avoid direct contact and report sightings. Site inspections will be conducted prior to activities to assess safety and identify potential hazards.
- **Heat and hydration protocols:** Work schedules will be adjusted to avoid peak midday heat and water stations will be provided at each work site to prevent dehydration.
- **First aid and emergency response:** First aid kits will be maintained at all work sites. Designated personnel will be trained in basic first aid, including snake bite response and allergic reaction management. Emergency contact numbers and referral procedures to nearby health facilities will be posted.

Occupational health and safety plan

An OHS Plan will be created before the project starts to ensure a safe working environment for everyone involved. It will follow South African labor laws and international standards, including ILO Convention 155. The plan will cover all safety procedures, addressing risks from activities such as tree planting and fieldwork. Identified risks will be managed with appropriate measures such as protective equipment and site inspections. In case of accidents, the plan will detail emergency protocols, including first aid kit locations, evacuation steps and the roles of responders. It will also outline procedures for reporting and investigating incidents to ensure corrective actions are taken. The plan will define the responsibilities of workers, supervisors and partners regarding safety. Workers must follow safety protocols, attend training and report unsafe conditions. Supervisors will receive additional training in enforcing safety standards and managing emergencies. Communication about the plan will be clear and available in local languages, with materials such as posters and briefings to reinforce important messages. The OHS Plan will also include contact details for medical facilities and emergency services for each project site, ensuring these are easily accessible to workers.

Workers' rights and accountability

All workers will be informed of their health and safety rights and responsibilities during induction and at regular intervals thereafter. Safety briefings will be held before major work phases, such as planting seasons, with refresher sessions scheduled periodically. A confidential mechanism will allow workers to report concerns, near misses or incidents without fear of reprisal. Reports will be logged, investigated and used to update risk management procedures. The project team will monitor compliance with OHS protocols and review overall performance. Incidents will be analyzed to refine training and improve procedures.

2.4 Management Capacity

2.4.1 Project Governance Structures (CCB, G4.1)

The project is governed by Sand Catchment Pty Ltd., with technical responsibilities assigned to partners focusing on implementation, conservation, aligning with local government institutions and the daily management of planting sites.

The governance framework (Figure 16) is outlined below.

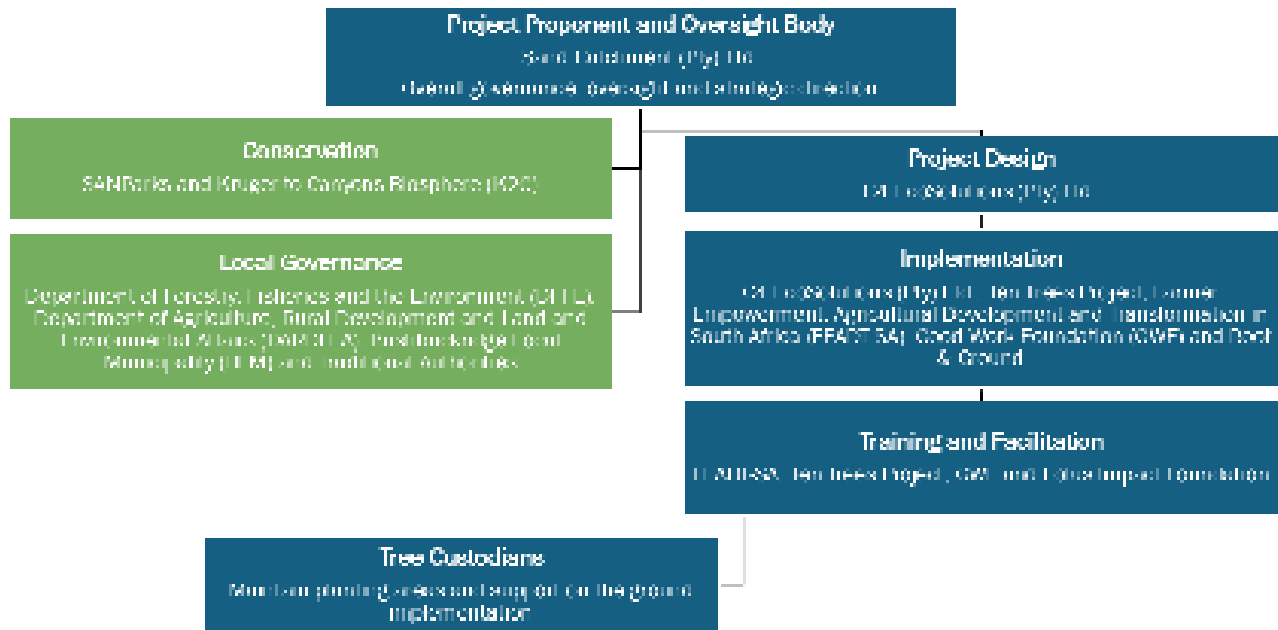


Figure 16. Governance structure for the project.

- **Coordination** – led by Sand Catchment Pty Ltd., responsible for overall governance, oversight and strategic direction.
- **Implementation branch** – led by C4 EcoSolutions (Pty) Ltd (C4), with support from: i) the Ten Trees Project; ii) FEADT-SA; iii) GWF; and iv) Root & Ground (Pty) Ltd. These entities will be responsible for technical delivery, project implementation and ongoing monitoring.
- **Training and facilitation** – a subset of the Implementation Branch led by FEADT-SA, the Ten Trees Project, the GWF and the Lotus Impact Foundation, focusing on tree custodian and community liaison training, capacity building and participatory facilitation.
- **Conservation** – involving SANParks and the K2C Biosphere Reserve, which supports alignment with landscape-level conservation and biodiversity objectives.
- **Local Governance** – including the DFFE, the DARDLEA, the BLM and the local traditional authorities, which together provide institutional integration, nursery support, policy alignment and recognition of customary governance structures.
- **Tree Custodians** – local cooperative governance structures responsible for maintaining planting areas and supporting on-the-ground implementation.

The roles and responsibilities of each entity will be refined during project implementation to address the project requirements for, *inter alia*, implementation, training and monitoring. Full details of these roles and responsibilities will be provided to the VVB on request.

2.4.2 Required Technical Skills (VCS, 3.19; CCB, G4.2)

The project activities require a variety of technical skills to ensure effective implementation, monitoring and long-term sustainability. Required areas of expertise include:

- general project management;
- financial and administrative management;
- nursery and agroforestry operations;
- climate monitoring;
- biodiversity management and monitoring;
- participatory community engagement;
- carbon accounting; and
- labor management.

Collectively, the Project Proponent, C4 EcoSolutions (Pty) Ltd. and partners will provide expertise within these thematic areas, summarized in the table below, ensuring the project team will meet both technical and social requirements in accordance with the VCS and CCB Standards.

Strategic area	Management team responsible	Technical skills required
General project management	Sand Catchment Pty Ltd. C4 EcoSolutions (Pty) Ltd.	<ul style="list-style-type: none"> • Strategic and adaptive project planning • Risk assessment and mitigation • Stakeholder coordination and reporting • Performance monitoring and evaluation
Financial and administrative management	Sand Catchment Pty Ltd.	<ul style="list-style-type: none"> • Budget planning • Carbon revenue management • Financial auditing and compliance with national and international requirements • Procurement and contract management
Nursery operations	Root and Ground (Pty) Ltd. DARDLEA SANParks	<ul style="list-style-type: none"> • Seed collection, handling and propagation techniques for native species • Nursery management, including disease and pest control, watering regimes and transplanting • Seedling growth monitoring, quality control and preparation for transplanting
Agroforestry operations	C4 EcoSolutions (Pty) Ltd. FEADT-SA The Ten Trees Project	<ul style="list-style-type: none"> • Design and management of agroforestry systems integrating trees within current land uses • Knowledge of species compatibility, planting densities and soil and water management • Pruning, coppicing and harvesting practices to maintain productivity and resilience
Climate monitoring	C4 EcoSolutions (Pty) Ltd.	<ul style="list-style-type: none"> • Remote sensing • Statistical analysis • Soil science • Erosion and sediment assessments • Agronomy
Biodiversity management and monitoring	C4 EcoSolutions (Pty) Ltd.	<ul style="list-style-type: none"> • Flora identification and taxonomy • Field-based biodiversity surveys • Remote sensing

		<ul style="list-style-type: none"> • Landscape ecology and spatial analysis • Statistical analysis
Participatory community engagement	C4 EcoSolutions (Pty) Ltd. The Ten Trees Project FEADT-SA GWF Lotus Impact Foundation	<ul style="list-style-type: none"> • Consultation and workshop facilitation • Awareness of social context • Capacity building expertise • Community-based monitoring
Carbon accounting	C4 EcoSolutions (Pty) Ltd.	<ul style="list-style-type: none"> • Application of carbon methodologies • Forest mensuration and sampling • MRV system development and implementation • Data management and analysis for verification • Knowledge of VCS and CCB Standards for compliance
Project labor management	C4 EcoSolutions (Pty) Ltd.	<ul style="list-style-type: none"> • Recruitment, training and supervision • Compliance with labor laws • Occupational health and safety standards • Conflict resolution and grievance redress mechanisms

2.4.3 Management Team Experience (VCS, 3.19; CCB, G4.2)

Sand Catchment Pty Ltd.

Sand Catchment Pty Ltd. was established to be the Project Proponent. Its staff have over 30 years of conservation experience in the KNP and surrounding protected areas, with expertise in: i) ecological management, biodiversity monitoring and restoration; ii) assessments of ecosystem recovery; iii) engagement with local communities to support consultation, communication and training; and iv) financial management, general management and logistics. Individual staff *curricula vitae* (CVs) will be made available to the VVB on request.

C4 EcoSolutions (Pty) Ltd. (C4)

Since 2006, C4 has worked on over 400 climate change adaptation and mitigation projects across 130 countries, specializing in Nature-based Solutions (NbS) for clients such as United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), Food and Agriculture Organization of the United Nations (FAO), United Nations International Children’s Fund (UNICEF), United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Global Water Partnership (GWP). C4’s work includes multiple scientific disciplines and sectors, such as: i) ecological restoration; ii) ecosystem management; iii) agriculture; iv) water resource management; v) early warning systems; vi) remote sensing; vii) climate policy; viii) carbon sequestration analysis; ix) gender-sensitive project design; x) risk assessment of carbon projects; and xi) voluntary carbon market methodologies. This experience provides C4 with the necessary skills to address complex challenges in project implementation and the team has extensive experience in AFOLU projects, including:

- developing and validating six PDDs focused on ecosystem restoration and carbon removal;
- completing over 30 scoping studies for ecosystem carbon projects worldwide;
- collecting field data on ecosystem carbon stocks, biodiversity and socio-economic conditions; and
- working with VVBs to validate PDDs and verify carbon credits.

Implementation Capacity

As the primary implementing partner, C4 has demonstrated its capacity through direct involvement in large-scale AFOLU projects. The company was the first in Africa to develop and validate a PDD focused on ecosystem restoration and carbon removal in 2008. The Kuzuko Lodge Private Game Reserve Thicket Restoration Project – where C4 worked with its sister company, AfriCarbon (Pty) Ltd. – implemented one of the world's largest ecosystem restoration initiatives. This Verra-validated project involved planting 30 million trees (*Portulacaria afra*, 'spekboom') across 5,200 ha of degraded thicket in South Africa. C4 was involved in both the design and implementation phases of this project, including extensive data collection on ecosystem carbon stocks and biodiversity following VCS and CCB protocols.

Carbon Accounting Expertise

The management team includes individuals with more than five years of experience in carbon accounting and reporting in accordance with the VCS and other approved GHG programs, with team members having successfully managed multiple projects through validation. Through this combination of AFOLU project experience, local presence and carbon accounting expertise, C4's management team fully satisfies the requirements of the Non-permanence Risk Tool.

2.4.4 Project Management Partnerships and Team Development (VCS, 3.19; CCB, G4.2)

Sand Catchment Pty Ltd. and C4 are supported by organizations that contribute technical expertise, community training, policy alignment and financial support, outlined below and summarized in the table below.

- **Community training and capacity-building** will be managed by entities such as the GWF, the Ten Trees Project and FEADT-SA, which provide experience in digital literacy, vocational training and farmer outreach using participatory approaches.
- **Technical and scientific input** into nursery operations, agroforestry design, propagation techniques and ecological monitoring from C4, Ten Trees and collaborating specialists such as Root & Ground (Pty) Ltd. These entities have experience in both practical implementation and the development of monitoring systems aligned with best practices in restoration and climate resilience. In addition, C4 provides expertise on the VCS and CCB methodologies, with experience in several validated projects.
- **Policy alignment and institutional coordination** with government entities, including the DFFE, the DARDLEA and the BLM, to ensure regulatory compliance, integration with national and provincial priorities and effective governance at the local level.
- **Conservation partnerships** with SANParks and the K2C, which will integrate project activities with broader landscape-level restoration and biodiversity goals.
- **Community Liaison** support from entities such as the Lotus Impact Foundation, which provides expertise for inclusive business models. These partners will also be responsible for training community liaisons to strengthen local engagement and participation.

Project partners are being finalized and will be adjusted over time in accordance with project requirements and priorities.

Strategic area	Management Team Responsible	Previous Experience
Community Training and capacity-building	FEADT-SA	4 years experience
	Ten Trees Project	5 years experience
	GWF	13 years experience

Technical and scientific input	C4	17 years experience; 60 projects
Policy alignment and institutional coordination	DFFE	31 years experience
	DARDLEA	31 years experience
	BLM	25 years experience
Conservation partnerships	SANParks	99 years experience
	K2C	24 years experience
Financial and enterprise development	Lotus Impact Foundation	20 years experience

2.4.5 Financial Health of Implementing Organization(s) (CCB, G4.3)

The project finances have not been made available in this public version of the PDD (Section 2.1.22), as the process of securing investment is ongoing. These details will be made available to auditors and relevant stakeholders at their request. Project finances will be secured through Sand Catchment Pty Ltd. – the Project Proponent – and used for the full implementation period. The implementing partners – C4, Ten Trees and FEADT-SA – contribute technical expertise under partnership agreements but are not financially responsible for sustaining the project.

2.4.6 Avoidance of Corruption and Other Unethical Behavior (VCS, 3.19; CCB, G4.3)

The Project Proponent and partner organizations affirm that they are not involved in, nor complicit in, any form of corruption, including bribery, embezzlement, fraud, favoritism, cronyism, nepotism, extortion or collusion. All partners will maintain anti-corruption and ethics policies, and where such policies are not yet formalized, they will be developed before implementation.

Compliance with these policies will be mandatory. Any participant or employee found in breach will be subject to disciplinary measures and, where applicable, legal action. Commitment to these standards is a condition of participation in the project. Copies of the policies will be provided to the VVB on request.

2.4.7 Commercially Sensitive Information (VCS, 3.5.2 – 3.5.4; CCB Rules, 3.5.13 – 3.5.14)

Commercially sensitive information has been excluded from the public version of the PDD. Detailed financial information has not been disclosed (see Section 2.1.22), as the process of securing investment is ongoing. In addition, personal details have also been omitted in accordance with the POPIA¹⁵¹. Financial records, CVs and other personnel information will be made available to auditors and relevant stakeholders upon request.

2.5 Legal Status and Property Rights

2.5.1 National and Local Laws (VCS, 3.1, 3.6, 3.7, 3.14, 3.18, 3.19; CCB, G5.6)

The project design complies with national legislation, local regulations and customary practices, which together form the applicable regulatory framework. This framework governs carbon mitigation, labor conditions, environmental safeguards and land tenure. In doing so, it ensures that biodiversity is protected, natural resources are managed sustainably and that communities benefit from secure tenure and fair

¹⁵¹ The Republic of South Africa. 2025. Protection of Personal Information Act 4 of 2013. The South African Government. Available at: <https://www.gov.za/documents/protection-personal-information-act>. Accessed on 29 Sep 2025.

working conditions. All project employees and participants will be informed of their rights upon signing MoUs or contracts. The Project Proponent will also ensure compliance with all legal requirements throughout implementation. The table below outlines the laws and regulations relevant to the project.

Category	Statute	Description of the legislation	Project compliance
Carbon mitigation legislation	Carbon Tax Act 15 of 2019 ¹⁵²	Offsets must comply with international standards such as the Clean Development Mechanism (CDM), VCS and Gold Standard or a future domestic standard.	South Africa allows private entities to develop carbon projects under the 2019 Carbon Tax Offset Regulations. The project operates according to the VCS and CCB certification. The project has co-developed a Landowner Lease Agreement with clauses on carbon credit ownership transfer.
	Climate Change Act 22 of 2024 ¹⁵³	Establishes a national response framework, including GHG activity lists, carbon budgets for entities and climate adaptation strategies.	The project complies with the Climate Change Act, 2024, by implementing activities recognized to sequester carbon, specifically through reforestation and tree planting. These activities deliver quantifiable carbon sequestration that will be reported into the National GHG Inventory (Section 29 of the Act) and support the achievement of sectoral emissions targets (Section 25 of the Act). In doing so, the project provides measurable mitigation outcomes that contribute to the implementation of carbon budgets (Section 27 of the Act) and align with national emissions reduction trajectories.
	Carbon Offsets Regulations of 2019 ¹⁵⁴	Specifies eligibility criteria, including project registration timelines and exclusion of "negative list" activities such as energy efficiency projects benefiting from tax incentives.	Participation in the project is ensured through formal agreements that allocate rights and responsibilities in line with the Carbon Offsets Regulations of 2019. These agreements secure land access for project activities, define benefit-sharing arrangements and confirm that activities fall outside the regulatory "negative list".
	NDC under the Paris Agreement ¹⁵⁵	Legally binds South Africa to reduce emissions to below business-as-usual trajectories.	The project's carbon removals and biodiversity co-benefits support South Africa's progress towards meeting its NDCs by increasing carbon sequestration and supporting climate resilience in landscapes vulnerable to the effects of climate change. The generated credits will be sold in voluntary carbon markets, with

¹⁵² The Republic of South Africa. 2019. Carbon Tax Act 15 of 2019. Pretoria: Government Gazette

¹⁵³ The Republic of South Africa. 2024. Climate Change Act 22 of 2024. Pretoria: Government Gazette

¹⁵⁴ Republic of South Africa. 2019. Carbon Offsets Regulations. Pretoria: Government Gazette.

¹⁵⁵ Republic of South Africa. 2021. Nationally Determined Contribution (NDC) under the Paris Agreement. Pretoria: Department of Forestry, Fisheries and the Environment.

			safeguards in place – including registry-based tracking and national reporting coordination – to prevent double counting and ensure that emission reductions are verified and measurable.
Environmental laws	National Environmental Management Act 107 of 1998 (NEMA) ¹⁵⁶	Establishes overarching principles for sustainable development, environmental governance and public participation in environmental decision-making in South Africa.	The project activities advance sustainability principles by restoring soil health, improving water retention and enhancing habitat connectivity, which align with ecological protection and resource use principles in the NEMA. Local input is integrated through participatory decision-making processes that comply with the NEMA's public participation requirements by ensuring affected communities have reasonable opportunities to engage with project planning and implementation.
	Environment Conservation Act 73 of 1989 ¹⁵⁷	Provides measures to control activities that are likely to harm the environment, including waste management, noise control and environmental impact assessments for listed activities.	While tree planting contributes positively to carbon sequestration and ecosystem function, mitigation measures are in place to prevent adverse impacts during implementation. These include safe handling and disposal of nursery and planting waste, measures to prevent soil erosion and runoff around planting sites, minimization of noise and disturbance during planting campaigns and compliance with any permitting processes required by the Act.
	National Environmental Management: Biodiversity Act 10 of 2004 ¹⁵⁸	Facilitates the management and conservation of biological diversity, including protected species lists, bioregional planning and the development of biodiversity management plans.	Through the planting of native trees such as marula, the project will expand native vegetation cover at project sites. This cover will improve soil stability and provide habitat for local species, thereby supporting biodiversity and ecosystem function.
	National Water Act 36 of 1998 ¹⁵⁹	Ensure sustainable water use by regulating allocation, protecting aquatic ecosystems and providing for catchment management agencies to oversee integrated water resource management.	Through tree planting, the project activities will increase vegetation cover at project sites. This added cover will generate organic matter and improve soil structure, which in turn supports water infiltration and maintains soil function. Where irrigation is applied, water use will follow best practices for efficient irrigation – such as watering in the cooler parts of the

¹⁵⁶ Republic of South Africa. 1998. National Environmental Management Act 107 of 1998 (NEMA). Pretoria: Government Gazette.

¹⁵⁷ Republic of South Africa. 1989. Environment Conservation Act 73 of 1989. Pretoria: Government Gazette.

¹⁵⁸ Republic of South Africa. 2004. National Environmental Management: Biodiversity Act 10 of 2004. Pretoria: Government Gazette.

¹⁵⁹ Republic of South Africa. 1998. National Water Act 36 of 1998. Pretoria: Government Gazette.

		day to minimize evaporation – to avoid over-extraction and sustain soil moisture.
National Forest Act 84 of 1998 ¹⁶⁰	Promotes the sustainable management of forests, protects native forest areas and trees of national importance and controls forest resource use through a licensing system.	The project activities protect native forests and increase vegetation cover at forest margins through tree planting. Should any forest resource be used, this will be accounted for in the leakage calculations and mitigated through the establishment of woodlots to maintain sustainability. Use will be authorized in accordance with the licensing system established by the National Forests Act 84 of 1998, with records of applications, permits and use maintained, where applicable, to demonstrate compliance and transparency.
National Environmental Management: Protected Areas Act 57 of 2003 ¹⁶¹	Regulates the declaration and management of national parks, nature reserves and other protected areas, with the objectives to conserve biodiversity and associated ecosystem services.	No activities occur within protected areas unless permitted by management authorities. The project activities support landscape connectivity, which complements protected area objectives.
National Heritage Resources Act 25 of 1999 ¹⁶²	Safeguards South Africa's cultural heritage by protecting archaeological, paleontological and historical sites, structures and landscapes through heritage resource authorities.	Project area screening excludes areas of cultural heritage significance. Consultations with local communities and heritage authorities verify that interventions do not affect protected sites. If culturally significant material is uncovered during implementation, activities will stop immediately and the area will be excluded from further project activities. In the event that a heritage site is affected by project activities, efforts will be made to restore it and no further project activities will be implemented on the site.
Convention on Biological Diversity (CBD), 1992 ¹⁶³	Commits parties to conserve biodiversity, use biological resources sustainably and ensure fair, equitable sharing of	South Africa has ratified the CBD and the project aligns with its objectives. Activities include the restoration of native vegetation, including HCV species, and

¹⁶⁰ Republic of South Africa. 1998. National Forests Act 84 of 1998. Pretoria: Government Gazette.

¹⁶¹ Republic of South Africa. 2003. National Environmental Management: Protected Areas Act 57 of 2003. Pretoria: Government Gazette.

¹⁶² Republic of South Africa. 1999. National Heritage Resources Act 25 of 1999. Pretoria: Government Gazette.

¹⁶³ United Nations. 1992. Convention on Biological Diversity. Rio de Janeiro: UN Conference on Environment and Development.

		benefits arising from genetic resources, including traditional knowledge.	increasing habitat connectivity. Agreements with local communities incorporate traditional knowledge and benefit-sharing provisions following the Convention's principles. The project aligns with the CBD by restoring native vegetation through planting activities. Increased vegetative cover from these project trees is likely to contribute to improved habitat connectivity and support species persistence in the landscape. Project agreements will incorporate traditional knowledge into planting practices by recognizing community preferences for native species, seasonal cycles and customary land-use practices. These agreements will also establish beneficiary mechanisms consistent with CBD principles, including participation in training and equitable distribution of project-derived benefits such as improved livelihoods.
	Local Agenda 21, 1992 ¹⁶⁴	Originating from the Earth Summit, this agenda encourages local authorities to develop participatory strategies and plans for sustainable development in collaboration with local communities.	Local authorities in South Africa integrate sustainable development through Integrated Development Plans (IDPs) in line with Agenda 21. The project collaborates with municipalities, aligns with IDPs and implements participatory processes such as FPIC, community mapping and benefit-sharing. This fosters local ownership of sustainable land use.
Land tenure laws	Restitution of Land Rights Act of 1994 (and Amendments 1996) ¹⁶⁵	Provides mechanisms for individuals or communities dispossessed as a result of racially discriminatory laws to claim restitution of their land rights, including compensation or restoration.	The project will confirm the land tenure status of project participants before implementation. Project activities will not proceed in contested areas or where land rights are not recognized, ensuring activities do not undermine restitution processes.
	Land Reform (Labor Tenants) Act 3 of 1996 ¹⁶⁶	Protects labor tenants by recognizing and securing their rights to occupy and use land, aiming to improve tenure security and prevent arbitrary evictions.	Project activities will not infringe on tenure rights and will be implemented in consultation with communities and traditional authorities. Engagement with stakeholder groups will ensure that customary practices in relation to land tenure are respected and that access to land for project activities is lawfully secured through MoUs and endorsement letters.

¹⁶⁴ United Nations. 1992. Local Agenda 21: Framework for localizing Agenda 21 at municipal level. Rio de Janeiro: United Nations Conference on Environment and Development.

¹⁶⁵ Republic of South Africa. 1994. Restitution of Land Rights Act of 1994 (and Amendments 1996). Pretoria: Government Gazette.

¹⁶⁶ Republic of South Africa. 1996. Land Reform: Labor Tenants, Act 3 of 1996. Pretoria: Government Gazette.

	<p>Extension of Security of Tenure Act 62 of 1997¹⁶⁷</p>	<p>The objective of the Extension of Security of Tenure Act 62 of 1997 is to protect people residing on land with consent or lawful right from unfair eviction, promoting long-term tenure security and orderly land occupation arrangements.</p>	<p>Through formal agreements with land users and traditional leaders, the project enables continued secure access to land. No evictions or displacements of residents will result from carbon-related land use transitions.</p>
	<p>Interim Protection of Informal Land Rights Act 31 of 1996 (IPILRA)¹⁶⁸</p>	<p>Safeguards informal and customary land rights by requiring that any development proceed with consent, pending broader land tenure reform.</p>	<p>The Project Proponent respects this act and will ensure that it obtains informed consent from all relevant parties with rights to the land in the project area before commencing any project activities on their land. Signed FPIC records and meeting minutes, co-signed by witnesses, will be maintained to ensure a transparent record of consent. An anonymous grievance redress mechanism will also remain in place to allow ongoing feedback and protect the rights of landowners and users throughout project implementation.</p>
	<p>Deeds Registries Act 47 of 1937¹⁶⁹</p>	<p>Regulates the registration of property rights, ensuring the legal certainty of land ownership and facilitating the transfer, mortgaging and subdivision of immovable property.</p>	<p>In the event that future PAIs take place on privately owned land with registered title deeds, land use agreements will be formalized to record consent and clearly define carbon credit ownership.</p>
	<p>Communal Property Associations Act 28 of 1996</p>	<p>Enables communities to form CPAs as legal entities to acquire, hold and manage land collectively, supporting land reform and local governance objectives¹⁷⁰.</p>	<p>Where land is held by CPAs, the project team will engage these community structures directly as the recognized legal landholders. The project will confirm that CPAs are properly constituted and registered in accordance with the Communal Property Associations Act with the Department of Agriculture, Rural Development and Land Reform. Consent for project activities will be secured through broad consultation with CPA members, consistent with the democratic decision-making requirements of the Act and formalized in lease agreements with the registered CPA executive committees to document consent and secure land access for carbon activities.</p>

¹⁶⁷ Republic of South Africa. 1997. Extension of Security of Tenure Act 62 of 1997. Pretoria: Government Gazette.

¹⁶⁸ Republic of South Africa. 1996. Interim Protection of Informal Land Rights Act 31 of 1996 (IPILRA). Pretoria: Government Gazette.

¹⁶⁹ Republic of South Africa. 1937. Deeds Registries Act 47 of 1937. Pretoria: Government Gazette.

¹⁷⁰ Republic of South Africa. 1996. Communal Property Associations Act 28 of 1996. Pretoria: Government Gazette.

Governance	Traditional and Khoi-San Leadership Act 3 of 2019 ¹⁷¹	Recognizes the authority of traditional and Khoi-San leaders, setting out their governance roles in community affairs, land administration and participation in development processes.	The Project Proponent consults with traditional authorities, respects customary governance and secures their documented consent through lease agreements and FPIC processes.
	Spatial Planning and Land Use Management Act (SPLUMA), No. 16 of 2013 ¹⁷²	SPLUMA provides the overarching framework for spatial planning and land use management in South Africa. The Act requires municipalities to adopt Spatial Development Frameworks (SDFs) that align land use planning with broader national and provincial priorities.	Project activities align with the SPLUMA by promoting efficient, multi-functional land use. Integrating trees into croplands and residential areas improves soil fertility, water retention and agricultural productivity, supporting climate resilience and sustainable rural development. These practices demonstrate compliance with the SPLUMA's principles of inclusive and equitable land use while contributing to the upgrading of underutilized areas. The project activities complement municipal planning by providing practical land management interventions that can inform SDFs. Furthermore, plans for tree planting activities are discussed with local municipalities to ensure that there is no overlap with areas planned for other development.
	Municipal Systems Act, No. 32 of 2000 ¹⁷³	The Municipal Systems Act obliges every municipality to prepare and implement an IDP, which constitutes a five-year strategic plan that coordinates development priorities, budgets and service delivery. It integrates sectoral strategies – such as housing, infrastructure, economic development and environmental management – into a framework for local development.	The Bushbuckridge IDP (2024–2025) identifies agriculture, environmental management and climate resilience as strategic priorities. Project activities align with these priorities by improving rural livelihoods through agroforestry, which diversifies household income, supports food security and creates employment. Tree planting contributes directly to IDP commitments on climate adaptation and greening by increasing vegetation cover, restoring degraded areas and supplying seedlings for community use. These outcomes demonstrate alignment with Bushbuckridge's IDP goals of sustainable rural development, improved land productivity and climate resilience.
Labor laws	Labor Relations Act 66 of 1995 ¹⁷⁴	Workers must be guaranteed fundamental labor rights, including: i) freedom of association; ii) recognition of organizational rights; iii) the ability to engage in collective	Workers will receive written contracts outlining their rights and responsibilities, supported by structured induction sessions explaining applicable labor laws, occupational health and safety requirements and grievance procedures.

¹⁷¹ Republic of South Africa. 2019. Traditional and Khoi-San Leadership Act 3 of 2019. Pretoria: Government Gazette.

¹⁷² Republic of South Africa. 2013. Spatial Planning and Land Use Management Act, No. 16 of 2013. Government Gazette, Pretoria.

¹⁷³ Republic of South Africa. 2000. Municipal Systems Act (No. 32 of 2000). Pretoria: Government Gazette.

¹⁷⁴ Republic of South Africa. 1995. Labor Relations Act 66 of 1995. Pretoria: Government Gazette.

	bargaining; iv) the right to strike; and v) protection against unfair dismissal.	Regular workplace meetings will provide opportunities for representation and collective discussion. A formal grievance mechanism, with confidential reporting and clear resolution pathways, will allow workers to raise concerns and have disputes addressed transparently and equitably.
Basic Conditions of Employment Act 75 of 1997 ¹⁷⁵	Employment conditions must follow established labor standards, including: <ul style="list-style-type: none"> • standardized hours of work; • annual leave; • sick leave; • maternity leave; • severance pay; • notice pay; and • sector-specific determinations. 	All project employment agreements meet the statutory requirements of the Basic Conditions of Employment Act 75 of 1997. Employment contracts specify hours of work, rates of pay and entitlements to annual, sick and maternity leave. Workers are informed of their rights during induction and receive written records of employment conditions. Payroll and attendance records are maintained to ensure compliance with prescribed hours, overtime limits and leave provisions. In cases of retrenchment or termination, statutory provisions for notice pay and severance are applied.
Employment Equity Act 55 of 1998 ¹⁷⁶	The Employment Equity Act's objective is to eliminate unfair discrimination in employment and implement affirmative action measures to advance equitable representation of designated groups across occupational levels.	Recruitment and training for the project will promote equitable opportunities for historically disadvantaged groups, with specific measures to support gender inclusivity and promote youth employment. Equitable recruitment, training and inclusion will be mediated through GWF, FEADT-SA and Ten Trees and training partners will be required to monitor gender and age representation (see Section 2.3.10: Stakeholder consultations).
Unemployment Insurance Act of 2001 ¹⁷⁷	Provides short-term financial relief to employees who become unemployed, or who cannot work due to illness, maternity or adoption leave, supporting household income stability.	Workers contracted by the project are registered for unemployment insurance where applicable, securing statutory benefits.
Skills Development Act 97 of 1998 ¹⁷⁸	Enhances employability, supports economic growth and encourages employers to use the workplace as an active learning environment. It also encourages self-employment and tackles historical inequalities in	Project activities include skills transfer through training in sustainable land management practices, equipping participants with competencies that are also applicable to sectors such as conservation and ecological restoration. In line with the Skills Development Act 97 of

¹⁷⁵ Republic of South Africa. 1997. Basic Conditions of Employment Act 75 of 1997. Pretoria: Government Gazette.

¹⁷⁶ Republic of South Africa. 1998. Employment Equity Act 55 of 1998. Pretoria: Government Gazette.

¹⁷⁷ Republic of South Africa. 2001. Unemployment Insurance Act. Pretoria: Government Gazette.

¹⁷⁸ Republic of South Africa. 1998. Skills Development Act 97 of 1998. Pretoria: Government Gazette.

		<p>education and training to foster a more equitable and skilled labor market.</p>	<p>1998, these training initiatives will be structured as skills programs, which are occupationally based and improve employability. Training will cover areas such as tree propagation, planting, nursery management and soil and water conservation. Where feasible, they may also be formalized into learnerships, delivered in partnership with the GWF, that combine structured learning with workplace experience and align with recognized occupational qualifications. All training will be documented to support participants' employment prospects in rural areas while contributing to the national skills development strategy and broader capacity-building objectives. Disadvantaged and unemployed groups will be prioritized for training.</p>
	<p>Compensation for Occupational Diseases Act 130 of 1993¹⁷⁹</p>	<p>Enables compensation to employees for work-related injuries and occupational exposures, providing a statutory process for claims linked to workplace-related health impacts.</p>	<p>The project proponent will register with the Compensation Fund to ensure statutory protection for workplace injuries and related claims.</p>
	<p>Occupational Safety and Health Act 85 of 1993¹⁸⁰</p>	<p>Require employers to maintain safe working environments and implement measures to prevent accidents and occupational diseases, with special provisions for mining operations.</p>	<p>The project includes an occupational health and safety framework designed to mitigate workplace risks and improve the overall safety of project working environments. Training and monitoring ensure compliance with national occupational health and safety standards. These measures include the use of appropriate PPE and the implementation of site-specific emergency procedures to ensure worker safety.</p>

2.5.2 Relevant Laws and Regulations Related to Worker's Rights (VCS, 3.18.2; CCB, G3.11)

Employment by the Project Proponent will comply with the Labor Relations Act 66 of 1995, as well as other labor-related acts detailed in Section 2.5.1. These statutes guarantee employee rights to freedom of association, collective bargaining and protection against unfair dismissal. In line with this Act, workers will be well informed about their rights through induction sessions, written contracts and regular workplace discussions. These informational sessions will explain, *inter alia*: i) the main labor laws that govern employment relations; ii) occupational health and safety requirements, including the correct use of protective equipment and emergency procedures; and iii) grievance procedures and mechanisms for workplace representation.

¹⁷⁹ Republic of South Africa. 1993. Compensation for Occupational Diseases and Injuries Act 130 of 1993. Pretoria: Government Gazette.

¹⁸⁰ Republic of South Africa. 1993. Occupational Health and Safety Act 85 of 1993. Pretoria: Government Gazette.

2.5.3 Human Rights (VCS, 3.19)

The Project Proponent and all implementing partners will uphold the principles of non-discrimination, dignity and equality and prohibit all forms of harassment or discrimination based on race, gender, age and disability. No individuals below the age of 18 will be employed in any capacity. Measures have been developed to promote a safe and inclusive environment for all workers and participants. Furthermore, the Project Proponent is committed to recognizing, respecting and promoting the rights of Indigenous Peoples (IPs), Local Communities (LCs) and customary rights holders in line with applicable international standards and national law. This includes the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)¹⁸¹, principles informed by the ILO Convention 169 – as an international best practice, although not ratified by South Africa)¹⁸². Additionally, the project proponent will adhere to the South African Constitution, alongside domestic statutes governing land rights and community governance (see section 2.5.1).

These commitments are implemented with the mechanisms outlined below.

- Documented FPIC processes that involve community assemblies, traditional leadership structures and individual landholders, with decisions recorded in written agreements.
- Participatory planning that incorporates local knowledge and prioritizes community-defined development goals.
- Benefit-sharing mechanisms that are co-developed and reviewed with communities to ensure equitable outcomes.
- Formal land use agreements that uphold customary land rights and reflect local governance structures.

A transparent and accessible grievance mechanism is in place throughout the project lifecycle (see Section 2.3.15). This mechanism allows community members to raise concerns confidentially and without retaliation, with procedures in place for resolution, monitoring and feedback.

2.5.4 Indigenous Peoples and Cultural Heritage (VCS, 3.18, 3.19)

The Project Proponent and associated partners respect Indigenous Peoples (IPs) and their cultural heritage therefore, several measures that promote inclusive participation and safeguard traditional values have been developed, detailed below.

- **Consultation and engagement:** Indigenous and local communities are consulted during project design and implementation. Engagement processes collect perspectives and traditional knowledge to inform project activities and support shared decision-making.
- **Cultural respect:** Sacred sites, shrines, burial grounds and other areas of cultural value will be identified using participatory approaches. These findings will guide activity planning to avoid adverse effects on cultural heritage.
- **Traditional knowledge:** Knowledge relating to land management, ecological stewardship and biodiversity practices is incorporated into project activities, where appropriate. This is intended to promote cultural practices while supporting ecological outcomes.
- **Customary land rights:** The project recognizes that land within the project area is managed in accordance with traditional governance systems. Consultations with Traditional Authorities and community leaders are integrated into all land use agreements in these areas.

¹⁸¹ Grain SA. 2015. Unpacking the various forms of land ownership. Available at: <https://www.grainsa.co.za/unpacking-the-various-forms-of-land-ownership>. Accessed on 26 September 2025.

¹⁸² Grain SA. 2015. Unpacking the various forms of land ownership. Available at: <https://www.grainsa.co.za/unpacking-the-various-forms-of-land-ownership>. Accessed on 26 September 2025.

- **Collaboration and partnership:** The project maintains partnerships with Traditional Authorities, community institutions and representative groups. These partnerships will be used to coordinate the protection of cultural heritage and enable Indigenous communities to participate in project governance.

2.5.5 Statutory and Customary Property Rights (VCS, 3.18, 3.19; CCB, G5.1)

Land within the Ehlanzeni District Municipality is governed by several land tenure types: i) customary, ii) communal, iii) state; and iv) private tenures¹⁸³. Approximately 70% of land within the targeted implementation zones is governed according to customary systems led by recognized traditional authorities¹⁸⁴. Land use planning and registration are overseen by the government at national, provincial and municipal levels, with statutory authority anchored in frameworks such as the SPLUMA¹⁸⁵. Within this broader system, recognized traditional authorities — established and regulated by the Traditional and Khoi-San Leadership Act (No. 3 of 2019)¹⁸⁶ — hold delegated rights to administer land allocation, inheritance and community-level decisions on external interventions in areas governed by customary tenure. Chiefs (*hosi/kgosi*) and headmen (*ndunas*) exercise these responsibilities in accordance with customary law and practices^{187,188}.

In areas governed by customary tenure, land is typically allocated through PTO rights — a form of land-use authorization granted by traditional leaders^{189,190,191}. PTOs allow individuals or families to occupy and use specific parcels of communal land, usually for residential or agricultural purposes. Although these rights are not registered in the national deeds system, they typically recognized by government departments such as the Department of Agriculture, Land Reform and Rural Development (DALRRD) and are widely respected within communities¹⁹². PTOs are often hereditary and passed down through generations, though formal recognition by traditional councils may still be required during inheritance.

State land also forms part of the project area and includes land managed at national, provincial or municipal levels. Local municipalities, constitutionally mandated by the Spatial Planning and Land Use Management Act (No. 16 of 2013)¹⁹³, contribute to spatial planning, land use regulation and integrating local development priorities. This ensures that land use planning — including within customary tenure areas — is aligned with statutory frameworks and supports more coordinated and equitable land allocation.

Access and use of natural resources, including grazing lands and water points, are typically managed through customary systems overseen by traditional leaders, who balance communal needs with land management practices. During participatory planning as part of Phase two of the FPIC process, these

¹⁸³ Grain SA. 2015. Unpacking the various forms of land ownership. Available at: <https://www.grainsa.co.za/unpacking-the-various-forms-of-land-ownership>. Accessed 26 September 2025.

¹⁸⁴ See project location map (Figure 1).

¹⁸⁵ Republic of South Africa. 2013. Spatial Planning and Land Use Management Act 16 of 2013. Pretoria: Government Gazette.

¹⁸⁶ Republic of South Africa. 2019. Traditional and Khoi-San Leadership Act 3 of 2019. Pretoria: Government Gazette.

¹⁸⁷ *Ibid.*

¹⁸⁸ Department of Cooperative Governance and Traditional Affairs. 2020. Profile and analysis: District Development Model – Ehlanzeni District, Mpumalanga. Pretoria: Republic of South Africa. Retrieved from: https://cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf

¹⁸⁹ Republic of South Africa. 1991. Upgrading of Land Tenure Rights Act (No. 112 of 1991). Retrieved from: https://www.gov.za/sites/default/files/gcis_document/201409/a1121991.pdf.

¹⁹⁰ Booi Z. 2023. The Interim Protection of Informal Land Right Act: How does it protect your rights to land? Cape Town: Land and Accountability Research Centre (LARC). Retrieved from: https://law.uct.ac.za/sites/default/files/media/documents/law_uct_ac_za/1149/A5-IPILRA-LARC-v2.pdf

¹⁹¹ Claassens A & Cousins B. 2008. Land, power and custom: Controversies generated by South Africa's Communal Land Rights Act. Cape Town: UCT Press. Retrieved from: <https://openuctpress.uct.ac.za/uctpress/catalog/book/40>

¹⁹² Claassens A & Cousins B. 2013. Land, Power & Custom: Controversies generated by South Africa's Communal Land Rights Act. Legal Resources Centre. UCT Press. Retrieved from: <https://openuctpress.uct.ac.za/uctpress/catalog/view/40/67/175>.

¹⁹³ The Republic of South Africa. 2013. Spatial Planning and Land Use Management Act 16 of 2013. Pretoria: Government Gazette.

property rights will be mapped and documented (see supporting document: Save the Sand FPIC Report (June 2025)). These activities will be led by the project team in collaboration with community representatives and traditional authorities before implementation begins. This will confirm the legitimacy of landholders and local use arrangements at each targeted site, directly informing benefit-sharing design and helping to prevent conflicts.

The project zone also includes land managed by CPAs in accordance with the Communal Property Associations Act (No. 28 of 1996)¹⁹⁴. CPAs represent communities that have secured collective land rights – often through land reform processes – and are responsible for managing land on behalf of their members in line with a registered constitution. The remaining areas consist of privately owned farms and smallholdings held under title deeds governed by the Deeds Registries Act (No. 47 of 1937)¹⁹⁵.

2.5.6 Recognition of Property Rights (VCS, 3.7, 3.18, 3.19; CCB, G5.1)

Evidence of rights to use land and resources for project activities is secured through written endorsements from traditional authorities, voluntary participation agreements with households and landholders and formal approvals from CPAs. These agreements provide Sand Catchment Pty Ltd. with permission to implement and monitor project activities. Measures are also being developed to support landholders and participants in securing statutory rights, including facilitating channels to register PTO certificates or to obtain lease agreements where applicable.

2.5.7 Free, Prior and Informed Consent (VCS, 3.18; CCB, G5.2)

<p>Description of process for obtaining consent</p>	<p>Given that most inhabitants of the project area were expected to have limited prior exposure to carbon markets or benefit-sharing mechanisms, the FPIC process was structured to allow for gradual understanding, inclusive participation and ongoing dialogue. A phased approach ensured that information was accessible, consent was culturally appropriate and mechanisms for continued participation were promoted throughout the stakeholder engagements.</p> <p>Phase One focused on early-stage awareness and orientation. Consultations introduced the project concept, explored governance dynamics and land tenure arrangements to gauge the level of community interest and support. Discussions centered on clarifying project intent, gathering stakeholder perspectives and identifying areas of concern – without making premature commitments on benefit-sharing or employment. This approach ensured that engagement remained realistic, inclusive and aligned with FPIC principles.</p> <p>By prioritizing early relationship-building and avoiding overpromising, the project team sought to establish transparency and legitimacy. Detailed planning discussions – including those related to financial benefits, legal agreements and implementation roles – will follow in later FPIC phases, once technical elements of the project have been developed and stakeholder feedback has been integrated.</p> <p>The initial engagements created space for community members to raise questions about implementation – such as how tree root systems are likely to affect homestead structures. These inputs informed aspects of the project design to better reflect local priorities.</p> <p>All consultations were translated and delivered in non-technical formats. Additionally, sensitization meetings were held with community members to communicate project goals, anticipated benefits, potential risks and the geographic scope of eligible areas.</p>
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¹⁹⁴ Republic of South Africa. 1996. Communal Property Associations Act 28 of 1996. Pretoria: Government Gazette.

¹⁹⁵ Republic of South Africa. 1937. Deeds Registries Act 47 of 1937. Pretoria: Government Gazette.

	<p>Engagements included:</p> <ul style="list-style-type: none"> • meetings with chiefs (<i>kgosi/hosi</i>) from six traditional authorities in the project area; • meetings with headmen (<i>ndunas</i>) and attending community members in these traditional authorities; • sessions at community venues such as the Good Work Foundation campus in Hazyview; • engagements with land users within the project area; • engagements with institutional stakeholders; • consultations with NGOs and private sector partners; and • engagements with land users across the project area. <p>Chiefs from each traditional authority provided written consent to proceed with community engagement and project implementation in areas under their jurisdiction.</p> <p>Ongoing FPIC engagements will continue with individuals and groups who choose to participate. This process will involve co-developing activity plans, formalizing participation arrangements and ensuring inclusive decision-making. Consent at the individual and household level will be formalized through signed consent forms and land-use agreements.</p>
<p>Outcome of FPIC process</p>	<p>The first phase of FPIC consultations resulted in formal consent from all consulted traditional authorities, documented through signed endorsement letters. No objections were raised regarding the planned ARR activities.</p> <p>Community members expressed support for the project activities and highlighted their compatibility with existing land use practices, including smallholder farming and the current cultivation of fruit- and nut-bearing trees.</p> <p>Communities also identified specific implementation factors and suggestions, including:</p> <ul style="list-style-type: none"> • selection of tree species by participants; • protection of saplings from livestock; • provision of water-efficient planting support; and • support for subsistence agriculture and improved market access. <p>These inputs have been integrated into project design, with planned interventions including training on drought-tolerant species, low-cost fencing, vegetable seed inputs and entry-level enterprise support. See Section 2.3.10 for further detail on stakeholder inputs.</p> <p>Ongoing FPIC activities will:</p> <ul style="list-style-type: none"> • consult women, youth and marginalized groups; • disseminate the finalized benefit-sharing arrangements; and • document consent through signed land use agreements at the individual and household level.

2.5.8 Benefit Sharing Mechanisms (VCS, 3.18, 3.19;)

<p>Process used to design the benefit sharing plan</p>	<p>The benefit-sharing plan has been developed through a participatory process with stakeholder groups including households, smallholder farmers, traditional authorities, women’s groups, youth representatives and partner NGOs. Initial consultations with community assemblies, focus groups and bilateral meetings identified priorities related to livelihoods, food security and training. Further</p>
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	<p>consultation – planned for Phase Two of the FPIC process in December 2025 and into 2026 – will confirm these priorities, validate proposed mechanisms and ensure representation of all community groups. Engagement is conducted in local languages using culturally appropriate methods, with results documented and incorporated into successive revisions of the plan. The process will continue iteratively until the final plan is endorsed by representative bodies and aligned with national policy frameworks and voluntary carbon market standards.</p>
<p>Summary of the benefit sharing plan</p>	<p>Direct benefits include performance-based incentives for tree custodians, wages for nursery and planting roles and agroforestry products such as fruit and nuts. Additionally, employment opportunities will focus on equitable representation of women, youth and vulnerable groups to ensure inclusive participation. Indirect benefits include training in sustainable agriculture such as permaculture, increased food security and strengthened institutions through project support. Oversight is provided by a representative Benefit Sharing Committee, which reviews allocations, ensures transparency and provides a forum for conflict resolution. Collectively, these measures support income generation, skills development and long-term social resilience while ensuring that benefits reach vulnerable groups.</p>
<p>Approval and dissemination of benefit sharing plan</p>	<p>The plan has been endorsed by traditional authorities, elected community representatives and participating households, with support documented through signed resolutions and meeting minutes. Further validation of the detailed benefit-sharing arrangements will occur during Phase Two of the FPIC process, when communities will have opportunities to review and confirm the benefit-sharing mechanisms. The plan will be disseminated through: i) community assemblies; ii) posting in public venues such as Traditional Authority offices, schools and community centers; and iii) digital platforms including the Save the Sand WhatsApp chatbot and project website to ensure accessibility. Copies will be available in English and local languages and all stakeholders may request access to review the plan. Stakeholders will be consulted on which elements, if any, should remain confidential, with commercially sensitive information maintained separately for review by the VVB.</p>

2.5.9 Property Rights Protection (VCS, 3.18, 3.19; CCB, G5.3)

No forced or voluntary displacement will result from the project activities. All participants and landowners hold legal land tenure titles and are required to submit proof of ownership to participate in project activities.

2.5.10 Illegal Activity Identification (VCS, 3.19; CCB, G5.4)

Human trafficking and forced or child labor are prohibited in all project activities. Illegal practices, including corruption and fraud, will not be permitted. Moreover, activities that could undermine the integrity or outcomes of the project have been identified and are listed below, together with the corresponding mitigation measures.

Illegal wood harvesting

Unauthorized tree felling for timber, fuelwood, poles and carvings occurs within the project landscape. Trees established as part of the project may be at risk of being harvested. Such practices could lower tree survival rates, reduce carbon benefits and require replanting, thereby increasing project costs. Mitigation measures are to:

- report incidents to forestry and policing authorities;

- promote community woodlots to meet local fuelwood demand;
- implement awareness campaigns on the ecological effects of unsustainable wood harvesting; and
- make use of project participants to monitor project trees and identify those at risk of being harvested.

Illegal sand mining

Unpermitted extraction of sand from riverbeds has been reported in the project zone. Sand extraction contributes to the destabilization of riverbanks, damages planted trees and degrades soil rehabilitation works. This would undermine soil retention and water management interventions in riparian zones. Within the project area, measures are to:

- collaborate with municipal and provincial authorities to monitor high-risk sites;
- report observed extraction to law enforcement; and
- promote compliance with licensing systems.

Fiduciary risks

Corruption and coercion are likely to undermine the project's social integrity and compromise trust with stakeholders. Mitigation measures include:

- implementing transparent procurement processes with clear criteria and oversight;
- conducting regular audits and financial reporting to ensure accountability; and
- establishing grievance mechanisms for reporting and addressing fiduciary misconduct.

2.5.11 Ongoing Disputes (VCS, 3.18, 3.19; CCB, G5.5)

Although land disputes exist within the project zone, areas affected will be excluded, ensuring that activities proceed only where rights are clear and uncontested. These disputes primarily relate to land restitution claims under South Africa's formal land reform program, administered through the Commission on Restitution of Land Rights following the Restitution of Land Rights Act 22 of 1994. In addition, areas governed by customary tenure may be subject to local disputes that are handled through traditional governance systems, including the headmen and traditional councils. To protect the integrity of the project and uphold the rights of claimants, the project design has incorporated the safeguards outlined below.

- **Exclusion of areas with unresolved disputes:** Project activities will not be implemented on land subject to active claims or known restitution processes. These exclusions will be documented through mapped boundaries and verified project records. This approach ensures that the project does not prejudice the outcome of any unresolved disputes over rights to lands, territories or resources.
- **Respect for formal and traditional dispute processes:** Where disputes exist, they will be addressed either through the government's land restitution mechanisms or using the recognized traditional leadership structures. The project proponent will not intervene in or influence these processes in any way.
- **Site selection and verification:** Before establishing PAIs, the project proponent will conduct due diligence assessments – including reviews of land claim registers and consultations with the DALRRD and local land tenure experts – to confirm the absence of unresolved disputes in each area. Only land areas free of such conflicts will be included in the project implementation.
- **Grievance redress mechanism:** For any concerns arising from project activities, communities will be able to use the formal grievance procedure outlined in Section 2.5.2. This process provides structured channels to raise, address and monitor concerns throughout the project lifecycle.
- **Support for communities in navigating disputes:** The project will seek to understand the procedures for resolving land disputes and, if requested, will assist communities by facilitating contact with the relevant institutions or authorities mandated to address such claims.
- **Reassessment of resolved disputes during expansion:** When new PAIs are added, previously disputed areas will be revisited. If disputes have been formally resolved and the landowners or land users wish to participate, these areas could be incorporated into the project.

2.5.12 Approvals (CCB, G5.7)

The project has received endorsement from traditional authorities, with additional support for implementation coming from the DFFE. Documentation of all existing approvals, including the letters of endorsement, will be made available upon request. Community members provided support for the project during the Stakeholder Engagement and FPIC Phase One process, which will be reaffirmed during Phase Two. Land use agreements will be signed by all participating landowners and land users in the project area.

2.5.13 Double Counting and Participation under Other GHG Programs (VCS, 3.23; CCB G5.9)

2.5.13.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program, or any other form of community, social, or biodiversity unit or credit?

Yes No

2.5.13.2 Registration in Other GHG Programs

Has the project been registered under any other GHG programs?

Yes No

Is the project active under the other program?

Yes No

2.5.13.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

Yes No

2.5.14 Double Claiming, Other Forms of Credit, and Scope 3 Emissions (VCS, 3.24)

2.5.14.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

Yes No

2.5.14.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system

Yes No

2.5.14.3 Supply Chain (Scope 3) Emissions

Do the project activities affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

Yes No

2.6 Additional Information Relevant to the Project

2.6.1 Leakage Management (VCS, 3.11, 3.15)

The modelled CO₂ removals in this PDD refer to the initial PAI, which includes tree planting on 30,000 ha of residential areas at 50 trees/ha and 10,000 ha of agroforestry on croplands at 100 trees/ha. Quantification is based exclusively on the census-based approach and leakage is therefore considered zero in accordance with VM0047. As this is a grouped project, future PAIs could incorporate reforestation activities using the area-based quantification approach. In such cases, the Project Proponent will estimate leakage, adapt the leakage management plan and update the PDD.

Although a leakage analysis is not required for the census-based quantification approach, market leakage risks could be associated with the project activities of the first PAI. This relates to the agroforestry design with 100 trees/ha. At this density, reduced crop yields are identified as a potential source of market leakage due to increased shading and competition for space. These risks are mitigated through strategic planting layouts and tree management practices that maintain crop production, as well as through yield gains associated with improved soil quality, favorable microclimates, diversified cropping systems and better market access.

In addition, activity shifting leakage related to fuelwood harvesting has been identified as a potential risk. Dedicated woodlots could be established as a leakage management measure to safeguard project trees from unsustainable harvesting and to prevent fuelwood extraction pressures from shifting to areas outside the project boundary. According to anecdotal in-field observations, fuelwood harvesting is not common in the residential areas and croplands, but future census-based PAIs in communal, riverine or rangeland areas could be subject to harvesting pressures. While harvesting is currently deemed uncommon in the project areas associated with the first PAI, the establishment of woodlots is a leakage mitigation option that the Project Proponent will consider once more information on future PAIs becomes available. Where implemented, such woodlots are likely to meet local fuelwood needs and reduce reliance on wood sourced from outside the project area while also safeguarding project trees. To reinforce these measures, the Project Proponent – alongside relevant partners – will provide training and education on sustainable wood use, including how to harvest and manage wood resources in ways that maintain long-term availability. These interventions reduce harvesting pressure on both project and non-project lands and align with the VCS encouragement to use leakage management zones and sustainable livelihood options to minimize displacement of land-use activities.

Leakage mitigation is supported through monitoring of agricultural production, wood and fuel use and community engagement. Pre-defined thresholds are used to determine if adaptive responses are necessary so that leakage risks are identified early and addressed through corrective actions. The indicators, methods, frequencies, triggers and adaptive responses are presented in the table below.

Indicator	Method	Frequency	Trigger	Possible adaptive responses
Crop yields in agroforestry plots	Field sampling of yields compared with reference fields	Twice per year (post-harvest)	≥10% persistent yield reduction over two consecutive seasons	Adjust tree planting layouts, reduce tree planting density, switch to shade-tolerant crop varieties and provide agronomic support.

Cropped area and land use in the buffer zone	Remote sensing (1–5 km buffer) with field checks	Annual	Net loss of cropped area >5% year-on-year (excluding weather/market shocks)	Establish or expand leakage management zones, support intensification and pause new plantings if needed.
Local crop price trends and volumes	Market surveys	Quarterly	Sharp increase in staple prices or reduced sales volumes	Provide input support, diversify crops and adjust planting cycles.
Woodlot survival and increment	Growth and survival audits	Annual	Survival <80% or insufficient standing volume for planned harvests	Expand woodlot area, replant and improve management regimes.
Household fuelwood sourcing	Household surveys on energy mix and sourcing	Annual	≥15% increase in fuelwood sourced outside woodlots	Expand woodlots, promote efficient stoves and increase training.
Tree cutting incidents	Community reporting and patrol logs	Quarterly	>3 verified incidents per quarter	Intensify monitoring, strengthen enforcement collaboration and adjust woodlot harvesting schedules.
Training and education delivered	Attendance records and follow-up surveys	Continuous, summarized quarterly	Participation below 60% of the participating households	Intensify outreach and adjust the timing or content of training.
Grievance mechanism use	Grievance log records	Continuous, summarized quarterly	Repeated grievances linked to leakage risks	Review procedures and adjust interventions based on feedback.

The leakage management plan is designed to be adaptive and thresholds and responses may be revised as site conditions, land-use dynamics and community needs evolve, or as new PAIs are introduced. Monitoring results and stakeholder feedback will inform these adjustments, ensuring that leakage mitigation measures remain context-appropriate and effective over the project lifetime.

2.6.2 Further Information

A deviation to VM0047 Methodology is being requested. This deviation entails increasing the tree planting density from 50 trees/ha to 100 trees/ha for the census-based approach for agroforestry on croplands. The increased planting unit density is expected to improve agroforestry systems for smallholder farmers by: i) increasing fruit and nut production; ii) improving soil quality; iii) controlling erosion; iv) buffering microclimates; and v) increasing ecosystem connectivity and biodiversity. The requested deviation applies only to the threshold of 50 trees/ha stipulated for the census-based quantification approach in VM0047. The deviation will not affect the conservativeness of the carbon dioxide removal quantification or monitoring and all other aspects of VM0047 remain unchanged. Additionally, the project design incorporates safeguards to ensure that the land remains suitable for crop production and will monitor

and account for any associated market leakage. For further details, please refer to the description of the methodology deviation in Section 3.1.6.

3 CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology (VCS, 3.1)

Type (methodology, tool, module)	Reference ID (if applicable)	Title	Version
Methodology	VM0047	VM0047 Afforestation, Reforestation and Revegetation (ARR) ¹⁹⁶	1.1
Module	VMD0054	VMD0054 Module for estimating Leakage from ARR Activities ¹⁹⁷	1.0
Tool	VT0001	VT0001 Tool for the Demonstration and Assessment of Additionality in Verified Carbon Standard (VCS) Agriculture, Forestry and Other Land Use (AFOLU) Project Activities ¹⁹⁸	3.0
Tool	VT0008	VT0008 Additionality Assessment ¹⁹⁹	1.0
Tool	N/A	AFOLU Non-Permanence Risk Tool ²⁰⁰	4.2

¹⁹⁶ Verified Carbon Standard. 2025. VCS Methodology: VM0047 Afforestation, Reforestation and Revegetation v1.1. Retrieved from: https://verra.org/wp-content/uploads/2025/05/VM0047-v1.1_Final.pdf.

¹⁹⁷ Verified Carbon Standard. 2025. VCS Module: VMD0054 Module for leakage from ARR activities v1.0. Retrieved from: https://verra.org/wp-content/uploads/2023/09/VMD0054_ARR-Leakage-Module_v1.0.pdf.

¹⁹⁸ Verified Carbon Standard. 2025. VCS Tool: VT0001 Tool for the demonstration and assessment of additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) project activities v3.0. Retrieved from: <https://verra.org/wp-content/uploads/imported/methodologies/VT0001v3.0.pdf>.

¹⁹⁹ Verified Carbon Standard. 2025. VCS Tool: VT0008 Additionality assessment v1.0. Retrieved from: <https://verra.org/wp-content/uploads/2024/10/VT0008-Additionality-Assessment-v1.0.pdf>.

²⁰⁰ Verified Carbon Standard. 2025. VCS Tool: AFOLU Non-permanence risk tool v4.2. Retrieved from: <https://verra.org/wp-content/uploads/2023/10/AFOLU-Non-Permanence-Risk-Tool-v4.2-last-updated-May-3-2024.pdf>.

3.1.2 Applicability of Methodology (VCS, 3.1)

Reference ID/Title	Applicability condition	Justification of conformance
VM0047 General Applicability Conditions (Section 4.1)		
VM0047 v1.1 Condition 1	Project activities increase vegetative cover.	The project activity, as described in Section 2.1, increases vegetative cover through direct planting of trees.
VM0047 v1.1 Condition 2	Where area-based and census-based approaches are used together, they are applied in non-overlapping areas defined at the project start.	The primary project activities, comprising tree planting in residential areas and agroforestry in croplands, will be quantified using the census-based approach, with delineations of these areas provided in Section 2.1.6 and a 10-m radius buffer around each tree. For potential restoration activities outside of the residential areas and croplands, the Project Proponent will apply either the census-based or area-based approach, depending on site-specific requirements. Additionally, the Project Proponent will ensure that areas quantified according to different approaches do not overlap.
VM0047 v1.1 Condition 3	For land enrolled in a project, the quantification approach is selected at the project start date and used for the entire project crediting period.	The census-based approach will be selected for croplands and residential areas at the project start date and used for the entire project crediting period. When reforestation activities are added to the grouped project as future Project Activity Instances (PAIs), the quantification approach will be established at the start of said activities and added to the updated Project Design Document (PDD) for the relevant PAI.
VM0047 v1.1 Condition 4 (b)	The project start date is documented as the earliest of the following: a) The date on which site preparation activities began. b) The land use change date.	The project start date will be 1 November 2025, coinciding with the planting of the first trees, with no site preparation required. The start dates of additional PAIs will be documented as they are added to the grouped project design.
VM0047 v1.1 Condition 5	Where projects take place on organic soils or wetlands, ARR activities are developed using a multiple project activity design, applying this methodology to account for aboveground biomass and using a Wetland Restoration and Conservation methodology (for example, VM0036 Methodology for Rewetting Drained Temperate Peatlands) to account for other carbon pools.	No project activities are planned to take place on organic soils or wetlands.

VM0047 Census-based Approach Applicability Conditions (Section 4.2)		
VM0047 v1.1 Condition 1	The project activity only includes direct planting.	The project activities, as described in Section 2.1, will be designed to increase vegetative cover through direct planting of trees.
VM0047 v1.1 Condition 2	The pre-project land use is maintained throughout the project lifetime (for example, where projects occur on agricultural land, agricultural production continues).	The project activities that use the census-based approach have been developed to integrate with existing land-use practices and will not result in land-use change. Agricultural production will continue on croplands where agroforestry interventions are implemented, while residential areas will retain their current function alongside tree planting. Even in areas identified for reforestation for the census-based approach, land use will be maintained for ecological restoration rather than conversion. Pre-project land use will be maintained throughout the project lifetime.
VM0047 v1.1 Condition 3	<p>Planting density does not exceed 50 planting units per hectare (/ha). The planting density limit applies proportionally to the size of each instance:</p> <p>a) Where an instance is less than one ha or includes part of a ha (for example, 0.50 ha or 1.50 ha, respectively), the planting density is scaled proportionally to the size of the instance. For example, an instance of 0.50 ha may include no more than 25 planting units.</p> <p>b) In instances larger than one ha, planting is dispersed to maintain compliance with the 50 planting units/ha limit across the entire instance (for example, in a 10 ha instance, up to 500 planting units may be planted, but must not be concentrated in a single ha or portion of the instance).</p>	<p>The 50-tree planting unit threshold will be applied in all residential areas as well as in restoration sites where the census-based approach is feasible, with planting density scaled to each site in line with methodological requirements.</p> <p>For croplands assessed using the census-based approach, the Project Proponent requests a methodology deviation to allow up to 100 trees/ha. The rationale for this deviation, including its consistency with methodological objectives and safeguards for land-use integrity, is set out in Section 3.1.6.</p>
VM0047 v1.1 Condition 4	The establishment of a complete census of all planting units marks the start of the project and is $t = 0$. The census is conducted to establish N , the total number of planting units. Only planting units planted by the Project Proponent are included in the census. Existing vegetation is not included in the census and does not count toward the 50 planting units/ha density threshold.	For each PAI, the start date ($t = 0$) is defined by the completion of a census of all planting units within that instance. Each PAI will therefore have its own census and start date. From this census, N , the total number of eligible planting units established by the Project Proponent, is determined. Only trees planted as part of project activities are included, while existing vegetation is excluded and does not count toward the accepted planting units/ha threshold.
VM0047 v1.1	Where planting units have died, plantings may be replanted, provided N does not	Where planting units die, the Project Proponent will consider replanting to ensure continuity of project

<p>Condition 5</p>	<p>exceed 50 live planting units/ha established by the project activity.</p>	<p>activities. Replanting will be managed to ensure that the number of live planting units does not exceed the accepted limit.</p>
<p>VM0047 v1.1 Condition 6</p>	<p>Individual planting units of woody biomass are clearly defined (for example, tree, shrub, bamboo clump) and identifiable in the field. One of the following identification approaches must be used:</p> <p>a) Global Positioning System (GPS) points: Project Proponents must ensure that the spacing between individual planting units is greater than or equal to the positional accuracy of the GPS units used for geolocating each planting unit. For example, if the positional accuracy of the GPS is five meters, the minimum spacing between planting units must be greater than or equal to five meters.</p> <p>b) Physical markers: Each planting unit must be marked with a durable, in-field physical identifier bearing a unique ID. These markers must be clearly visible and easily located during verification activities.</p>	<p>The Project Proponent will ensure that all planting units are clearly defined and identifiable in the field using GPS and physical markers, in line with methodological requirements.</p>
<p>VM0047 v1.1 Condition 7</p>	<p>Where a planting unit cannot be located during a monitoring event, it is conservatively assumed that the planting unit has died.</p>	<p>To comply with this requirement, the Project Proponent will record any planting unit that cannot be located during a monitoring event as dead. Monitoring teams will use GPS data and physical markers to locate planting units, with support from farmers and homeowners where relevant. If a unit cannot be identified despite these measures, it will not be counted as a live planting unit in the census.</p>
<p>VM0047 v1.1 Condition 8</p>	<p>The project activity occurs:</p> <p>a) within an area with less than 10% pre-existing woody biomass cover; and/or</p> <p>b) in an area subject to continuous cropping, or in “settlements” or “other lands” land use categories.</p>	<p>Compliance is ensured by implementing agroforestry interventions within croplands and residential areas, which are defined as eligible land-use categories with either continuous cropping and settlements, and contain less than 10% pre-existing woody biomass. Areas designated for restoration in accordance with the census-based approach will likewise be limited to sites with less than 10% pre-existing woody biomass.</p>
<p>VM0047 v1.1 Condition 9</p>	<p>Soil disturbance from project activities (for example, site preparation) meets the following conditions:</p> <p>a) Soil disturbance is permitted only at the time of planting. Where replanting or additional waves of planting occur, soil</p>	<p>The Project Proponent will comply with all soil disturbance criteria specified in the methodology. Soil disturbance will occur only during planting, replanting or subsequent PAIs. Localized techniques such as pit planting will be used, in which case the depth of disturbance may exceed 25 cm as permitted by the methodology. Where planting involves soil inversion,</p>

	<p>disturbance is permitted under the same conditions.</p> <p>b) Planting techniques that cause localized soil disturbance, such as pit planting, may exceed a depth of 25 cm.</p> <p>c) Where planting involves soil inversion (for example, ploughing), the depth must not exceed 25 cm (such as that caused by a moldboard plough) and may only occur once during the project crediting period.</p>	<p>the depth will not exceed 25 cm and inversion will happen only once during the crediting period.</p>
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VM0047 Area-based Approach Applicability Conditions (Section 4.2)

<p>VM0047 v1.1 Condition 1</p>	<p>Project activities involve direct planting activities (for example, manual planting, broadcast seeding), indirect activities associated with assisted natural regeneration (for example, liana cutting, weed management, or barriers that prevent animal grazing), or a combination of direct and indirect activities.</p>	<p>Project activities using the area-based quantification approach will be limited to direct planting.</p>
<p>VM0047 v1.1 Condition 2 (b)</p>	<p>Project Proponents establish a $t = 0$ carbon stock estimate for all significant carbon pools. The method for establishing $t = 0$ estimates depends on the activity that initiates the project start date.</p> <p>b) Where the project start date is defined by a land use change date or where the project start date did not include site preparation that caused a significant decrease in carbon stocks in monitored carbon pools (for example, pit planting without clearing existing vegetation), the following conditions must be met:</p> <p>i) The Project Proponent establishes $t = 0$ estimates within two years after the project start date.</p> <p>ii) Plot-based sampling occurs for all significant carbon pools.</p> <p>iii) Evidence is provided to demonstrate that site preparation did not involve clearing, burning, or mechanical disturbance of existing vegetation that would significantly reduce monitored carbon pools. Evidence may include, but is not limited to, georeferenced photos, field survey data, satellite imagery and signed attestations from landowners.</p>	<p>Site preparation will not be undertaken at project start, as this would decrease carbon stocks. Therefore, condition 2b applies.</p> <p>i) The $t = 0$ estimates will be established within two years of the PAI start date, where the area-based quantification approach is used.</p> <p>ii) Plot-based sampling will be conducted for all significant carbon pools.</p> <p>iii) The Project Proponent will provide evidence that site preparation did not involve clearing, burning or mechanical disturbance of existing vegetation that would reduce monitored carbon pools.</p>

<p>VM0047 v1.1 Condition 3</p>	<p>Leakage must be monitored and quantified using VMD0054. It must not be assumed to be de minimis.</p>	<p>For PAIs using the area-based quantification approach, leakage will be monitored and quantified in accordance with the most recent version of VMD0054 available at the time of monitoring.</p>
<p>VM0047 Census-based Approach Exclusion Conditions (Section 4.4)</p>		
<p>VM0047 v1.1 Condition 1</p>	<p>This methodology does not apply to projects where woody biomass, which serves a similar purpose as the planting units in the project, has been removed within the last 10 years (confirmed via pre-project photos and/or attestation).</p>	<p>The primary project activities are located in residential areas and croplands where woody biomass removal is understood to have occurred more than ten years ago during land conversion, rather than through recent extraction of similar tree types. In these areas, species are selected for their fruit-bearing capacity and their cultural and medicinal importance, which makes them unlikely to be removed for firewood. Community participation in species selection and planting-site decisions further ensures that trees are not removed for firewood or land conversion. Where targeted reforestation occurs, the Project Proponent will ensure not to select species that have been removed in the past 10 years based on pre-project photos and attestations.</p>
<p>VM0047 v1.1 Condition 2</p>	<p>This methodology does not apply to projects where soil disturbance from the project activity involves soil inversion to a depth exceeding 25 cm (for example, that would result from a moldboard plough).</p>	<p>Soil disturbance from project activities will not involve soil inversion deeper than 25 cm.</p>
<p>VM0047 Area-based Approach Exclusion Conditions (Section 4.4)</p>		
<p>VM0047 v1.1 Condition 1</p>	<p>This methodology is not applicable to projects when the project occurs on lands that have met the definition of managed forest at any point in the 10-year period immediately preceding the project start date.</p>	<p>No managed forests have existed in the project area for the 10 years prior to the project start date.</p>
<p>VM0047 v1.1 Condition 2</p>	<p>This methodology is not applicable to projects when clearing of pre-existing woody biomass involves timber harvesting or results in degradation of native ecosystems.</p>	<p>No clearing of existing woody biomass will take place.</p>
<p>VM0047 v1.1 Condition 3</p>	<p>This methodology is not applicable to projects when the project is planting fewer than 50 planting units/ha and could use the census-based approach.</p>	<p>Planting densities will average more than 50 planting units/ha across all land-use classes in PAIs using the area-based approach.</p>

Leakage Tool Applicability Conditions		
VMD0054 v1.1	Projects using this module must meet all applicability conditions of the VM0047 Methodology for ARR.	All applicability conditions of the VM0047 Methodology are met, as demonstrated in this table.
Additionality Tool Applicability Conditions		
VT0008 v1.0 Condition 2	The VCS Program rules and requirements require or permit the use of this tool.	The VCS Program rules and requirements allow the use of VT0008.

3.1.3 Project Boundary (VCS, 3.12)

Figure 17 shows a map of the project zone, which is made up of the Sabie and Sand River Catchments, as described in Section 2.1. The boundaries of the traditional authorities where the first PAI is planned to take place are also displayed. Project activities include agroforestry in the croplands and residential areas, quantified using the census-based approach. Potential cropland and residential areas outside of the traditional authorities are also displayed in the figure, whereas potential restoration sites outside of these areas will be mapped for future revisions of this PDD as the associated PAIs are introduced.

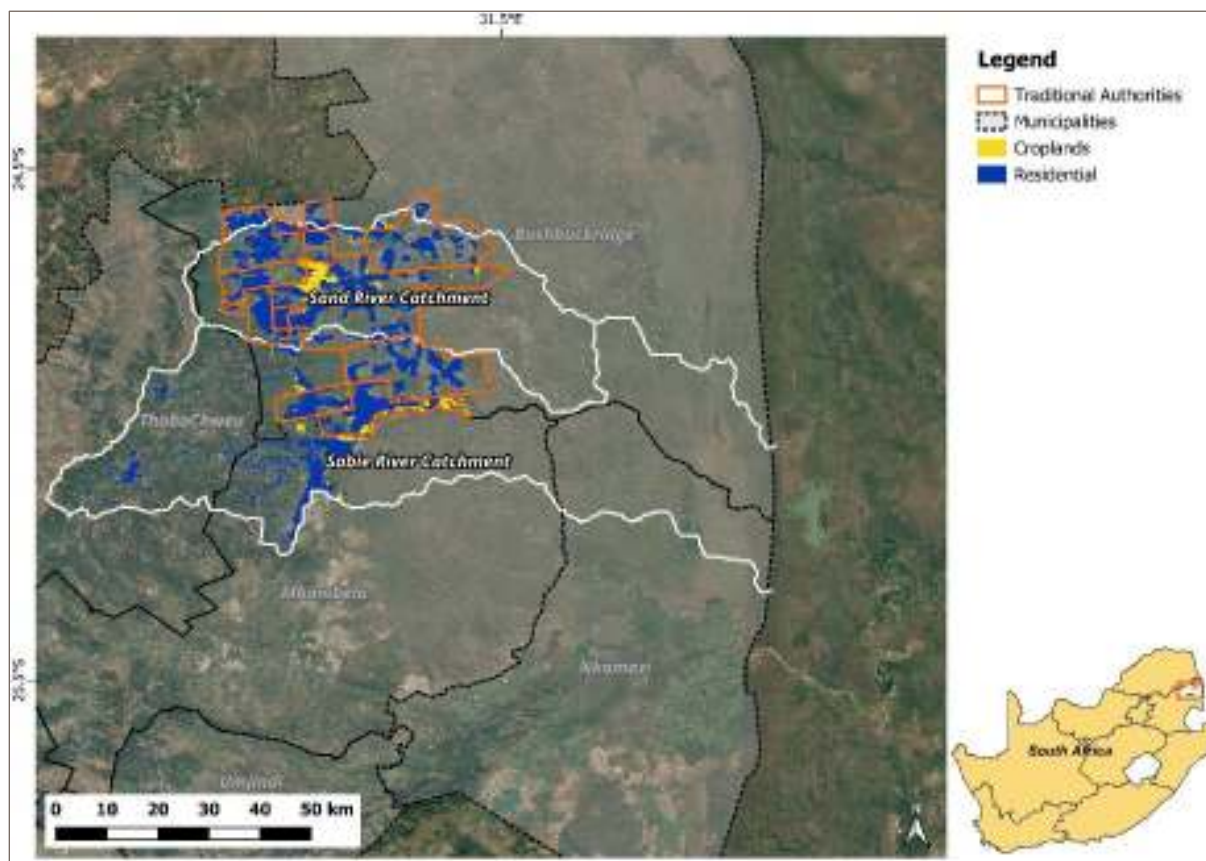


Figure 17. Map of the project zone, tribal authorities, cropland and residential areas.

The following table presents the relevant greenhouse gas (GHG) sources and sinks for the census-based quantification approach for both the baseline and project scenario. If any areas are added in future PAs that would follow the area-based approach, the relevant GHG sinks and sources in this table will be updated in the associated PDD.

Source	Gas	Included?	Justification/explanation	
Baseline	Aboveground woody biomass	CO ₂	Yes	Aboveground woody biomass is included as a major carbon pool in the baseline in accordance with VM0047 and is quantified as a stock change rather than as an emissions source.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Aboveground non-woody biomass	CO ₂	No	The carbon pool is excluded from the baseline in accordance with the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Belowground woody biomass	CO ₂	Yes	Belowground woody biomass is included as a major carbon pool in the baseline in accordance with VM0047 and is quantified as a stock change rather than as an emissions source.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Belowground non-woody biomass	CO ₂	No	The carbon pool is excluded from the baseline in accordance with the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Dead wood	CO ₂	No	The carbon pool is excluded from the baseline accordance with the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047

Source	Gas	Included?	Justification/explanation	
	Other	-	Not applicable for VM0047	
	Litter	CO ₂	No	The carbon pool is excluded from the baseline accordance with the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
		Soil organic carbon (SOC)	CO ₂	No
	CH ₄		-	Not applicable for VM0047
	N ₂ O		-	Not applicable for VM0047
	Other		-	Not applicable for VM0047
	Harvested Wood products	CO ₂	No	Wood products are not included in the baseline and VM0047, requires exclusion of this pool from the project boundary.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Burning of biomass	CO ₂	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047
		CH ₄	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047
N ₂ O		No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	
Other		-	Not applicable for VM0047	
Burning of fossil fuels	CO ₂	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	
	CH ₄	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	
	N ₂ O	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	
	Other	-	Not applicable for VM0047	
Emissions from nitrogen fertilizer	CO ₂	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	

Source	Gas	Included?	Justification/explanation	
	CH ₄	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	
	N ₂ O	No	This carbon pool is conservatively excluded from the baseline in accordance with VM0047	
	Other	-	Not applicable for VM0047	
Project	Aboveground woody biomass	CO ₂	Yes	Above-ground woody biomass is included as a major carbon pool in the project scenario in accordance with VM0047. This carbon pool is quantified as a stock change rather than as an emissions source.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Aboveground non-woody biomass	CO ₂	No	The carbon pool is conservatively excluded from the project in accordance with the exclusion requirement for the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Belowground woody biomass	CO ₂	Yes	Below-ground woody biomass is included as a major carbon pool in the project scenario in accordance with VM0047. This carbon pool is quantified as a stock change rather than as an emissions source.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Belowground non-woody biomass	CO ₂	No	The carbon pool is conservatively excluded from the project in accordance with the exclusion requirement for the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
Dead wood	CO ₂	No	The carbon pool is conservatively excluded from the project in accordance with the exclusion requirement for the census-based approach.	

Source	Gas	Included?	Justification/explanation	
	CH ₄	-	Not applicable for VM0047	
	N ₂ O	-	Not applicable for VM0047	
	Other	-	Not applicable for VM0047	
	Litter	CO ₂	No	The carbon pool is conservatively excluded from the project in accordance with the exclusion requirement for the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	SOC	CO ₂	No	The carbon pool is conservatively excluded from the project in accordance with the exclusion requirement for the census-based approach.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
	Harvested Wood products	CO ₂	No	Wood products are not included in the project scenario and VM0047, requires exclusion of this pool from the project boundary.
		CH ₄	-	Not applicable for VM0047
		N ₂ O	-	Not applicable for VM0047
		Other	-	Not applicable for VM0047
Burning of biomass	CO ₂	No	Carbon stock losses from burning within the project are treated as a carbon stock change	
	CH ₄	Yes	This GHG source is included in the project as required by VM0047, as it may be a significant source	
	N ₂ O	Yes	This GHG source is included in the project as required by VM0047, as it may be a significant source	
	Other	-	Not applicable for VM0047	
Burning of fossil fuels	CO ₂	No	The GHG source is excluded from the project, as it is considered de minimis according to VM0047	
	CH ₄	No	The GHG source is excluded from the project, as it is considered de minimis according to VM0047	

Source	Gas	Included?	Justification/explanation	
	N ₂ O	No	The GHG source is excluded from the project, as it is considered de minimis according to VM0047	
	Other	-	Not applicable for VM0047	
	CO ₂	No	The GHG source is conservatively excluded from the project in accordance with VM0047	
	CH ₄	No	The GHG source is conservatively excluded from the project in accordance with VM0047	
	Emissions from nitrogen fertilizer	N ₂ O	No	The GHG source is conservatively excluded. While nitrogen fertilizers are applied once during the rooting phase at the nursery, the resulting emissions, as defined in Appendix 2 of VM0047, are negligible. Nitrogen fertilizer use by project participants will be monitored and if the significance test in Appendix 2 substantiates inclusion, this emission will be accounted for.
		Other	-	Not applicable for VM0047

3.1.4 Baseline Scenario (VCS, 3.13)

In accordance with VM0047, the baseline scenario is defined differently for the census-based and area-based quantification approaches. For the census-based approach, the baseline is set to zero, as ARR would not be expected to occur naturally or through other means in the absence of the project. This applies to agroforestry tree planting in croplands in residential areas, which constitute the first PAI. Reforestation activities that meet the census-based applicability criteria will also be assigned a baseline of zero. For similar activities using the area-based quantification approach, the baseline will be determined through a Performance Benchmark analysis. This analysis will use remote sensing of a stocking index, such as Normalized Difference Vegetation Index (NDVI), over time in both project and comparable control plots to establish expected vegetation changes in the absence of the project. The procedure is outlined in Appendix 1 of VM0047. Where Performance Benchmarking is not possible, a plot-based baseline analysis will be conducted. The methods and results of these analyses will be included in revisions of the PDD as PAIs associated with area-based reforestation are introduced.

3.1.5 Additionality (VCS, 3.14)

3.1.5.1 Regulatory Surplus (VCS, 3.14)

Is the project located in an UNFCCC Annex 1 or Non-Annex 1 country?

- Annex 1 country Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

- Yes No

3.1.5.2 Additionality Methods (VCS, 3.14)

The additionality methods applicable to the census-based approach include: i) regulatory surplus, as detailed in Section 3.1.5.1; ii) a common practice analysis; and iii) an investment analysis. Where PAIs are added using the area-based approach, a dynamic Performance Benchmark analysis will be added to indicate carbon additionality to the baseline, per VM0047 requirements.

Common practice analysis

The project activities for the census-based quantification approach are not considered common practice within the project zone. These include agroforestry tree planting in croplands and residential areas under the initial PAI and reforestation in eligible areas in future PAIs. From in-field observations and discussions with community members and relevant stakeholders, there is a cultural tradition of residential tree planting in the project zone, but this is limited to a few fruit-bearing species such as mango and avocado. Systematic integration of native and culturally significant tree species into residential areas is uncommon. Agroforestry in croplands and restoration of degraded areas are seldom undertaken without external incentives. Several national and subnational policies, such as Actionable Guidelines for the Implementation of Climate-Smart Agriculture²⁰¹, the National Climate Change Adaptation Strategy²⁰², the Mpumalanga Province Climate Change Mitigation Strategy and Implementation Plan²⁰³, emphasize land rehabilitation and climate-smart agriculture. However, these remain largely aspirational due to limited institutional capacity, fragmented implementation and insufficient financial incentives. Without carbon finance, adoption of these diversified practices has been minimal, particularly at the scale proposed by this project.

Unlike isolated planting efforts, this project is distinguished by its integrated design and emphasis on diversifying species composition beyond common fruit trees, while also incorporating community-driven planning that combines agroforestry and reforestation. Barriers such as limited access to quality seedlings, weak market linkages, insecure tenure and inadequate extension services continue to constrain uptake of these practices.

In line with VM0047 requirements, a representative survey of landowners and households will be conducted within five years of the start date of each PAI to quantify adoption rates in the absence of carbon finance. These surveys will be incorporated into the project's implementation plan and integrated in the onboarding process for new participants, ensuring that the project design reflects evidence of non-common practice. Where available, government statistics or independent data will be applied to support the analysis. Through this combined approach, the Project Proponent will demonstrate that limited fruit tree planting is a cultural norm in residential areas. However, the integrated and diversified planting strategy – together with agroforestry in croplands and reforestation – is not common practice and would not occur without carbon finance.

Investment Analysis

In accordance with VM0047, an investment analysis is required only when revenues are generated beyond carbon credit sales. The project is not expected to generate revenues beyond carbon credit sales and, therefore, an investment analysis is not required.

²⁰¹ Department of Environment, Forestry and Fisheries (DFFE). 2020. Actionable Guidelines for the Implementation of Climate Smart Agriculture in South Africa: Volume 2 – Climate Smart Agriculture Practices. Pretoria, South Africa. Retrieved from: https://www.dffe.gov.za/sites/default/files/docs/strategy.framework/ccaq/csa_volume2.pdf.

²⁰² DFFE. 2020. National Climate Change Adaptation Strategy. Pretoria, South Africa. Retrieved from: https://soer.environment.gov.za/soer/UploadLibraryImages/UploadDocuments/270122125139_National%20Climate%20Change%20Adaptation%20Strategy%202020.pdf.

²⁰³ Agriculture, Rural Development, land and environmental affairs. 2023. Mpumalanga Climate Change Mitigation Strategy and Implementation Plan. Nelspruit. South Africa. Retrieved from: <https://letsrespondtoolkit.org/wp-content/uploads/2023/03/Mpumalanga-Climate-Change-Mitigation-Strategy-And-Implementation-Plan-2022.pdf>.

Performance Benchmark

The Performance Benchmark analysis applies only to areas where removals are quantified using the area-based approach. For the first PAI, the census-based approach is used to quantify agroforestry tree planting in croplands and residential tree planting. Therefore, the Performance Benchmark is not explicitly modelled in this PDD. For reforestation areas added during subsequent PAIs that require the area-based approach, a Performance Benchmark analysis will be conducted in accordance with the procedures set out in Appendix 1 of VM0047. The analysis will compare project sites with representative control areas using remote sensing of a stocking index and apply the required statistical Z test to determine whether project performance differs significantly from the benchmark. Project activities in these areas will commence only if the Performance Benchmark shows additionality beyond the baseline scenario, to ensure that carbon benefits are additional and conservatively quantified.

3.1.6 Methodology Deviations (VCS, 3.20)

The Project Proponent requests a deviation to apply the VM0047 census-based approach at planting densities of up to 100 trees/ha on croplands. This deviation relates to the census-based provisions in VM0047 v1.1, specifically the Summary (Section 1.2) and Applicability Conditions (Section 4.3). These provisions state that the census-based approach applies only where activities do not occur in forests or result in land-use changes, and they limit planting density to 50 planting units/ha.

The project design applies the census-based quantification approach to agroforestry on active croplands at up to 100 trees/ha, exceeding the current 50 trees/ha threshold. This density is consistent with Africa-based agroforestry guidance and practice: i) the Food and Agricultural Organization (FAO) documents 50–100 trees/ha for cereal-based FMNR systems in Niger²⁰⁴; ii) CIFOR-ICRAF report 40 to >150 trees/ha in Sahelian parklands²⁰⁵; and iii) technical guidance for *Faidherbia albida* recommends ~100 trees/ha in cropland (with later thinning)²⁰⁶. These analogs indicate the proposed 100 trees/ha is within established practice for crop–tree systems in the region. A brief photographic record of representative local field conditions and canopy development will be maintained to support verification and stakeholder confidence. All other VM0047 requirements and census-based criteria remain unchanged. These state that:

- the land will remain classified as non-forest, with pre-project cropland use maintained throughout the project crediting period;
- project sites will continue to meet census-based applicability conditions, including <10% pre-existing woody cover or continuous cropping, settlements and other lands;
- quantification will continue to rely on a complete census at $t = 0$ to establish N , with biomass estimated by sampling and scaled by N as specified; and
- all measurement techniques, equations, sampling procedures, mortality treatment, accounting boundaries and monitoring plan elements remain as specified in VM0047.

The deviation does not reduce the conservativeness of the carbon dioxide (CO₂) removal quantification and the mechanics of the census-based quantification approach remain unchanged. A complete enumeration (N) will be conducted at $t = 0$. Biomass per unit will be obtained through sampling. Removals will then be scaled by N with mortality applied. Therefore, increasing planting density from 50/ha to 100/ha does not reduce the conservativeness of the calculations; it only increases the number of units to which

²⁰⁴ Rinaudo, T. n.d. SLM Technology: Farmer Managed Natural Regeneration – Niger. FAO. Retrieved from: <https://www.fao.org/4/i1861e/i1861e08.pdf>.

²⁰⁵ Garrity, DP & Bayala, J. 2019. Zinder: farmer-managed natural regeneration of Sahelian parklands in Niger. In M. van Noordwijk (Ed.), Sustainable development through trees on farms: agroforestry in its fifth decade (pp. 153-174). Bogor, Indonesia: World Agroforestry (ICRAF).

²⁰⁶ Hargrave, B. 2010. *Faidherbia albida*, and important 'Fertilizer Tree'. Echo community. Available at: https://www.echocommunity.org/resources/7b5614b0-8854-40cd-a75b-5c28f552654d?utm_source=chatgpt.com. Accessed on 30 October 2025.

the same equations and Quality Assurance and Quality Control (QA/QC) measures are applied. Accounting boundaries and separation rules remain unchanged. The required GHG sinks and sources will still be applied to the baseline and projected scenarios. Moreover, each planting unit retains the prescribed 10-m radius buffer and overlap conditions to prevent double-counting. A leakage management plan is included to account for any loss of crop production due to planting 100 trees/ha. This preserves the intent of the method, as the census approach applies to ARR activities that do not occur in forests or result in land-use changes.

The proposed density of up to 100 trees/ha remains below the threshold for forest classification under the FAO definition, which defines forest as land spanning more than 0.5 ha with trees taller than 5 m and canopy cover exceeding 10%, and not primarily under agricultural use. In this project, trees are arranged in alley-cropping configurations, with smaller species or periodically pruned individuals planted in widely spaced rows within cropland and larger species confined to field boundaries. Based on expected mature crown diameters of 3–5 m and the proposed row geometry, the aggregate projected crown area across each hectare may reach up to ~15 to 20%. However, crowns are discontinuous, separated by wide cropping alleys, and regularly pruned to prevent closure. As a result, the continuous canopy cover – the metric used for forest classification – remains below the 10% threshold over any contiguous area ≥ 0.5 ha. Crops continue to dominate land use and periodic monitoring of canopy cover, tree height and spatial contiguity will ensure that the land remains classified as non-forest throughout the crediting period. The project design maintains the pre-project land use (agriculture) throughout the project lifetime. Crop production remains the primary land use. All agroforestry activities are supplementary and designed to enhance soil fertility, shade regulation and microclimate without converting land to tree-dominated systems. Annual monitoring of canopy cover, crop productivity and spatial contiguity will verify that land-use classification as cropland is maintained.

Training, implementation and monitoring plans incorporate canopy and contiguity controls, along with adaptive design measures, to ensure that cropland remains suitable for agriculture with agroforestry of up to 100 trees/ha. Design measures include: i) planting densities tailored to site conditions; ii) rows oriented north–south to minimize shading; iii) interior rows spaced at least twice the mature tree height; and iv) rows on the south and west perimeters to provide wind protection. Tree species that exceed 10 m should be confined to boundaries with wide spacing or scattered individually across fields. Pollarding²⁰⁷ and trimming reduces tree competition, provides mulch for soil fertility and improves microclimate regulation and soil moisture retention. Such practices prevent canopy closure, maintain open cropping space and preserve sunlight for crop growth – ensuring that continuous cropping is maintained. These activities will not exceed more than 20% of carbon stocks within five years from the onset of the reduction and do not constitute harvesting as per the VCS Program Definitions v4.5²⁰⁸.

To ensure compliance with non-forest criteria, canopy cover and tree height will be periodically measured. Should projections indicate crown cover approaching forest definition thresholds, management actions will be implemented to maintain open-canopy conditions. If any mapped sub-area approaches canopy closure, it will be segmented with a minimum 10-m separation buffer and converted into a new non-overlapping PAI, where the area-based quantification approach is applied. This is consistent with VM0047's rule that projects may combine approaches only in clearly separated, non-overlapping areas. For such converted PAIs, a Performance Benchmark analysis for the baseline and additionality will be conducted. Direct measurements of crop production will also be conducted to account for any potential leakage associated with canopy closure. The approach ensures that any reductions in agricultural yields are captured and factored into the quantification process. All other requirements of the area-based quantification approach will be met if an area is converted from the census-based approach.

²⁰⁷ A tree management technique where the upper branches are cut back to a defined height to stimulate dense shoot regrowth, while controlling size, reducing shade and extending tree lifespan.

²⁰⁸ Verra. 2024. VCS Program Definitions. V4.2. Available at: <https://verra.org/wp-content/uploads/2024/08/VCS-Program-Definitions-v4.2.pdf>

3.2 Quantification of Estimated GHG Emission Reductions and Removals

3.2.1 Baseline Emissions (VCS, 3.15)

According to the VM0047 v1.1 ARR Methodology²⁰⁹, baseline GHG emissions and carbon stock changes are determined using either a census-based or an area-based quantification approach. For both approaches, GHG emissions from nitrogen fertilizer use and the burning of biomass or fossil fuels are conservatively excluded from the baseline. For activities that apply the census-based approach, the baseline is defined as the absence of planting units, resulting in zero changes to carbon stock. By contrast, the area-based approach requires a Performance Benchmark analysis, which estimates baseline stocks by comparing relative changes between control and project plots. Where carbon stocks in control plots increase, this amount is deducted from the CO₂ removals achieved by project activities, as per the guidelines in Appendix 1 of VM0047.

The project follows a grouped design, with several PAIs scheduled for later timesteps or for different activities. The first PAI — which is the focus of this PDD — is quantified using the census-based approach and comprises: i) residential planting in urban, peri-urban and rural areas; and ii) agroforestry planting in croplands. In line with VM0047, baseline carbon stock changes for both activities in the first PAI are zero. For future PAIs, either the census-based or the area-based approach will be applied, depending on site-specific conditions. If the area-based approach is adopted, the Performance Benchmark procedure will be followed and the relevant VM0047 equations will be included in an updated PDD. All calculations for each implemented PAI will be recorded in the Emission Reduction and Removal Calculation Spreadsheet to allow full reproduction of results.

3.2.2 Project Emissions (VCS, 3.15)

Because the project uses a grouped design and only the first PAI is included in this PDD, this section describes the methods for estimating project emissions using the census-based approach. If area-based PAIs are added in future, the PDD will be updated with the relevant equations. Net project emissions are calculated by subtracting GHG emissions from fertilizer use and biomass burning from the GHG removals achieved through ARR activities. As outlined in Section 3.1, the census-based approach accounts only for above- and below-ground woody biomass carbon pools, with CO₂ removals derived from estimates of carbon stocks in planting units scaled up to the PAI. Above-ground woody biomass for each planting unit is first estimated and then converted to carbon using a carbon fraction²¹⁰ and an appropriate root-to-shoot ratio²¹¹ (Equation 4). The average woody biomass carbon stock per planting unit is scaled to the number of surviving units in the PAI (Equation 3), producing the average woody biomass carbon stock for the PAI in each monitoring year. Changes in carbon stock over time are calculated as the difference between these averages (Equation 2) and the result is converted to CO₂ equivalent using the molecular weight ratio of CO₂ to carbon. Pre-existing woody biomass is assumed to be zero, as only biomass introduced by project activities is included for this approach. The equations used in these calculations are provided in the sub-sections below.

²⁰⁹ Verra. 2025. VM0047. Methodology for Afforestation, Reforestation and Revegetation. Version 1.1. Available at: <https://verra.org/methodologies/vm0047-afforestation-reforestation-and-revegetation-v1-1/>.

²¹⁰ Intergovernmental Panel on Climate Change (IPCC). 2019. Chapter 4: Forest Land. In 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use. IPCC. Bonn. Available at: https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch04_Forest%20Land.pdf.

²¹¹ IPCC. 2019. Chapter 4: Forest Land. In 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use. IPCC. Bonn. Available at: https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch04_Forest%20Land.pdf.

Project carbon stock changes

Project carbon stock change refers to the CO₂ equivalent of the total change in above- and below-ground woody biomass carbon stocks resulting from project activities.

$\Delta C_{WP,t} = (\Delta C_{WP-woody,t}) \times \frac{44}{12} \quad (1)$	
$\Delta C_{WP,t}$	Project carbon stock change through year t (t CO ₂ e)
$\Delta C_{WP-woody,t}$	Change in carbon stock in woody biomass in the project scenario through year t (tC)
44/12	Ratio of molecular weight of carbon dioxide to carbon (dimensionless)
t	1, 2, 3, ..., t years elapsed since the project start date

Census-based quantification of woody biomass

The change in woody biomass carbon stocks under the project scenario is expressed as the difference in average carbon stock over time.

$\Delta C_{WP-woody,t} = C_{WP-woody,t} \quad (2)$	
$\Delta C_{WP-woody,t}$	Change in carbon stock in woody biomass in the project scenario through year t (tC)
$C_{WP-woody,t}$	Average carbon stock in woody biomass in the project scenario in year t (tC)
t	1, 2, 3, ..., t years elapsed since the project start date

Woody biomass carbon stock in the project scenario is calculated by scaling the average carbon stock per planting unit to the total number of planting units, adjusted for mortality, as per the equation below.

$C_{WP-woody,t} = N \times (1 - M_t) \times C_{WP-woody-pu_{avg,t}} \quad (3)$	
$C_{WP-woody,t}$	Average carbon stock in woody biomass in the project scenario in year t (tC)
N	Initial population size (number of planting units)
M_t	Mortality through year t (%)

$C_{WP-woody-pu_{avg},t}$	Average carbon stock in woody biomass per planting unit pu in the project scenario in year t (tC/planting unit)
t	1, 2, 3, ..., t years elapsed since the project start date

The average woody biomass carbon stock per planting unit is calculated using the following equation:

$C_{WP-woody-pu_{avg},t} = \frac{1}{n_t} \times \sum_{pu=1}^{n_t} (B_{WP-woody-AB,pu,t} \times (1 + R) \times CF) \quad (4)$	
$C_{WP-woody-pu_{avg},t}$	Average carbon stock in woody biomass per planting unit (pu) in the project scenario in year t (tC/planting unit)
n_t	Number of planting units sampled in year t (integer)
$B_{WP-woody-AB,pu,t}$	Estimated biomass stock in aboveground woody biomass in sampled planting unit pu in the project scenario in year t (t d.m.)
R	Root to shoot ratio (t root d.m./t shoot d.m.)
CF	Carbon fraction of dry biomass (t C/t d.m.)
t	1, 2, 3, ..., t years elapsed since the project start date

Census-based quantification of emissions from biomass burning

Ex-ante estimates of emissions from biomass burning are not conducted for the first PAI, as fires rarely occur in residential and cropland areas of the project zone. MODIS data for area burned across the Sabie and Sand River Catchments in 2025, categorized by land use, shows that less than 2% of fires occur in croplands with none in residential areas²¹². Fire occurrence will be monitored during implementation. If emissions are considered material, they will be estimated ex-post in line with Appendix 2 of VM0047 and the PDD will be updated accordingly.

Census-based quantification of emissions from fertilizer use

Emissions from fertilizer use are excluded from ex-ante estimates, as fertilizer application is not part of project activities. During implementation, fertilizer use will be monitored through a combination of field surveys and attestations from project participants. This is to demonstrate that reductions in fertilizer use on croplands are observed over time. Agroforestry is expected to enhance soil quality and water retention, thereby lowering the need for fertilizer inputs and increasing crop resilience to climate change. If monitoring shows fertilizer use above the de minimis threshold, emissions will be quantified ex-post per VM0047 Appendix 2, and this section of the PDD will be updated.

²¹² Giglio L, Justice C, Boschetti L & Roy D. 2021. MODIS/Terra+Aqua Burned Area Monthly L3 Global 500m SIN Grid V061 [Data set]. NASA Land Processes Distributed Active Archive Center. <https://doi.org/10.5067/MODIS/MCD64A1.061>
Date Accessed: 2025-10-28.

3.2.3 Leakage Emissions (VCS 2.5, 3.2, 3.6, 3.15, 4.3)

In accordance with VM0047, leakage is assumed to be zero for the census-based quantification approach, as planting occurs within existing land uses and does not involve land-use change or displacement of production. For the first PAI, which applies the census-based approach to agroforestry in residential areas and on croplands, no leakage emissions are included. Potential indirect effects, such as changes in crop yields, will be monitored, and a leakage management plan is in place to address any displacement should it be observed (see Section 2.6). If any future PAIs are implemented under the area-based approach, site-specific leakage assessments will be undertaken and leakage emissions estimated in accordance with the VMD0054 *Module for Estimating Leakage from ARR Activities*²¹³.

3.2.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals (VCS, 3.15, 4.1)

CO₂ removals using the census-based quantification approach are calculated with baseline carbon stock changes (see Section 3.2.1) and leakage (see Section 3.2.3) assumed to be zero. The following equation is applied:

$$CR_t = (\Delta C_{WP,t} \times (1 - UNC_t)) - (\Delta C_{WP,t-x} \times (1 - UNC_{t-x})) - PE_t \quad (5)$$

CR_t	Carbon dioxide removals from the project activity over the monitoring interval ending in year t (t CO ₂ e)
$\Delta C_{WP,t}$	Project carbon stock change through year t (t CO ₂ e)
UNC_t	Uncertainty in cumulative removals through year t (%)
PE_t	Project emissions from biomass burning and fertilizer use in year t (t CO ₂ e)
t	1, 2, 3, ..., t years elapsed since the project start date

Ex-post estimation of above-ground woody biomass is based on field measurements of tree height and diameter at breast height (DBH) for a representative sample of planting units. These data are combined with either a generic allometric equation²¹⁴ or, where available, species-specific allometric equations (see Section 3.3), and where these are not feasible, the volume approach reported by the FAO will be used²¹⁵. Monitoring activities, such as in-field observations and remote sensing, are used to estimate emissions from biomass burning as a result of fire occurrence, and surveys are used to determine if fertilizer was applied to project trees and the amounts applied. This information is used to estimate the net project emissions for a specific monitoring period.

For ex-ante estimations, growth simulations were generated using the forest simulator model developed by the World Agroforestry Centre (ICRAF) and IRD²¹⁶. The model applies the Richards–Chapman growth function to predict DBH over time, using default shape and growth parameters and associated competition modifiers within the simulator. Because the project employs a guild-based approach, specific species parameters are not yet required; instead, planting units are grouped into small, medium and large guilds with assumed asymptotic maxima of 5 m, 10 m, and 15 m in height, and corresponding maximum DBH values of 0.4 m, 0.6 m, and 0.8 m, respectively. The simulator’s default height–DBH,

²¹³ Verra. 2025. VMD0054. Module for estimating leakage from ARR activities. Version 1.0. Available at: https://verra.org/wp-content/uploads/2023/09/VMD0054_ARR-Leakage-Module_v1.0.pdf.

²¹⁴ Chave J, et al. 2014. Improved allometric models to estimate the above-ground biomass of tropical trees. *Global Change Biology*, 20(10), 3177-3190. <https://doi.org/10.1111/gcb.12629>.

²¹⁵ FAO. 2025. Methods for estimating biomass density from existing data. FAO. Available at: <https://www.fao.org/4/W4095E/w4095e06.htm>. Accessed on: 30 October 2025.

²¹⁶ World Agroforestry Centre (ICRAF) & Institut de Recherche pour le Développement (IRD). (2017). *SExi-FS*. World Agroforestry Centre (ICRAF). Available at: <https://apps.worldagroforestry.org/sea/Products/AFModels/SExi/index.htm>. Accessed on 30 October 2025.

crown-width-DBH, and crown-height allometric relationships are retained to maintain internal consistency with its light-competition and growth modules. These settings represent conservative averages for tropical dry forest conditions. The growth simulations account for light competition, space, topography and soil quality, which influence DBH and height trajectories over the project lifespan.

In the residential areas within this PAI – comprising 30,000 ha – 50 small, medium and large planting units are modelled per hectare using a random spacing design, reflecting the irregular distribution created by buildings, roads, gardens and other infrastructure. For cropland areas – comprising 10,000 ha – 100 planting units are modelled per hectare. Larger trees are placed along the southern and western boundaries to act as windbreaks and reduce shading, while medium and small trees are planted in north-south oriented rows at least 15 m wide to maintain sufficient space for annual cropping. Smaller woody shrubs may be planted beneath these rows, or the understory used for cover crops such as grasses or fodder species. These planting configurations are incorporated into the simulations to represent residential and cropland conditions.

Above-ground biomass for each planting unit in each guild is estimated from simulated height and DBH using a cylindrical volume approach. Stem volume is converted to dry biomass using a biomass conversion and expansion factor (BCEF) of 1.25, derived from IPCC default component ratios for tropical dry forests²¹⁷, and a mean wood density representative of African tropical dry forest species²¹⁸. Below-ground biomass is added using a root-to-shoot ratio of 0.29 for South Africa²¹⁹. Equations (4), (3), (2) and (1) in Section 3.2.2 are then applied sequentially to derive changes in carbon stock and corresponding CO₂ removals for the PAI.

Considerations for phased implementation are included, with agroforestry in croplands implemented over four years (1 million trees) and in residential areas over five years (1.5 million trees). Estimates of emissions from biomass burning and fertilizer use are excluded, as described in Section 3.2.2, and, in line with VM0047 guidance, a conservative uncertainty deduction of 10% is applied to ex-ante calculations.

State the non-permanence risk rating (%)	16
Has the non-permanence risk report been attached as either an appendix or a separate document?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
For ARR and IFM projects with harvesting, state, in tCO _{2e} , the Long-term Average (LTA).	Not applicable as the project does not involve harvesting.
Has the LTA been updated based on monitored data, if applicable?	<input type="checkbox"/> Yes <input type="checkbox"/> No Not applicable.
State, in tCO _{2e} , the expected total GHG benefit to date.	0
Is the number of GHG credits issued below the LTA?	<input type="checkbox"/> Yes <input type="checkbox"/> No Not applicable.

²¹⁷ Intergovernmental Panel on Climate Change (IPCC). (2019). 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse-Gas Inventories. Retrieved from <https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/>.

²¹⁸ Carsan S, Orwa C, Harwood C, Kindt R, Stroebe A, Neufeldt H, Jamnadass R. 2012. African Wood Density Database. World Agroforestry Centre, Nairobi.

²¹⁹ Food and Agriculture Organization of the United Nations (FAO). 2025. *Global Forest Resources Assessment 2025 (FRA 2025) – Country reports: South Africa*. Retrieved from: <https://openknowledge.fao.org/handle/20.500.14283/A03520EN>.

Verra defines *project emissions* as the combined total of GHG emissions and removals, with negative values representing CO₂ removals from the atmosphere. Under the census-based approach applied in this project, baseline and leakage emissions are zero and emissions from biomass burning and fertilizer use are excluded (see Section 3.2.2). The risk buffer contribution reflects the 16 % deduction estimated using the Non-Permanence Risk Tool, while the CO₂ removals presented already incorporate deductions for uncertainty. As this is an ARR project, it contributes solely to removals through tree planting, with no reductions from project activities. A summary of the estimated project overall GHG emissions balance over the 40-year crediting period is provided in the table below. Estimated project emissions represent the removals, less emissions, the buffer pool allocation indicates the number of credits that are deducted for non-permanence and the estimated removal VCUs are the total credits eligible to offset or trade.

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions (tCO ₂ e) ²¹⁹ F ₂₂₀	Estimated leakage emissions (tCO ₂ e)	Estimated buffer pool allocation (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e)	Estimated removal VCUs (tCO ₂ e)	Estimated total VCU issuance (tCO ₂ e) ²²² O _{F221}
01-Jan-2026 to 31-Dec-2026 ^{221F222}	-	-32	-	6	-	26	26
01-Jan-2027 to 31-Dec-2027	-	-511	-	91	-	420	420
01-Jan-2028 to 31-Dec-2028	-	-2,643	-	470	-	2,173	2,173
01-Jan-2029 to 31-Dec-2029	-	-8,856	-	1,574	-	7,282	7,282
01-Jan-2030 to 31-Dec-2030	-	-22,191	-	3,945	-	18,246	18,246
01-Jan-2031 to 31-Dec-2031	-	-45,677	-	8,120	-	37,556	37,556
01-Jan-2032 to 31-Dec-2032	-	-79,185	-	14,077	-	65,108	65,108
01-Jan-2033 to 31-Dec-2033	-	-118,939	-	21,145	-	97,795	97,795
01-Jan-2034 to 31-Dec-2034	-	-160,558	-	28,544	-	132,014	132,014
01-Jan-2035 to 31-Dec-2035	-	-201,471	-	35,817	-	165,654	165,654
01-Jan-2036 to 31-Dec-2036	-	-240,440	-	42,745	-	197,695	197,695

²²⁰ This column represents the overall GHG emission balance, project emissions less removals. The negative value indicates net removals.

²²¹ This column represents the potential credits for offset or trade after the buffer pool allocation for non-permanence has been deducted.

²²² Note that the year 2026 represents the zeroth year, also known as the time of planting, where the associated ERRs are related to the carbon sequestered during growth of the tree sapling in the nursery.

01-Jan-2037 to 31-Dec-2037	-	-276,368	-	49,132	-	227,236	227,236
01-Jan-2038 to 31-Dec-2038	-	-306,783	-	54,539	-	252,244	252,244
01-Jan-2039 to 31-Dec-2039	-	-330,001	-	58,667	-	271,334	271,334
01-Jan-2040 to 31-Dec-2040	-	-343,999	-	61,155	-	282,844	282,844
01-Jan-2041 to 31-Dec-2041	-	-349,795	-	62,186	-	287,609	287,609
01-Jan-2042 to 31-Dec-2042	-	-348,634	-	61,979	-	286,655	286,655
01-Jan-2043 to 31-Dec-2043	-	-345,762	-	61,469	-	284,293	284,293
01-Jan-2044 to 31-Dec-2044	-	-340,199	-	60,480	-	279,719	279,719
01-Jan-2045 to 31-Dec-2045	-	-333,831	-	59,348	-	274,484	274,484
01-Jan-2046 to 31-Dec-2046	-	-326,871	-	58,110	-	268,761	268,761
01-Jan-2047 to 31-Dec-2047	-	-320,215	-	56,927	-	263,288	263,288
01-Jan-2048 to 31-Dec-2048	-	-312,563	-	55,567	-	256,996	256,996
01-Jan-2049 to 31-Dec-2049	-	-304,513	-	54,136	-	250,378	250,378
01-Jan-2050 to 31-Dec-2050	-	-296,588	-	52,727	-	243,861	243,861
01-Jan-2051 to 31-Dec-2051	-	-289,263	-	51,425	-	237,839	237,839
01-Jan-2052 to 31-Dec-2052	-	-280,725	-	49,907	-	230,818	230,818
01-Jan-2053 to 31-Dec-2053	-	-272,745	-	48,488	-	224,257	224,257
01-Jan-2054 to 31-Dec-2054	-	-265,752	-	47,245	-	218,507	218,507
01-Jan-2055 to 31-Dec-2055	-	-258,509	-	45,957	-	212,552	212,552

01-Jan-2056 to 31-Dec-2056	-	-251,464	-	44,705	-	206,759	206,759
01-Jan-2057 to 31-Dec-2057	-	-243,964	-	43,371	-	200,593	200,593
01-Jan-2058 to 31-Dec-2058	-	-236,241	-	41,998	-	194,243	194,243
01-Jan-2059 to 31-Dec-2059	-	-228,827	-	40,680	-	188,146	188,146
01-Jan-2060 to 31-Dec-2060	-	-222,030	-	39,472	-	182,558	182,558
01-Jan-2061 to 31-Dec-2061	-	-215,954	-	38,392	-	177,562	177,562
01-Jan-2062 to 31-Dec-2062	-	-210,754	-	37,467	-	173,286	173,286
01-Jan-2063 to 31-Dec-2063	-	-204,815	-	36,411	-	168,403	168,403
01-Jan-2064 to 31-Dec-2064	-	-198,849	-	35,351	-	163,498	163,498
01-Jan-2065 to 31-Dec-2065	-	-193,019	-	34,315	-	158,705	158,705
01-Jan-2066 to 31-Dec-2066	-	-186,919	-	33,230	-	153,689	153,689
Total	-	-9,176,456	-	1,631,370	-	7,545,086	7,545,086

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation (VCS, 3.16)

The following tables provide the data and parameters available at validation for the first PAI, which includes agroforestry in both croplands and residential areas quantified using the census-based approach. These tables will be updated for every addition of a new PAI using the area-based approach.

Data / parameter	A
Data unit	Ha
Description	Project area
Equations	(3), (5), (7), (9), (11)
Source of data	Calculated from Geographic Information System (GIS) data
Value applied	The project zone – made up of the Sabie and Sand River catchments – consists of 630,000 ha. Planting activities are allowed on all eligible land within the project zone. Save the Sand is a grouped project, with several PAIs, of which the first will encompass activities in two land use classes, residential and cropland, within customary land. These are associated with 30,000 and 10,000 ha, respectively. Additional areas will be added to this table in updated versions of the PDD upon the addition of new PAIs.

Justification of choice of data or description of measurement methods and procedures applied	Delineation of the project area used a combination of GIS coverage and remote satellite imagery. A Google satellite basemap was used and the project boundaries were digitized directly on this imagery. Geo-referencing was therefore achieved by aligning polygons with visible landmarks and features in the basemap (for example, field edges, roads and intersections). No additional ground control points were applied, as the basemap itself provides the spatial reference framework.
Purpose of data	Calculation of project emissions and removals
Comments	The project activity will be implemented on more than one discrete area of land. These are categorized into land use: residential and cropland.

Data / parameter	N
Data unit	Integer
Description	Initial population size (number of planting units)
Equations	(24), (27), (30)
Source of data	Complete census/enumeration
Value applied	<p>The original population size (N) is established via an initial complete census of all planting units. For each planting unit, the following must be recorded in the project description:</p> <ol style="list-style-type: none"> 1) Unique ID 2) Geo-referenced point of the location 3) Year planted 4) Species <p>The total number of trees that will be planted during the initial PAI is 2.5 million. Residential planting will occur over an area of 30,000 ha at 50 trees/ha, making up 1.5 million trees. Agroforestry in croplands will occur over an area of 10,000 ha at 100 trees/ha, making up 1 million trees.</p>
Justification of choice of data or description of measurement methods and procedures applied	See "Source of data." A full census ensures accurate baseline population accounting for all planting units under the project.
Purpose of data	Calculation of project removals
Comments	Planting units must be clearly defined (for example tree, shrub, bamboo clump) and identifiable in the field.

Data / parameter	R
Data unit	Dimensionless
Description	Root-to-shoot ratio, i.e., the ratio of belowground (root) biomass to aboveground biomass per unit area or per stem
Equations	(4), (25)
Source of data	<p>For project activities involving facilitated natural regeneration or with more than two species in a single stand, R must be chosen from the following, listed in descending order of preference:</p> <ol style="list-style-type: none"> 1) Values specific to the forest type within the same ecoregion (defined at the biome level per Olson et al. 2001) or Holdridge life zone as the project region 2) Global values specific to the forest type (for example, Table 4.4 in Chapter 4, Volume 4 of the 2019 Refinement to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines) <p>Otherwise (for example, monoculture plantations), R must be chosen from:</p> <ol style="list-style-type: none"> 3) Values specific to the species, genus, or family within the same ecoregion or Holdridge life zone as the project region 4) Global values specific to the species, genus, or family (for example, Table 4.4 in Chapter 4, Volume 4 of the 2019 IPCC Refinement)

	Where a global R ratio is used, it must be developed from or validated with datasets including direct destructive sampling measurements from the same ecoregion or Holdridge life zone.
	Since more than two species are being planted as part of the project activity, option 1) was selected and a country-specific value for the root-to-shoot ratio was applied based on forest type. The source is Table 2c (pg 27) in the Food and Agriculture Organization of the United Nations (FAO) country-specific Forest Resources Assessment (FRA) Report for South Africa (2020) ²²³ .
Value applied	0.25
Justification of choice of data or description of measurement methods and procedures applied	See “Source of data.” The selection hierarchy ensures that the most regionally accurate and scientifically robust R value is applied.
Purpose of data	Calculation of project removals
Comments	None

Data / parameter	CF
Data unit	t C/t.d.m.
Description	Carbon fraction of dry biomass
Equations	(6), (8), (10), (13), (25)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	The IPCC default value of 0.47 represents the average proportion of carbon in dry biomass, derived from laboratory analyses across a wide range of vegetation types. Reported values generally fall between 0.45 and 0.50, and 0.47 provides a conservative midpoint that avoids underestimation. Adoption of this parameter ensures consistency with VM0047, alignment with international reporting standards and verifiable estimates for project removals.
Purpose of data	Calculation of project removals
Comments	None

Data / parameter	COMF
Data unit	Dimensionless
Description	Combustion factor, representing the fraction of pre-fire biomass combusted during a fire event
Equations	(12), (26)
Source of data	Default mean values from Table 2.6 in Chapter 2, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	The combustion factor is selected based on the quantification approach and vegetation type. For the census-based approach, a conservative value of 1.0 is applied. For any area-based PAIs added in future, a specific value will be added to this table in the updated version of the PDD. This will relate to the savanna woodland vegetation type provided in Table 2.6 (as described under source of data) and will range from 0.4 to 0.74, depending on whether it is a tropical, woodland or parkland system and when burning occurs.

²²³ FAO. 2020. Forest Resources Assessment Country Reports: South Africa. Available at: <https://openknowledge.fao.org/server/api/core/bitstreams/44cfbcc0-4001-48d3-8f77-66d8cad80d00/content>.

Justification of choice of data or description of measurement methods and procedures applied	The use of IPCC default combustion factors is required according to VM0047, which stipulates internationally recognized datasets where project-specific measurements are not available. The IPCC values are based on empirical burn studies conducted across relevant vegetation types, including African savanna woodlands comparable to the project zone. The applied values, therefore, reflect the ecological conditions of the project area and ensure conservative, verifiable estimates consistent with international reporting standards.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	EF_g
Data unit	kg/t d.m. burned
Description	Emission factor for gas g (for example CO ₂ , CH ₄ , or N ₂ O) per tonne of dry matter burned
Equations	(12), (26)
Source of data	Table 2.2 in Chapter 2, Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories; for CH ₄ and N ₂ O, see Appendix 2 of the same volume for emission factors by burning type
Value applied	CO ₂ : 112,000 kg/TJ N ₂ O: 4 kg/TJ CH ₄ : 30 kg/TJ
Justification of choice of data or description of measurement methods and procedures applied	Default emission factors for CO ₂ , CH ₄ and N ₂ O are provided in the 2006 IPCC Guidelines, based on peer-reviewed combustion studies across ecosystems and fuel types. These values are required or encouraged according to VM0047, where project-specific measurements are not available and are approved for use in accordance with the VCS Standard. Adoption of these defaults ensures methodological consistency, alignment with international reporting practices and conservative, verifiable estimates of project emissions.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	GWP_g
Data unit	Dimensionless
Description	Global Warming Potential (GWP) for gas g (for example CO ₂ , CH ₄ , N ₂ O), used to convert emissions to CO ₂ -equivalents
Equations	(13), (16), (20), (21), (26)
Source of data	Default factors from the most recent IPCC Assessment Report
Value applied	Most recent IPCC Assessment Report (for example AR6 values for CO ₂ = 1, CH ₄ = 27.2, N ₂ O = 273 over 100-year horizon)
Justification of choice of data or description of measurement methods and procedures applied	Global Warming Potential factors are published in the IPCC Assessment Reports, drawing on peer-reviewed atmospheric science and endorsed for use according to the UNFCCC. VM0047 requires or encourages the use of these factors and the VCS Standard approves their application for converting non-CO ₂ gases into CO ₂ -equivalent values. Applying the most recent Assessment Report ensures consistency with international practice and the use of the best available scientific data in project accounting.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	EF_{Ndirect}
Data unit	t N ₂ O-N / t N applied
Description	Emission factor for direct nitrous oxide (N ₂ O) emissions from nitrogen additions due to synthetic fertilizers, organic amendments and crop residues
Equations	(16)
Source of data	Table 11.1, Chapter 11, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.01
Justification of choice of data or description of measurement methods and procedures applied	The 2019 Refinement to the 2006 IPCC Guidelines provides peer-reviewed default emission factors for direct N ₂ O emissions from nitrogen inputs, based on global field studies across cropping systems. VM0047 requires or encourages the use of these IPCC defaults where project-specific data are unavailable and their application is approved in accordance with the VCS Standard. The default value of 0.01 represents a conservative estimate of nitrogen additions from synthetic fertilizers, organic amendments and crop residues, ensuring consistency, transparency and verifiability in project emission accounting.
Purpose of data	Calculation of project emissions
Comments	Emission factors apply to nitrogen inputs from mineral fertilizers, organic amendments and crop residues.

Data / parameter	Frac_{CGASF}
Data unit	Dimensionless
Description	Fraction of all synthetic nitrogen added to soils that volatilizes as ammonia (NH ₃) and nitrogen oxides (NO _x)
Equations	(20)
Source of data	Table 11.3, Chapter 11, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.11
Justification of choice of data or description of measurement methods and procedures applied	The 2019 Refinement to the 2006 IPCC Guidelines provides peer-reviewed default fractions of synthetic nitrogen that volatilize as NH ₃ and NO _x , derived from global agronomic studies. VM0047 requires or encourages the use of these defaults where project-specific measurements are not available and their application is approved in accordance with the VCS Standard. The default value of 0.11 represents a conservative estimate that ensures consistency, transparency and verifiability in the calculation of project emissions.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	Frac_{CGASM}
Data unit	Dimensionless
Description	Fraction of all organic nitrogen added to soils that volatilizes as ammonia (NH ₃) and nitrogen oxides (NO _x)
Equations	(20)
Source of data	Table 11.3, Chapter 11, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.21

Justification of choice of data or description of measurement methods and procedures applied	The 2019 Refinement to the 2006 IPCC Guidelines provides peer-reviewed default fractions of organic nitrogen that volatilize as NH ₃ and NO _x , based on global field observations. VM0047 requires or encourages the use of these IPCC defaults where project-specific data are unavailable and their application is approved in accordance with the VCS Standard. The default value of 0.21 represents a conservative estimate that supports consistency, transparency and verifiability in project emission accounting.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	EF_{Nvolat}
Data unit	t N ₂ O-N / (t NH ₃ -N + NO _x -N volatilized)
Description	Emission factor for nitrous oxide (N ₂ O) emissions from atmospheric deposition of nitrogen on soils and water surfaces due to volatilized ammonia (NH ₃) and nitrogen oxides (NO _x)
Equations	(20)
Source of data	Table 11.3, Chapter 11, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.01
Justification of choice of data or description of measurement methods and procedures applied	The 2019 Refinement to the 2006 IPCC Guidelines provides peer-reviewed default emission factors for N ₂ O emissions arising from the atmospheric deposition of volatilized nitrogen. VM0047 requires or encourages the use of these defaults where project-specific data are not available and their application is approved in accordance with the VCS Standard. The default value of 0.01 is a conservative estimate that ensures consistency, transparency and verifiability in project emission calculations.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	Frac_{LEACH}
Data unit	Dimensionless
Description	The fraction of synthetic or organic nitrogen added to soils that is lost through leaching and runoff in regions where these processes occur
Equations	(21)
Source of data	Table 11.3, Chapter 11, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.24
Justification of choice of data or description of measurement methods and procedures applied	The 2019 Refinement to the 2006 IPCC Guidelines provides peer-reviewed default fractions of nitrogen lost through leaching and runoff, based on global field studies across agricultural systems. VM0047 requires or encourages the use of these defaults where project-specific measurements are not available and their application is approved in accordance with the VCS Standard. The default value of 0.24 represents a conservative estimate that supports consistency, transparency and verifiability in the calculation of indirect N ₂ O emissions.
Purpose of data	Calculation of project emissions
Comments	None

Data / parameter	EF_{Nleach}
Data unit	t N ₂ O-N / t N leached and runoff
Description	Emission factor for nitrous oxide (N ₂ O) emissions resulting from nitrogen lost through leaching and runoff

Equations	(21)
Source of data	Table 11.3, Chapter 11, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.011
Justification of choice of data or description of measurement methods and procedures applied	The 2019 Refinement to the 2006 IPCC Guidelines provides peer-reviewed default emission factors for indirect N ₂ O emissions resulting from nitrogen losses through leaching and runoff. VM0047 requires or encourages the use of these defaults where project-specific data are not available and their application is approved in accordance with the VCS Standard. The default value of 0.011 represents a conservative estimate that ensures consistency, transparency and verifiability in project emission accounting.
Purpose of data	Calculation of project emissions
Comments	None

3.3.2 Data and Parameters Monitored (VCS, 3.16)

The following tables present the data and parameters monitored for the first PAI, covering the relevant carbon pools, emissions and equations applied in the census-based quantification approach. Additionally, parameters monitored for the climate change adaptation aspect of the Climate, Community and Biodiversity (CCB) labels are also provided. For each parameter, a consistent set of details is provided, including definitions, measurement methods, data sources and applications. Any additional data and parameters required for future area-based PAIs will be incorporated into updated versions of the PDD as they are introduced.

Data/parameter	n_t
Data unit	Integer
Description	Number of planting units sampled in year t
Equations	(25), (27), (31) in VM0047
Source of data	Sampling
Value applied	The number of planting units selected as a sample from the original population size (N), is determined through randomized sampling of the initial complete census of all planting units. For each sampled unit, the following will be recorded: i) Unique ID; ii) geo-referenced location; iii) year planted; iv) species; and v) other relevant information.
Justification of choice of data or description of measurement methods and procedures applied	Derived from a representative, randomized sample of the fully enumerated planting unit population, this parameter reflects the entire population without systematic bias, thereby supporting unbiased census-based quantification.
Purpose of data	Calculation of project removals
Comments	Each planting unit will be geo-referenced and marked with a physical identifier bearing a unique ID, ensuring it is easily identifiable in the field and will be accompanied by an attestation from the homeowner or smallholder farmer confirming its location.

Data/parameter	M_t
Data unit	%
Description	Mortality through year t
Equations	(24), (30), (31)
Source of data	Complete re-enumeration or sampling
Description of measurement methods and procedures to be applied	Mortality of planting units will be monitored through a combination of citizen-science reporting and field-based verification. To mitigate risks of incomplete or inaccurate reporting, independent random audits of a subset of sites each year, cross-check citizen reports against systematic survey results, and use statistical tests will be applied to detect potential reporting bias. Quality-control protocols will include consistency checks, photo verification and GPS validation of reported mortalities. Misreporting identified through audits will be investigated and may result in exclusion

	<p>of data from incentive calculations or re-training of contributors to ensure data integrity. Tree custodians and participating community members, on whose properties trees have been planted, will serve as the primary monitors, reporting any tree deaths to the project team on an ongoing basis. These reports will be submitted either through a dedicated mobile application or via communication with community liaisons. The project team will collate and review this information annually and conduct field missions to independently verify mortality and ensure data quality. In addition to these citizen science contributions, complete re-enumeration of all planting units or representative stratified systematic sampling will be applied every five years to determine mortality rates, derived from the initial complete census (parameter N). For the latter option, sampling will follow this procedure: i) sample selection will occur systematically from the census list of planting units, with a random start to ensure statistical validity; ii) annual planting cohorts will provide stratification (and, where necessary, by land use type or micro-site conditions) to improve precision and detect cohort-specific mortality rates; and iii) target precision of $\pm 10\%$ at 95% confidence for mortality estimates will be achieved through appropriate sample size calculations based on the initial population size and variability. Criteria for declaring a planting unit dead are: i) absence of all green vascular tissue (for example, cambium in trees and shrubs) and absence of green leaves; or ii) inability to relocate the planting unit using the geo-referenced coordinates from the initial census. GPS-enabled devices ($\pm 1-3$ m accuracy) and photographic records will support field measurements to confirm mortality status.</p>
Frequency of monitoring/recording	Annually, with complete or sampled re-enumeration every five years. Mortality sampling will be conducted concurrently with biomass measurement sampling.
QA/QC procedures to be applied	QA/QC procedures will include: i) independent re-measurement of 10% of sample plots by a second team to verify mortality counts; ii) annual cross-checking of sample locations with the initial census database to confirm that no planting units are omitted; iii) verification of geo-coordinates and visual documentation for all sampled dead units; and iv) internal data validation using consistency checks between total initial population, surviving units and recorded mortality.
Purpose of data	Calculation of project removals
Calculation method	Mortality is calculated as the percentage of dead planting units from the total population (census) or from the sampled population (sampling).
Comments	None

Data/parameter	BWP-woody-AB,pu,t
Data unit	Tonnes of dry matter (t d.m.)
Description	Estimated biomass stock in aboveground woody biomass in the sampled planting unit pu in the project scenario in year t
Equations	(25), (27)
Source of data	Field measurement

<p>Description of measurement methods and procedures to be applied</p>	<p>Representative sampling from the initial population of planting units (parameter N) will be used to determine aboveground woody biomass. A stratified approach will be applied, with optional stratification by annual planting cohorts and land use or vegetation type to improve precision. Sample measurements will achieve $\pm 10\%$ precision at 95% confidence for aboveground biomass estimates through an unbiased, representative design. Field measurement procedures will include: i) DBH, diameter at breast height and total height will be recorded for each sampled tree or shrub using diameter tapes, calipers and hypsometers; ii) GPS ($\pm 1-3$ m accuracy) will geo-reference each sampled unit for repeatability; iii) fixed thresholds for minimum measurable DBH or root collar diameter will remain consistent across all monitoring events; and iv) published allometric equations will be used to calculate biomass for each sampled planting unit in the following order of preference: i) species, genus or family-specific equations from the same ecoregion or Holdridge life zone; and ii) global species/genus/family equations validated with local destructive sampling datasets. Biomass estimates will include wood density values and be reported as dry mass per planting unit. The average of sample measurements will provide the mean aboveground woody biomass per planting unit, supporting project carbon stock calculations.</p>
<p>Frequency of monitoring/recording</p>	<p>Every five years or more frequently</p>
<p>QA/QC procedures to be applied</p>	<p>QA/QC procedures will include: i) independent re-measurement of 10% of sampled units by a secondary team to verify accuracy; ii) cross-checking recorded measurements for outliers or inconsistencies in DBH, height or calculated biomass; iii) calibration of field equipment before each field campaign; and iv) photographic documentation of a subset of sampled units to verify field identification and measurement techniques.</p>
<p>Purpose of data</p>	<p>Calculation of project removals</p>
<p>Calculation method</p>	<p>Calculated as the average of sample measurements per planting unit and aggregated to derive total aboveground woody biomass for the project scenario in year t.</p>
<p>Comments</p>	<p>Sampled live planting units below a pre-determined size threshold (for example, minimum DBH) are assigned a biomass value of zero but remain included in the sample dataset to maintain representativeness.</p>

<p>Data/parameter</p>	<p>$n_{burn,t}$</p>
<p>Data unit</p>	<p>Integer</p>
<p>Description</p>	<p>Number of sampled planting units recorded as burned in the monitoring interval ending in year t</p>
<p>Equations</p>	<p>(27)</p>
<p>Source of data</p>	<p>Field sampling</p>
<p>Description of measurement methods and procedures to be applied</p>	<p>Representative sampling from the full population of planting units (parameter N) will determine the number of sampled planting units recorded as burned ($n_{burn,t}$) for the census-based quantification approach. A stratified systematic design will be applied, optionally stratified by annual planting cohorts and vegetation type, to ensure unbiased spatial coverage and precise estimation of burned unit incidence across the project area. Monitoring will combine project-led field assessments with a citizen science approach, whereby tree custodians and participating community members report fire damage observed on their properties to the project team. Reports will be submitted through a dedicated mobile application or via community liaisons, providing location details and photographic evidence of burned planting units. The project team will collate and review this information annually and undertake independent field missions to verify reported data. Visual inspection will occur for each sampled planting unit during monitoring intervals, with units classified as burned if they exhibit clear evidence of fire-induced mortality, such as: i) complete absence of live cambium tissue and green foliage; ii) blackened or charred stems with heat-induced bark cracking; and iii) collapse or structural damage from fire events. To strengthen detection and verification, remote sensing will be employed to identify and validate fire-affected areas</p>

	within the project boundary, enabling cross-checks between community reports, field observations and satellite-derived burn scar data. Field measurement and recording will include: i) georeferenced locations of each sampled unit using GPS ($\pm 1-3$ m accuracy) to ensure repeatability; ii) photographic documentation of each confirmed burned planting unit, capturing visible burn damage; and iii) recording burn incidence in digital field logs with time-stamped observations and sample IDs.
Frequency of monitoring/recording	Every five years or more frequently, aligned with biomass monitoring intervals and verification schedules.
QA/QC procedures to be applied	QA/QC procedures will include: i) independent re-inspection of 10% of sampled units by a second field team to confirm fire damage classification; ii) cross-checking digital logs with photographic evidence to eliminate misclassification; iii) verification of sample stratification and coverage against the original census list before data finalization; iv) routine calibration of GPS units and cameras to ensure positional and visual accuracy; and v) use of remote sensing products (for example satellite-derived burn scar maps) to validate and cross-check reported and observed burned areas across the project boundary.
Purpose of data	Calculation of project emissions
Calculation method	This variable is a counted integer of fire-affected planting units and is used as an input in project emission calculations.
Comments	None

Data/parameter	$SE_{p,t}$
Data unit	t CO ₂ e
Description	Standard error of the mean carbon stock estimate for carbon pool p in the project scenario in year t
Equations	(28), (29)
Source of data	Calculations from sampled field measurements
Description of measurement methods and procedures to be applied	Each monitored carbon pool p (above-ground biomass) will require calculation of the standard error ($SE_{p,t}$) to quantify the precision of the mean carbon stock estimate. The standard deviation of the sample values divided by the square root of the total number of samples will provide $SE_{p,t}$. Sampling design and field measurements will include: i) representative, unbiased sample selection using stratified systematic or random approaches; ii) optional stratification by land-use type, vegetation type or planting cohort to improve precision; iii) minimum of 30 samples per stratum, targeting $\pm 15\%$ precision at 95% confidence; and iv) consistent sampling design maintained across all monitoring and verification periods to allow valid comparisons of $SE_{p,t}$ values over time.
Frequency of monitoring/recording	Every five years or more frequently, aligned with monitoring and verification cycles
QA/QC procedures to be applied	QA/QC procedures will include: i) independent re-measurement of 10% of sampled units to validate recorded data; ii) cross-checking data entries and calculations for standard deviation and SE computations; iii) verification of sample coverage and stratification against the census or plot list prior to analysis; and iv) statistical review of $SE_{p,t}$ outputs, including detection of outliers and confirmation that $SE_{p,t}$ meets the target precision thresholds before reporting.
Purpose of data	Used in the calculation of project-level uncertainty.
Calculation method	$SE = SD / \sqrt{n}$ for simple random or stratified sampling; for double sampling, SE is derived from the root mean squared error of the regression or ratio estimator scaled to the sample size ²²⁴ .
Comments	None

²²⁴ Cochran WG. 1977. Sampling techniques. 3rd ed. John Wiley & Sons, New York, USA.

Data/parameter	$M_{wp,SF,t}$ (synthetic fertilizer) $M_{wp,OF,t}$ (organic fertilizer)
Data unit	Tonnes
Description	Mass of nitrogen-containing synthetic fertilizer ($M_{wp,SF,t}$) and organic fertilizer ($M_{wp,OF,t}$) applied in the project scenario during the monitoring interval ending in year t
Equations	(17), (18)
Source of data	Land management records of the project area
Description of measurement methods and procedures to be applied	Direct consultation with local land managers and review of supporting documentation will determine the mass of nitrogen-containing synthetic fertilizer ($M_{wp,SF,t}$) and organic fertilizer ($M_{wp,OF,t}$) applied during each monitoring interval. Nurseries and tree custodians will be asked to keep record of all fertilization events within their cropland with an explanation of why it is important to monitor, they will be provided with data sheets to record. Project field staff will collect the following records, where available, for each fertilization event: i) dates and location of application (georeferenced by field block); ii) type of fertilizer (synthetic or organic, with product name); iii) total mass applied (in tonnes or kilograms); and iv) nitrogen content (%), verified through manufacturer specifications, published nutrient tables or IPCC defaults. Supporting documents will substantiate all records using at least one of the following, as available: i) farm or community management logs; ii) receipts or invoices confirming fertilizer purchases and quantities; and iii) written attestations from land managers or implementing partners. Moreover, soil samples will be collected at the baseline and over the project lifespan to confirm fertilizer use. Where organic fertilizers (for example, manure, compost or biochar blends) are used, peer-reviewed or government-published data will provide nitrogen content to ensure accuracy.
Frequency of monitoring/recording	At least every five years or before each verification event, if more frequent
QA/QC procedures to be applied	QA/QC procedures will include: i) cross-verification of self-reported data with receipts and invoices; ii) random spot checks of fertilizer storage and field application to confirm accuracy; iii) independent re-entry and review of data by a second MRV team member; and iv) annual internal audit of nutrient management records.
Purpose of data	Calculation of project emissions. The verified mass of synthetic and organic fertilizers will contribute directly to calculating direct and indirect N_2O emissions.
Calculation method	These data are used as input values for nitrogen-related emissions calculations.
Comments	Both synthetic and organic fertilizer applications are reported separately, with their nitrogen content documented for emission factor application.

Data/parameter	$NC_{wp,SF,t}$
Data unit	t N/t fertilizer
Description	Nitrogen content of synthetic fertilizer applied in the project scenario in year t
Equations	(17)
Source of data	Fertilizer manufacturer's specifications
Description of measurement methods and procedures to be applied	Manufacturer's specifications expressed as percentage nitrogen (% N) by weight will record the nitrogen content of all synthetic fertilizers applied within the project area. Product packaging, technical datasheets or official manufacturer certificates will provide this information. Supporting evidence will be collected and archived for each monitoring period: i) fertilizer purchase receipts or invoices clearly identifying the product and batch; ii) farm or community management records indicating the date, quantity and field location of application; and iii) product labels or manufacturer specifications confirming the % N content. Nitrogen content values will require substantiation using at least one of these documents and cross-verification against

	recorded fertilizer application logs to ensure internal consistency between reported application rates and nutrient content.
Frequency of monitoring/recording	At least every five years or prior to each verification event if verification is more frequent
QA/QC procedures to be applied	QA/QC procedures will include: i) double-entry of % N values by separate MRV team members to avoid transcription errors; ii) cross-check of receipts, invoices and field application logs to confirm consistency; iii) random spot inspections during the growing season to ensure applied products match documented specifications; and iv) annual internal audit of nutrient data and supporting evidence before submission for verification.
Purpose of data	Calculation of project emissions
Calculation method	The value is used as an input to calculate nitrogen additions from synthetic fertilizers.
Comments	None

Data/parameter	$NC_{wp,OF,t}$
Data unit	t N/t fertilizer
Description	Nitrogen content of organic fertilizer applied in the project scenario in year t
Equations	(18)
Source of data	Published or peer-reviewed data, with preference for the most recent data from the country where the project is located.
Description of measurement methods and procedures to be applied	Published or peer-reviewed sources will determine the nitrogen content of all organic fertilizers applied in the project area, rather than direct measurement. Datasets generated from South Africa or neighboring regions with similar agro-ecological conditions will be prioritized. Where no regional data are available, internationally recognized peer-reviewed references will be used and their applicability to local conditions will be documented. Supporting evidence will be collected and archived for each monitoring period: i) citations or copies of peer-reviewed articles, national agricultural research reports or FAO/United Nations Environment Programme (UNEP) publications providing % N content for the specific organic material (for example compost, manure, biochar-amended compost); ii) records of the organic fertilizer source and type, including production method if project-produced (for example composted manure, vermicompost); and iii) field application logs documenting the quantity, application dates and locations of the organic fertilizer. The recorded % N values will support calculations of direct and indirect N ₂ O emissions from organic fertilizer application in the project GHG inventory.
Frequency of monitoring/recording	At least every five years or before each verification event if verification is more frequent.
QA/QC procedures to be applied	QA/QC procedures will include: i) verification that cited nitrogen content values are peer-reviewed or published by credible institutions (for example universities, national research centers, FAO); ii) annual internal audit to confirm that the correct nitrogen content source was used and that it matches the type of organic fertilizer applied; iii) cross-check of application logs and receipts or internal production records to ensure that applied volumes correspond to the documented nutrient content; and iv) retention of all literature references and application records in the MRV database for traceability and verification.
Purpose of data	Calculation of project emissions
Calculation method	This value is used to convert the applied mass of organic fertilizer to the mass of nitrogen added to soils.
Comments	None

Data/parameter	Soil moisture
Data unit	% volumetric water content (VWC)
Description	Soil water retention expressed as volumetric water content, measured in agroforestry plots compared with control plots, to assess the effect of project activities on soil hydrology and resilience to drought.
Source of data	Field measurements using paired TDR probes calibrated against gravimetric soil moisture samples.
Methods	Soil moisture will be measured at a depth of 0–5 cm using portable time-domain reflectometry (TDR) probes. Measurements will be paired with gravimetric samples collected from the same plots to calibrate probe readings. Sampling design will follow a stratified random approach with a minimum of 30 samples per stratum (agroforestry vs control), distributed across representative land-use types and soil textures. Land-use types will include annual croplands (with furrow or drip irrigation), residential properties, and other relevant land categories described in Section 2. Soil texture classes will follow the standard classification based on percentage sand, silt and clay derived from laboratory analysis of composite samples. Gravimetric samples will be oven-dried at 105 °C until constant weight is reached and VWC will be calculated from water loss and bulk density. Measurements will be taken biannually in the wet and dry seasons to capture seasonal variability. Consistent sampling protocols will be maintained across monitoring cycles to allow valid temporal comparisons.
Frequency	Biannually (wet and dry seasons), aligned with monitoring and verification cycles.
Value applied	Baseline values are measured at the start of the project and used as a comparison to values measured during the project's lifetime.
Monitoring equipment	Portable TDR probes, soil corers and drying ovens for gravimetric calibration.
QA/QC procedures to be applied	Quality assurance will include: i) duplicate TDR readings in at least 10% of sampling locations; ii) gravimetric calibration checks in ≥10% of plots during each monitoring round; iii) cross-checking of data entries and probe calibration constants; and iv) statistical review of results to identify outliers and confirm that seasonal means fall within expected natural ranges before reporting.
Purpose	Used to evaluate the adaptation benefits of agroforestry practices by quantifying improvements in soil water retention relative to control plots.
Calculation method	TDR probe readings will be corrected using calibration curves derived from gravimetric samples. Final values will be reported as mean VWC (%) per stratum, with standard errors calculated from sample variance.
Comments	Results will be stratified by land-use type (agroforestry vs control) and reported per stratum.
Data/parameter	Erosion
Data unit	mm/yr (erosion pins), t/ha/yr (sediment traps)
Description	Soil loss and deposition rates measured in project plots and controls, expressed through changes in erosion pin exposure and accumulated sediment captured in traps. These indicators quantify the effect of agroforestry and soil conservation interventions on erosion control.
Source of data	Field measurements using erosion pins and sediment traps, with laboratory drying and weighing of sediment samples.
Methods	Erosion pins consisting of 50 cm steel rods will be installed vertically into the soil surface at fixed monitoring points in both treatment and control plots. Annual measurements of exposed pin length will record net erosion (positive change) or deposition (negative change). In parallel, sediment traps will be established downslope of plots to collect eroded soil. Sediment samples will be dried at 105 °C until constant weight is reached and converted to t/ha/yr by dividing by the contributing catchment area of each trap. A minimum of 30 erosion pins and 10 sediment traps will be installed per stratum to ensure representative sampling. Consistent positioning and annual measurement protocols will be applied throughout the crediting period.

Frequency	Annually or aligned with monitoring and verification cycles.
Value applied	Baseline erosion rates are used to compare to soil erosion rates during the project lifetime.
Equipment	Steel erosion pins (50 cm), sediment traps with defined contributing areas, soil corers, field logbooks and drying ovens for sediment processing.
QA/QC	QA/QC measures will include: i) duplicate readings of erosion pin exposure at each monitoring point; ii) installation of paired sediment traps in at least 10% of monitoring locations to validate results; iii) calibration of catchment area measurements for sediment traps; iv) cross-checking data entries and mass calculations; and v) statistical review of erosion datasets to identify outliers and confirm that trends are consistent with expected land use and seasonal rainfall patterns.
Purpose	Used to track the effectiveness of project interventions in reducing soil erosion and improving land management, contributing to CCB adaptation benefit indicators.
Calculation method	For erosion pins: change in exposed pin length (Δ mm/yr) averaged per stratum. For sediment traps: oven-dry mass of collected sediment divided by the contributing area and the monitoring period (t/ha/yr).
Comments	Reported as an adaptation indicator according to the CCB Standards. Results will be stratified by land use and slope class to isolate the effect of agroforestry and soil conservation interventions.

Data/parameter	Crop yields
Data unit	t/ha
Description	Crop productivity measured under agroforestry systems compared with control plots, expressed as oven-dry weight/ha. Data capture both staple crops and agroforestry products, providing an indicator of food security and livelihood co-benefits.
Source of data	Field measurement
Methods	Crop yield will be determined using quadrat sampling at each harvest. Three 1 m ² quadrats will be randomly placed within each monitored plot, ensuring unbiased coverage of field variability. All aboveground crop biomass within each quadrat will be harvested, weighed fresh in the field using calibrated portable scales and subsampled for oven-drying at 65 °C until constant weight is achieved. Fresh-to-dry ratios will be applied to scale total fresh weights to oven-dry equivalents. Harvested yields will then be extrapolated from 1 m ² to per-hectare equivalents. For fruit and nut trees in agroforestry plots, per-tree yields will be measured directly and converted to t/ha using recorded planting densities. Consistent quadrat positioning rules and subsampling procedures will be maintained across monitoring cycles to ensure comparability.
Frequency	At each harvest cycle for annual crops; annually for perennial fruit and nut yields.
Value applied	Baseline productivity will be compared to that of control plots outside of the project.
Equipment	1 m ² quadrat frames, calibrated portable field scales, sample bags, drying ovens and field logbooks.
QA/QC	Procedures include: i) duplication of 10% of quadrat harvests for validation; ii) daily calibration of field scales against standard reference weights; iii) cross-checking of quadrat placement and area measurements; iv) verification of oven temperatures and drying consistency; and v) statistical review of yield data to detect outliers and confirm that results align with expected seasonal and management conditions.
Purpose	Used to assess food security co-benefits of project interventions and demonstrate productivity gains attributable to agroforestry practices relative to baseline conditions.
Calculation method	Harvested fresh weight is converted to oven-dry weight using measured fresh-to-dry ratios from subsamples. Results are scaled to per-hectare equivalents by multiplying dry yield per quadrat (kg/m) by 10,000. For per-tree yields, oven-dry weight per tree is multiplied by planting density and converted to t/ha.
Comments	Data will be disaggregated by crop type and stratum (agroforestry vs control). Fruit and nut yields will also be reported separately on a per-tree basis in addition to per-hectare equivalents.

Data/parameter	Yield stability
Data unit	Coefficient of variation (CV, %)
Description	Inter-annual stability of crop yields, measured as the coefficient of variation of time-series yield data. This indicator reflects the resilience of production systems under agroforestry relative to control plots.
Source of data	Time-series of measured yields collected through field harvest records and quadrat sampling.
Methods	Yield stability will be assessed by compiling at least three consecutive years of crop yield data per stratum (agroforestry vs control). Rolling multi-year datasets will be maintained to capture both seasonal and inter-annual variability. The coefficient of variation (CV) will be calculated as the standard deviation of annual mean yields divided by the mean, expressed as a percentage. Consistent methods of yield measurement (quadrats and per-tree harvests for fruit/nuts) will be applied across all years to ensure comparability. Disaggregation by crop type and management stratum will be maintained.
Frequency	Annually, updated after each harvest season and integrated into rolling time-series analyses.
Value applied	Baseline yield stability is expected to be low, with CV values typically increasing over time.
Equipment	Database for storage of annual yield data; standardized spreadsheets for CV calculation.
QA/QC	Procedures will include: i) cross-checking yield records against harvest logs and field notes; ii) verification of data entry and consistency of units across years; iii) recalculation of CV by a second analyst for validation; and iv) statistical review to identify outliers or anomalous yield values before inclusion in rolling datasets.
Purpose	To assess resilience of agroforestry systems by quantifying the stability of crop yields across years and comparing outcomes with baseline conditions.
Calculation method	$CV (\%) = (\sigma \div \mu) \times 100$, where σ is the standard deviation of annual mean yields and μ is the mean yield across the multi-year period. Calculations will be performed separately per crop and per stratum.
Comments	Results will be reported per stratum and crop type. Longer time-series (>5 years) will be used where available to strengthen confidence in stability estimates.
Data/parameter	Crop/tree diversity
Data unit	Species richness (count of species per plot/household) and diversity indices (Shannon or Simpson)
Description	Diversity of cultivated species, including annual crops, perennial trees and agroforestry species, measured at household and plot levels. This indicator captures livelihood diversification and ecological co-benefits of agroforestry practices.
Source of data	Plot-level species inventories and household surveys recording all cultivated crop and tree species.
Methods	Annual plot inventories will record all crop and tree species cultivated within representative agroforestry and control plots. Household surveys will collect additional data on cultivated species not captured in inventories, such as home-garden crops and fruit trees. Species lists will be verified using local species guides, photographs and voucher specimens. Data will be compiled to calculate species richness (total number of species per plot or household) and diversity indices (Shannon or Simpson), which account for both richness and evenness. A minimum of 30 households or plots per stratum will be surveyed annually to ensure representative sampling.
Frequency	Annually, aligned with the main harvest season and household survey cycles.
Value applied	Baseline crop diversity is typically 2–3 species per plot, with project interventions targeting ≥ 5 species per plot or household, including both food and income-generating species.
Equipment	Field species identification guides, survey forms, GPS units for georeferencing, cameras for photographic records and facilities for preparing voucher specimens for species verification.

QA/QC	Procedures include: i) photographic documentation of at least one specimen per species per stratum; ii) preparation of voucher specimens for ambiguous or new records, verified by a trained botanist; iii) cross-checking household survey responses with field observations; iv) validation of species names against standard taxonomic references; and v) independent re-survey of 10% of plots to confirm completeness of species lists.
Purpose	To demonstrate livelihood diversification and ecological co-benefits of project activities, supporting reporting for CCB Standards and contributing to resilience assessment.
Calculation method	Species richness is calculated as the total number of species per plot or household. Diversity indices are calculated using the Shannon or Simpson formulas, based on relative abundances of species recorded in inventories and surveys.
Comments	Reported per stratum (agroforestry vs control) and disaggregated by crop type (annuals, perennials, fruit/nuts). Supports demonstration of CCB co-benefits for biodiversity and livelihoods.
Data/parameter	Microclimate moderation
Data unit	$\Delta^{\circ}\text{C}$ (difference in mean air temperature between canopy and open plots)
Description	Difference in near-surface air temperature between shaded agroforestry canopy plots and open control plots, used to demonstrate the capacity of trees and vegetation cover to moderate local microclimates.
Source of data	Field measurements from paired temperature data loggers installed in shaded and open locations.
Methods	Pairs of temperature data loggers will be installed in representative agroforestry canopy plots and adjacent open control plots. Sensors will be placed at a standard height (1.5 m) above ground level and will record air temperature at 30-minute intervals throughout the year. Shaded loggers will be positioned beneath tree canopy cover, while open loggers will be located in exposed croplands or control areas. Data will be downloaded at least annually, with seasonal subsets (wet and dry seasons) extracted for reporting. A minimum of 10 logger pairs per stratum will be deployed to capture spatial variability. Logger placement will remain fixed over time to allow valid temporal comparisons.
Frequency	Continuous logging (regular intervals), with data retrieved and summarized annually.
Value applied	Baseline temperature moderation is expected to be $<1^{\circ}\text{C}$ between canopy and open plots; project interventions target improvements of $2\text{--}4^{\circ}\text{C}$ moderation.
Equipment	Calibrated temperature data loggers, GPS units for georeferencing and protective radiation shields for sensors.
QA/QC	Procedures include: i) deployment of duplicate loggers at 5% of monitoring sites to validate sensor performance; ii) annual calibration of all loggers against a certified reference thermometer; iii) inspection of logger housings and batteries at each download to ensure data integrity; and iv) cross-checking downloaded datasets for anomalies, gaps or drift.
Purpose	To provide evidence of resilience benefits by demonstrating the capacity of agroforestry systems to moderate local microclimates and buffer crops against heat stress.
Calculation method	$\Delta T = T(\text{open}) - T(\text{canopy})$, calculated as the mean difference in air temperature between paired loggers over defined reporting periods. Results will be summarized as seasonal and annual means.
Comments	Reported as seasonal and annual means per stratum. Data provide evidence for climate adaptation and co-benefits in accordance with the CCB Standards.
Data/parameter	Extreme heat days
Data unit	Number of days per year exceeding 35°C and 40°C thresholds
Description	Frequency of extreme heat stress events, expressed as the number of days per year with daily maximum air temperature above 35°C and 40°C . This indicator captures exposure of crops and households to climate extremes and the extent to which project activities may buffer impacts.

Source of data	Daily temperature records from local meteorological stations, supplemented by field weather stations installed in project areas.
Methods	Daily maximum temperature data will be obtained from project-deployed automatic weather stations and validated against national meteorological service records and regional datasets (for example reanalysis or satellite-derived climate data). Thresholds of >35°C and >40°C will be applied to daily maximum values to count the number of extreme heat days per year. Long-term baseline values will be compiled from historical datasets where available (≥10 years). Project monitoring will focus on annual and seasonal counts, disaggregated by stratum (agroforestry vs control) where paired station data are available.
Frequency	Continuous weather station logging, with analysis and reporting of extreme heat day counts per verification cycle.
Value applied	Baseline conditions indicate approximately 20–30 extreme heat days per year, varying by location and inter-annual climate variability.
Equipment	Automatic weather stations with temperature sensors, radiation shields and GPS units for georeferencing; access to national meteorological databases for validation.
QA/QC	Procedures include: i) annual calibration of project weather station sensors against certified thermometers; ii) cross-checking local records with national meteorological datasets and regional climate reanalysis products; iii) screening for data gaps, instrument drift, or anomalous readings; and iv) independent re-analysis of annual datasets by a second analyst to confirm counts of extreme heat days.
Purpose	To monitor climate risk and exposure to heat stress in project areas, providing evidence for adaptation benefits of agroforestry and vegetation cover in reducing local impacts.
Calculation method	For each station, count the number of days when daily maximum temperature exceeds 35°C and 40°C. Results reported as annual totals, with seasonal breakdowns where relevant. Comparisons made across years to track trends.
Comments	Linked to the microclimate moderation indicator, with canopy cover expected to reduce local exposure to extreme heat events. Reported annually and used to demonstrate climate adaptation benefits in accordance with the CCB Standards.

Data/parameter	Drought frequency/severity
Data unit	Standardized Precipitation Index (SPI) or Standardized Precipitation Evapotranspiration Index (SPEI), dimensionless
Description	Frequency and severity of meteorological drought events, calculated from long-term precipitation and temperature records. Negative SPI/SPEI values indicate below-normal conditions, with thresholds of -1.0 to -1.5 (moderate drought), -1.5 to -2.0 (severe drought) and <-2.0 (extreme drought).
Source of data	Daily or monthly meteorological data (precipitation, temperature, evapotranspiration) from project weather stations, national meteorological services and regional/global climate databases.
Methods	Drought indices will be calculated annually using the SPI and/or SPEI algorithms applied to monthly meteorological data. SPI uses precipitation only, while SPEI accounts for both precipitation and potential evapotranspiration. Data from at least two independent sources (for example local stations and global reanalysis products) will be used to ensure robustness. Historical records (≥20 years where available) will establish baseline drought frequency and severity. Project monitoring will compare annual results with baseline to assess whether agroforestry interventions contribute to improved resilience.
Frequency	Annual calculation, updated with each year of meteorological data.
Value applied	Baseline analysis indicates that SPI < -1 (moderate drought) occurs approximately once every five years, with occasional more severe droughts (SPI < -1.5).
Equipment	Climate databases, statistical software packages (for example, R, Python, or CLIMPACT tools) and project-managed weather stations to provide local calibration data.
QA/QC	QA/QC will include: i) use of version-controlled scripts for SPI/SPEI calculations to ensure reproducibility; ii) cross-checking index outputs across at least two independent datasets; iii) archiving all input datasets and scripts used in

	calculations; and iv) validation of index results against observed drought impacts recorded by local communities, agricultural yield data, or national reports.
Purpose	To track the frequency and severity of drought events as a key climate risk variable, providing evidence of resilience and adaptation outcomes in project areas.
Calculation method	SPI and SPEI will be calculated following standardized algorithms ^{225,226} . Indices are derived by fitting probability distributions to long-term precipitation (SPI) or precipitation minus potential evapotranspiration (SPEI), then transforming values into standardized units.
Comments	Drought indices will be cross-checked against observed impacts (for example yield losses, water scarcity) to ensure relevance. Both SPI and SPEI will be reported where data availability allows.

Data/parameter	Flood/rainfall extremes
Data unit	Number of days per year with rainfall ≥ 200 mm per 24 h
Description	Frequency of extreme rainfall events and associated flood impacts in project areas, expressed as the count of days with ≥ 200 mm precipitation in 24 h. Community survey data will supplement meteorological records to confirm flood occurrence and impacts.
Source of data	Meteorological station records, project-installed weather stations and household/community surveys on flood events and impacts.
Methods	Extreme rainfall events will be identified by screening daily precipitation records from local and national meteorological stations and project weather stations. Events exceeding 200 mm in 24 h will be recorded as extreme rainfall days. Community surveys will be conducted annually to confirm whether identified meteorological events resulted in flooding and to record the percentage of households affected. Where possible, site inspections will be carried out to verify physical evidence of flooding. Historical meteorological records will be analyzed to establish baseline frequency (<1 event per decade).
Frequency	Annual analysis of meteorological data and community survey responses, aligned with monitoring and verification cycles.
Value applied	Baseline conditions indicate rare extreme rainfall events, typically <1 per decade in the project area, with increasing frequency projected under climate change scenarios.
Equipment	Automatic and manual weather stations, household/community survey tools, GPS units and field inspection checklists. Household-level monitoring kits will include simple instruments such as rain gauges and measuring tapes, together with mobile applications (for example, KoBo Collect, Open Data Kit, or a dedicated project app) for recording rainfall, tree growth, and observed flood or drought events. A subset of participating households or community liaisons will be trained to operate these tools and to upload records directly to the project database for verification and integration with meteorological station data.
QA/QC	QA/QC will include: i) cross-checking meteorological records against at least two independent datasets (for example reanalysis or satellite rainfall products); ii) validation of reported events through household surveys and key informant interviews; iii) site inspections conducted for at least 10% of affected areas following reported flood events; iv) verification of survey data entry and consistency; and v) archiving all meteorological datasets and survey records for reproducibility.
Purpose	To provide evidence of adaptation benefits by monitoring exposure to flood and extreme rainfall events, and to demonstrate how project interventions may reduce impacts on households and agricultural production.
Calculation method	Annual event counts derived from the number of days with ≥ 200 mm rainfall in 24 h. Community survey data used to calculate the percentage of households affected per event.
Comments	Reported per stratum where weather station data are available. Supports demonstration of climate adaptation benefits in accordance with the CCB Standards.

²²⁵ McKee TB, Doesken NJ & Kleist J. 1993. The relationship of drought frequency and duration to time scales. Proceedings of the 8th Conference on Applied Climatology. Anaheim, California. American Meteorological Society, 179–184.

²²⁶ Vicente-Serrano SM, Beguería S & López-Moreno JI. 2010. A multi-scalar drought index sensitive to global warming: The Standardized Precipitation Evapotranspiration Index (SPEI). Journal of Climate. 2(7):1696–1718.

3.3.3 Monitoring Plan (VCS, 3.16, 3.20)

The monitoring plan is structured to inform the collection of data for quantifying GHG emissions and removals, assessing co-benefits and demonstrating compliance with VM0047 v1.1²²⁷ and the CCB Standard v3.1²²⁸. Parameters monitored include those required to determine: i) above- and below-ground carbon stocks; ii) potential GHG emissions from fire occurrence and fertilizer use; and iii) ancillary climate indicators, such as soil moisture retention and crop yield stability. This data is used to derive stocking indices and Performance Benchmarks and to quantify emissions and co-benefits. Together, these outputs provide the basis for verification of outcomes under the monitoring plan and ensure transparent reporting throughout the crediting period.

Quantification approach and accounting boundaries

As detailed in Section 2, both the census-based and area-based quantification approaches, as defined in VM0047, are applied to the project in non-overlapping areas. Quantification for the first PAI – which will focus on agroforestry on croplands and residential areas – will follow the census-based quantification approach. Herein, each planting unit is defined as a single georeferenced tree with species, planting year and location recorded. Each planting unit is assigned a unique identification number and is individually monitored throughout the project crediting period. Dead or missing units are recorded as lost and excluded from biomass calculations. Replacement plantings are assigned as new units with new identification numbers. The accounting boundary comprises the sum of 10-m radius buffers around each planting unit. Buffers may overlap within census-based areas but cannot overlap with area-based quantification boundaries to prevent double-counting. For future PAIs, where the area-based quantification approach is applied, details on the parameters to be monitored, measurement techniques and relevant estimations will be added to the updated PDD for the associated monitoring period.

Sampling framework

Randomized or stratified sampling will be used, depending on the parameter, with initial stratification distinguishing between agricultural and residential planting areas. Sample sizes are designed to achieve statistically valid results, targeting $\pm 10\%$ precision at the 95% confidence level and a minimum of 30 sites per stratum where applicable. After the first monitoring cycle, sample sizes will be reviewed and adjusted if variance prevents the attainment of the required precision. Re-stratification will be considered where environmental factors such as soil type, slope or hydrology cause marked differences in sampling results. For above-ground biomass monitored under the census-based approach, fixed-area plots will not be established, as each tree is treated as an independent sampling point. For climate change adaptation and co-benefit indicators, however, fixed-area plots will be used to enable consistent and repeatable measurements. For any future PAIs adopting the area-based approach, fixed-area plots will also be established for biomass monitoring. Details of sampling design for individual parameters are set out in Section 3.3.2, Data and Parameters Monitored.

Quality Assurance and Quality Control Procedures

QA/QC procedures apply across all monitoring activities to ensure accuracy and consistency in data collection and analysis. Standard procedures include independent re-measurement of a subset of field data, duplicate sampling, regular calibration of instruments and laboratory cross-checks. These procedures are applied across biomass, soil, crop and climate indicators, with tolerances and verification steps tailored to the specific parameter. Internal audits are conducted annually to review data integrity, database completeness and detection of anomalies. Any non-conformances are documented, corrected and logged in a non-conformance register. Parameter-specific QA/QC protocols, including sampling percentages, calibration frequencies and re-measurement thresholds, are detailed in Section 3.3.2.

²²⁷ Verra. 2021. VM0047 Area-Based Approach for Landscape Restoration Projects. Retrieved from: <https://verra.org/wp-content/uploads/2021/09/VM0047-v1.1.pdf>.

²²⁸ Climate, Community & Biodiversity Alliance. 2017. Climate, Community & Biodiversity Standards. Third Edition. Available at: <https://www.climate-standards.org/ccb-standards/>. Accessed on 26 September 2025.

Data management and archiving

Field data are collected on GPS-enabled devices using offline-first digital forms and synchronized to the central database once connectivity is available. Census-based planting units are recorded as georeferenced points with attributes such as species, planting date, survival status and tree dimensions. In addition, the locations of field and control plots used for sampling are georeferenced, allowing attributes for plot-level measurements of soil and biomass to be linked to spatial datasets.

The control-plot design will be finalized once stratification and the boundaries of Project Activity Instance (PAIs) are confirmed. At this stage, the framework to be applied in line with VM0047 Appendix 1 will be applied. For each ecological stratum, at least one control plot will be established outside the project boundary but within the same land-use and bioclimatic context. Control plots will be matched to treatment areas by soil type, slope, vegetation potential and proximity to ensure comparability. Plot size will align with the biomass-monitoring design (approximately 0.1 ha circular or rectangular), with layout and coordinates recorded using GPS. Landholder consent and baseline data-collection procedures will be confirmed prior to initiation of performance benchmarking. Once strata and PAIs are finalized, the exact number, location and access agreements for control plots will be included in the baseline monitoring plan and subsequent reports.

Figure 18 shows the monitoring workflow for the project. Field records and remote sensing inputs are first consolidated in geospatial datasets such as geopackages or shapefiles, with attribute tables storing planting unit and plot-level information. These datasets are processed in GIS software together with satellite imagery from Sentinel-2 or MODIS to generate indicators such as vegetation indices, canopy cover and land-use maps. Data then move through QA/QC loops, including automated validation checks, re-measurement of a subset of plots and cross-checking of field and satellite results. Once verified, datasets are stored in the central database, backed up on cloud and local servers and prepared for periodic reporting to verification events.

All records are stored in a central database with redundant storage across cloud servers and local back-ups. Back-up and retrieval procedures are tested at regular intervals to confirm data integrity. Version control procedures log updates and convert file formats, where necessary, to ensure long-term accessibility. Registers for planting units, mortality, training, disturbances and non-conformances are maintained to support chain-of-custody requirements. Records are retained for a minimum of two years beyond the final crediting period.

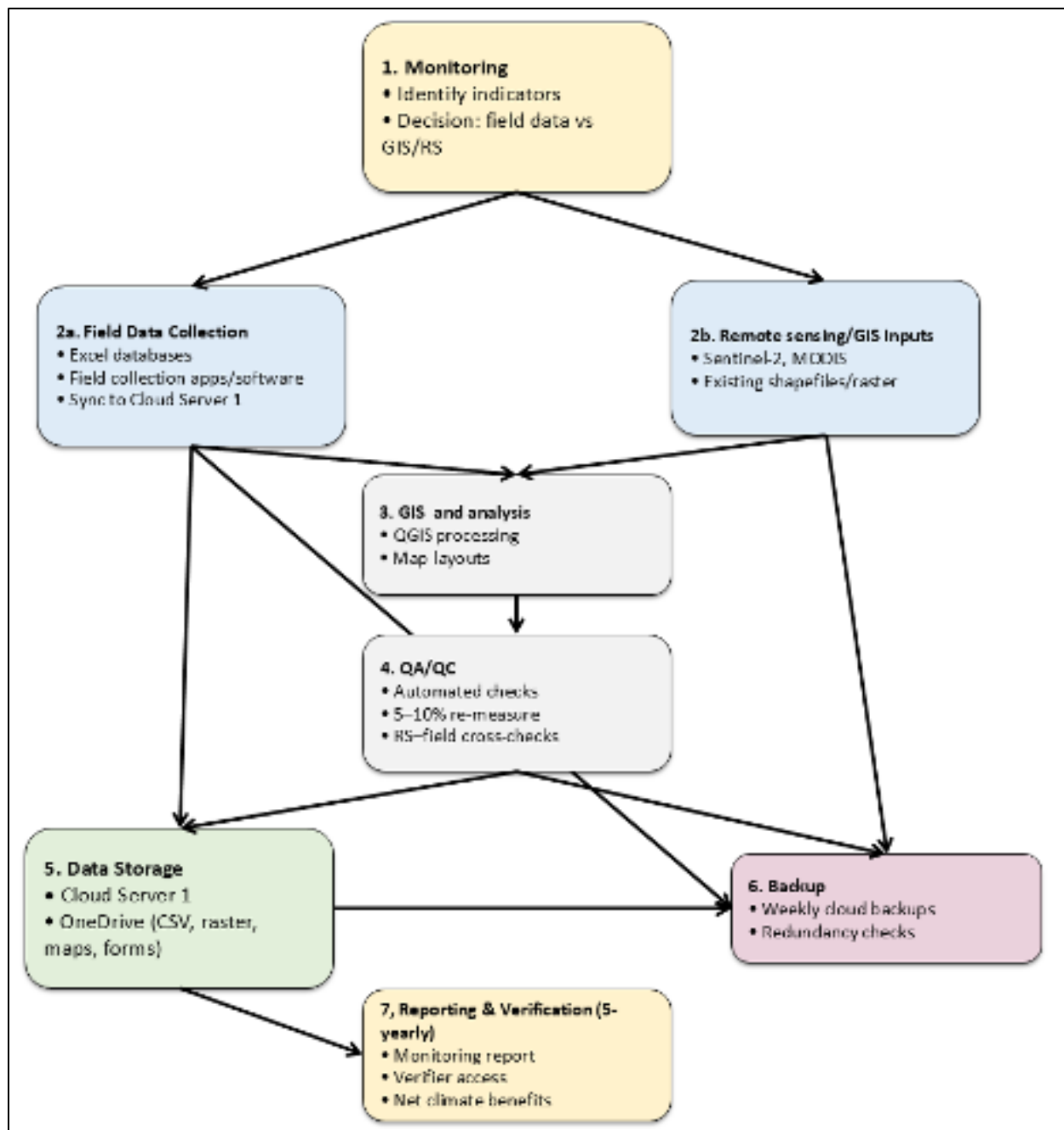


Figure 18. Monitoring system workflow for the project, showing data collection, storage, quality assurance, analysis and reporting.

Monitoring Schedule

The parameters listed in the table below represent the full set of variables monitored as part of the project and cover carbon accounting requirements in accordance with VM0047 as well as adaptation and resilience indicators aligned with the CCB Standard. For each parameter, the table specifies the frequency of monitoring, the method or data source and any relevant notes on sample design or target precision. More details on monitoring for each parameter are provided in Section 3.3.2.

Parameter or indicator	Frequency of monitoring	Method or source
Planting unit census (N)	Once at t = 0	GPS-enabled field register
Mortality	5-yearly	Field log
Biomass (DBH, height)	5-yearly	Systematic or stratified sample
Fire occurrence	5-yearly	MODIS and Sentinel-2 data paired with in-field validation
Fertilizer use	Annual	Surveys
Soil moisture	Biannual	TDR ²²⁹ and gravimetric ²³⁰
Erosion and sediment	Annual	Erosion pins and sediment traps
Crop yields	Each harvest	Crop-cut and per-tree harvest
Yield stability	Annual after 3 years	Time series of yields
Crop and tree diversity	Annual	Planting unit registry and surveys
Canopy cover and stocking indices	Annual	Sentinel-2 data and in-field photos
Extreme heat days (>35/40° C)	Annual	Meteorological data
Drought frequency and severity	Annual	SPI or SPEI
Flood and rainfall events (>200 mm/24 h)	Annual	Meteorological data and community records
Microclimate moderation	Annual	Soil temperature loggers
Tree survival	Annual	Tagged units

Reporting

Monitoring results are compiled and reported at each verification event, at intervals of no more than five years. Reports cover all parameters required in accordance with VM0047 and the CCB Standards, including census records, mortality data, biomass and emissions estimates, adaptation and co-benefit indicators, QA/QC outcomes and non-conformance logs. Reports and underlying datasets are archived and made available to verifiers and, where relevant, project stakeholders.

Organizational structures

Monitoring is implemented through specialized teams, each with a designated lead to provide oversight and ensure compliance with agreed protocols. All teams receive training relevant to their specific tasks as

²²⁹ Time Domain Reflectometry: A field method that measures soil moisture content by sending an electromagnetic pulse along metal probes inserted into the soil and calculating volumetric water content from the signal's travel time.

²³⁰ Gravimetric method: A laboratory reference technique for determining soil moisture, where fresh soil samples are weighed, oven-dried at 105 °C to constant mass and re-weighed to calculate water content as a percentage of dry soil weight.

well as an understanding of the overall monitoring structure, ensuring accuracy within their domain and coherence across the system.

- **Monitoring, Reporting and Verification (MRV) Lead:** Provides overall coordination of monitoring activities and ensures that all requirements in the VCS and CCB Standards are met.
- **Field measurement team:** Responsible for biophysical data collection in planting areas and control sites as well as administering household and farm-level surveys.
- **Remote sensing team:** Manages acquisition, processing, analysis and validation of satellite and aerial imagery to monitor canopy cover and other landscape indicators.
- **Laboratory teams:** Conduct soil and biomass sample analyses under agreements that define protocols, quality standards and reporting requirements.
- **Data management team:** Maintains the central monitoring database, ensures secure storage and backups of data and manages chain-of-custody procedures.
- **QA/QC team:** Conducts duplicate sampling, re-measurements and internal audits of data integrity, with independent facilitators supporting the verification of field and laboratory results.
- **Reporting team:** Compiles monitoring results into reports for submission at verification events, prepares non-technical summaries of the monitoring plan and results, and ensures that all outputs are aligned with VCS and CCB requirements.
- **Community liaison teams:** Facilitate survey administration, support local engagement in monitoring activities and disseminate monitoring reports and summaries to stakeholders through accessible formats and locally appropriate communication channels.

Detailed sampling design procedures, including sample-size calculations to achieve a precision of $\pm 10\%$ at 95 % confidence, the stratification rationale and allocation of samples across strata, and the statistical power analysis for detecting changes over time, will be presented in the Monitoring, Reporting and Verification Standard Operating Procedures (MRV SOP). The SOP will define replacement rules where observed mortality exceeds expected levels and provide guidance for any adaptive redesign required during implementation. These elements will therefore not be detailed in the PDD but will form part of the operational baseline and monitoring protocols referenced at validation.

3.3.4 Dissemination of Monitoring Plan and Results (VCS, 3.18; CCB, CL4.2)

The monitoring plan is made publicly available through inclusion in this and any updated version of this PDD, which is uploaded to the Verra registry. Results generated through monitoring are compiled in reports prepared before each verification event and uploaded to the registry in accordance with VCS requirements. Summaries of the monitoring plan and monitoring reports are prepared in non-technical language, translated into the predominant local languages disseminated using a combination of electronic and printed formats throughout the crediting period.

Community dissemination will take place at stakeholder engagements planned throughout the crediting period. At these meetings, project staff, community organizations and NGOs will present the monitoring plan and associated results and provide printed summaries. Copies of these summaries will be left with traditional councils, local administration and non-governmental organization (NGO) offices and schools to ensure wide accessibility. In addition, summary information is broadcast through local radio channels, shared via the WhatsApp chatbot platform and published on the project's website. This approach ensures transparency for external audiences, via the Verra registry and project website, and broad accessibility for local communities through multiple, locally appropriate communication channels.

3.4 Optional Criterion: Climate Change Adaptation Benefits

The Project Proponent seeks validation of Save the Sand at the Gold Level of the CCB Standard for climate change adaptation benefits. Project activities are intended to help communities and biodiversity adapt to climate change impacts. According to the CCB Standard, adaptation strategies may include: i) diversifying livelihoods; ii) strengthening community organizations and social security systems; iii) maintaining

important ecosystem services such as hydrological regulation, pollination, pest control and soil fertility; and iv) increasing habitat connectivity. The following sub-sections present regional climate change scenarios, the associated impacts and planned adaptation measures.

3.4.1 Regional Climate Change Scenarios (CCB, GL1.1)

Measured records show that South Africa’s average national temperatures increasing by ~1.0°C since 1901 (Figure 19)^{231,232}. Projections indicate that this warming trend will intensify, with mean annual temperatures expected to rise by 1.5–2.5°C above pre-industrial levels by mid-century, depending on the region^{233,234}. Greater temperatures are projected to increase evaporative demand, intensifying water stress in ecosystems and agricultural systems^{235,236}.

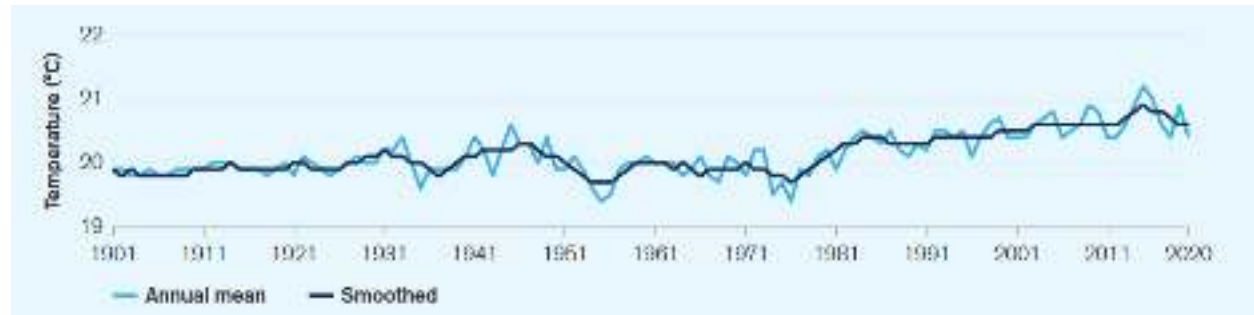


Figure 19. Observed and projected mean annual maximum temperatures for South Africa, showing the steady increase since the 1901 baseline²³⁷.

In addition to long-term warming, South Africa has experienced more climate variability, with increasing frequency of extreme events such as droughts and floods²³⁸. Rainfall has become more erratic, altering the onset and duration of the rainy season, contributing to prolonged dry spells interspersed with heavy

²³¹ van der Walt AJ & Fitchett JM. 2021. Exploring extreme warm temperature trends in South Africa: 1960–2016. *Theoretical and Applied Climatology*, 143, 3-4, 1341–1360.

²³² World Bank Group. 2021. South Africa Country Profile. Retrieved from: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15932-WB_South%20Africa%20Country%20Profile-WEB.pdf

²³³ Arnell NW, Lowe JA, Challinor AJ & Osborn TJ. 2019. Global and regional impacts of climate change at different levels of global temperature increase. *Climatic Change*, 155, 377–391.

²³⁴ Allen MR. et al. 2018. Framing and Context. In: *Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate*. Cambridge University Press, Cambridge, UK and New York, 49-92.

²³⁵ Yang Y, Yin J, Kang S, Slater LJ, Gu X & Volchak A. 2024. Quantifying the drivers of terrestrial drought and water stress impacts on carbon uptake in China. *Agricultural and Forest Meteorology*, 344, 109817.

²³⁶ Department of Environmental Affairs (DEA). 2018. South Africa’s Third National Communication under the United Nations Framework Convention on Climate Change. Pretoria: Government of South Africa.

²³⁷ World Bank Group. 2021. South Africa Country Profile. Available at: <https://climateknowledgeportal.worldbank.org/country/south-africa/climate-data-projections>. Accessed on 26 September 2025.

²³⁸ Department of Environmental Affairs (DEA). 2018. South Africa’s Third National Communication under the United Nations Framework Convention on Climate Change. Pretoria: Government of South Africa. Retrieved from: https://unfccc.int/sites/default/files/resource/South%20African%20TNC%20Report%20%20to%20the%20UNFCCC_31%20Aug.pdf

rainfall events^{239,240}. These changes threaten water security, reduce agricultural productivity and elevate risks to human health and infrastructure²⁴¹.

The Kruger Lowveld region, which includes the Sabie and Sand River catchments, has undergone measurable climatic shifts over recent decades. Observations indicate a clear increase in maximum temperatures and increasing rainfall variability, accompanied by more frequent extreme weather events^{242,243}. For example, heavy rainfall in early 2024 caused floods along sections of the Sabie River, which damaged infrastructure and croplands in low-lying areas²⁴⁴. Temperature data from the ERA5-Land ECMWF²⁴⁵ dataset show that mean annual maximum temperatures increased from 25.5°C in the early 1980s to peaks exceeding 28°C in years such as 2015 and 2024²⁴⁶. Climate models indicate that, under higher-emission pathways (SSP5-8.5), South Africa could experience considerable warming by the end of the century, with increases projected to continue through mid-century even under more moderate pathways (SSP2-4.5). Interior regions are expected to face the greatest temperature rise^{247,248}.

Alongside warming, rainfall patterns are becoming increasingly erratic. Although total annual rainfall may not decline markedly, it is projected to occur in shorter, more intense storm events with longer intervening dry spells. These changes are expected to increase flooding and erosion and reduce groundwater recharge, with direct consequences for water security in households, agriculture and ecosystems²⁴⁹. Regional climate projections for the Sabie and Sand River catchments indicate greater temperatures, more frequent extreme heat events and increasingly variable rainfall, with consequences for water availability.

3.4.1.1 Temperature

By 2050, average regional temperatures are projected to rise ~1.5–2.5°C above late 20th-century baselines²⁵⁰, with increasing frequency of extreme heat days (>40°C) and heat waves (consecutive days

²³⁹ World Bank Group. 2021. South Africa Country Profile. Retrieved from: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15932-WB_South%20Africa%20Country%20Profile-WEB.pdf

²⁴⁰ Department of Environmental Affairs (DEA). 2018. South Africa's Third National Communication under the United Nations Framework Convention on Climate Change. Pretoria: Government of South Africa. Retrieved from: https://unfccc.int/sites/default/files/resource/South%20African%20TNC%20Report%20%20to%20the%20UNFCCC_31%20Aug.pdf

²⁴¹ World Bank Group. 2021. South Africa Country Profile. Retrieved from: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15932-WB_South%20Africa%20Country%20Profile-WEB.pdf

²⁴² World Bank Group. 2021. South Africa Country Profile. Available at: <https://climateknowledgeportal.worldbank.org/country/south-africa/climate-data-projections>. Accessed on 26 September 2025.

²⁴³ Department of Environmental Affairs (DEA). 2018. South Africa's Third National Communication under the United Nations Framework Convention on Climate Change. Pretoria: Government of South Africa. Retrieved from: https://unfccc.int/sites/default/files/resource/South%20African%20TNC%20Report%20%20to%20the%20UNFCCC_31%20Aug.pdf

²⁴⁴ Office of the Premier, Mpumalanga Province. 2024. Premier Ndlovu to discuss storm damages with affected Municipalities and Departments. Media Release, 29 October 2024. Mbombela: Office of the Premier. Retrieved from: <https://www.mpg.gov.za/sites/default/files/media/MEDIA%20ADVISORY%20-%20PREMIER%20STORM%202024.pdf>

²⁴⁵ European Centre for Medium-Range Weather Forecasts. ERA5-Land. Available at: <https://www.ecmwf.int/en/era5-land>

²⁴⁶ Hersbach H. et al. 2020. The ERA5 global reanalysis. Quarterly Journal of the Royal Meteorological Society, 146, 1999–2049.

²⁴⁷ IPCC. 2021. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Cambridge, UK.

²⁴⁸ Engelbrecht F. et al. 2015. Projections of rapidly rising surface temperatures over Africa under low mitigation. Environmental Research Letters. 10,085004

²⁴⁹ Trisos CH. et al. 2022. Africa, in Pörtner HO, Roberts DC, Tignor M, et al. Climate change 2022: impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Cambridge, UK.

²⁵⁰ Adeola AM, Kruger A, Makgoale TE & Botai JO. 2022. Observed trends and projections of temperature and precipitation in the Olifants River Catchment in South Africa. PLoS ONE, 17, 8, e0271974.

>35°C)^{251,252,253}. Projections for 2080 indicate warming could reach 3–4°C under high-emission scenarios^{254,255,256}, while climate models for the Kruger Lowveld region project temperature increases of ~3°C by mid-century and up to 6°C by 2100 without mitigation^{257,258,259}. Under moderate mitigation scenarios, mid-century warming of ~2.5–3°C is projected for interior South Africa²⁶⁰. Such temperature increases are expected to accelerate evaporation and evapotranspiration, reducing soil moisture and placing plants under greater water stress, even if total rainfall does not decline substantially^{261,262}. These rising temperatures are likely to increase wildfire risk, intensify heat-related health stresses, reduce crop and livestock productivity and alter pest and disease dynamics.

3.4.1.2 Rainfall and climate variability

Annual rainfall is expected to remain stable or increase slightly due to more intense, episodic storms rather than gentle season-long rains^{263,264}. Rainfall projections for the Kruger National Park (KNP) by mid-century vary by emission scenario and model²⁶⁵. One assessment projected an 8.8% increase in mean annual rainfall by 2050 in the RCP8.5 scenario, while other models suggest minimal change (1% decrease by 2080)²⁶⁶. Adjacent catchments such as the Olifants River are projected to experience variable rainfall changes by the mid-2050s, with decreases of 5–30% in central areas but potential 5% increases in southern regions²⁶⁷. These projections indicate the spatial variability of climate impacts across the broader region. Irrespective of the changes to annual rainfall, projected changes in the nature of the rainfall are more likely to impact ecosystems and people. Increasingly, rain is expected to become more sporadic and

²⁵¹ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in savanna national parks of South Africa. *Environmental Development*, 55, 101216.

²⁵² Coldrey KM, Turpie JK, Midgley G, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36, e13941.

²⁵³ Mbokodo I, Bopape M-J, Chikoore H, Engelbrecht F & Nethengwe N. 2020. Heatwaves in the future warmer climate of South Africa. *Atmosphere*, 11, 7, 712.

²⁵⁴ Adeola AM, Kruger A, Makgoale TE & Botai JO. 2022. Observed trends and projections of temperature and precipitation in the Olifants River Catchment in South Africa. *PLoS ONE*, 17, 8, e0271974.

²⁵⁵ Aich V. et al. 2014. Comparing impacts of climate change on streamflow in four large African river basins. *Hydrology and Earth System Sciences*. 18,1305–1321.

²⁵⁶ Bunting EL, Fullman T, Kiker G & Southworth J. 2016. Utilization of the SAVANNA model to analyze future patterns of vegetation cover in Kruger National Park under changing climate. *Ecological Modelling*, 342, 147–160.

²⁵⁷ Mbokodo I, Bopape M-J, Chikoore H, Engelbrecht F & Nethengwe N. 2020. Heatwaves in the future warmer climate of South Africa. *Atmosphere*. 11, 7, 712.

²⁵⁸ van Wilgen NJ, Goodall V, Holness S, Chown SL & McGeoch MA. 2016. Rising temperatures and changing rainfall patterns in South Africa's national parks. *International Journal of Climatology*, 36, 706–721.

²⁵⁹ Erasmus BFN, van Jaarsveld AS, Chown SL, Kshatriya M & Wessels KJ. 2002. Vulnerability of South African animal taxa to climate change. *Global Change Biology*, 8, 7, 679–693.

²⁶⁰ Bunting EL, Fullman T, Kiker G & Southworth J. 2016. Utilization of the SAVANNA model to analyze future patterns of vegetation cover in Kruger National Park under changing climate. *Ecological Modelling*, 342, 147–160.

²⁶¹ Qiao L, Zuo Z, Zhang R, Piao S, Xiao D & Zhang K. 2023. Soil moisture–atmosphere coupling accelerates global warming. *Nature Communications*, 14, 4908.

²⁶² Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks. Potential implications for tourism in the Kruger National Park. *Environmental Development*. 33, 100485.

²⁶³ MacFadyen S, Zambatis N, Van Teeffelen AJA & Hui C. 2018. Long-term rainfall regression surfaces for the Kruger National Park, South Africa: a spatio-temporal review of patterns from 1981 to 2015. *International Journal of Climatology*, 38, 5, 2506–2519.

²⁶⁴ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks. Potential implications for tourism in the Kruger National Park. *Environmental Development*, 33, 100485.

²⁶⁵ Adeola AM, Kruger A, Makgoale TE & Botai JO. 2022. Observed trends and projections of temperature and precipitation in the Olifants River Catchment in South Africa. *PLoS ONE*, 17, 8, e0271974.

²⁶⁶ Zhao M, Gerber S, MacBean N, Sitch S & Engström J. 2016. The role of environmental variables in shaping carbon turnover and accumulation in global forests. *Ecological Modelling*, 342, 177–188.

²⁶⁷ Coldrey KM, Turpie JK, Midgley G, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36, e13941.

occur in shorter and more intense downpours, with an associated increase in the frequency of extreme rainfall events (>200 mm in 24 hours)²⁶⁸ and risk of damaging floods and hail²⁶⁹.

Extended dry spells between rainfall events, combined with rising temperatures, are projected to increase the frequency and severity of droughts. In this region, short return periods for drought are already evident, with maize drought occurring on average every 1.5–2.5 years during the rainy season²⁷⁰. A return period refers to the average interval of time between events of a certain magnitude, such that shorter return periods indicate more frequent events. Consequently, farmers face crop-threatening drought conditions multiple times per decade under the historical climate, and future projections indicate greater frequency and severity of such events²⁷¹. Climate change is likely to make such fluctuations more pronounced, with more years of drought and occasional floods²⁷². These shifts are also expected to intensify flood²⁷³ and erosion hazards²⁷⁴, reduce groundwater recharge²⁷⁵ and alter river flow regimes²⁷⁶, with consequences for water quality and availability²⁷⁷ including higher river temperatures that stress aquatic species²⁷⁸, increased sedimentation from flood-driven erosion²⁷⁹, greater incidence of waterborne diseases²⁸⁰, reduced streamflow in already water-stressed basins²⁸¹ and suppressed groundwater recharge during droughts²⁸².

Recent observations already reflect these projections: the frequency of flash drought events in South Africa has increased by ~220% over the past 50 years²⁸³ and extreme heat days have risen significantly in KNP²⁸⁴. The Sabie and Sand River catchments have also experienced severe droughts with increasing

²⁶⁸ Thomas TS, Schlosser CA, Strzepek K, Robertson RD & Arndt C. 2022. Using a large climate ensemble to assess the frequency and intensity of future extreme climate events in Southern Africa. *Frontiers in Climate*, 4, 787721.

²⁶⁹ Scafetta N. 2024. Impacts and risks of "realistic" global warming projections for the 21st century. *Geoscience Frontiers*, 15, 2, 101774.

²⁷⁰ Malherbe J, Smit IPJ, Wessels KJ & Beukes PJ. 2020. Recent droughts in the Kruger National Park as reflected in the extreme climate index. *African Journal of Range & Forage Science*, 37, 1, 1–17.

²⁷¹ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks. Potential implications for tourism in the Kruger National Park. *Environmental Development*, 33, 100485.

²⁷² Malherbe J, Smit IPJ, Wessels KJ & Beukes PJ. 2020. Recent droughts in the Kruger National Park as reflected in the extreme climate index. *African Journal of Range & Forage Science*, 37, 1, 1–17.

²⁷³ Milan DJ, Heritage GL, Tooth S & Entwistle N. 2018. Morphodynamics of bedrock-influenced dryland rivers during extreme floods: Insights from the Kruger National Park, South Africa. *Geological Society of America Bulletin*, 130, 11–12, 1825–1841.

²⁷⁴ Heritage G, Tooth S, Entwistle N & Milan D, 2015. Long-term flood controls on semi-arid river form: Evidence from the Sabie and Olifants rivers, eastern South Africa. *Proceedings of the International Association of Hydrological Sciences*. 367, 141–146.

²⁷⁵ Kolusu SR. et al. 2019. The El Niño event of 2015–2016: Climate anomalies and their impact on groundwater resources in East and Southern Africa. *Hydrology and Earth System Sciences*, 23, 1751–1762.

²⁷⁶ Aich V. et al. 2014. Comparing impacts of climate change on streamflow in four large African river basins. *Hydrology and Earth System Sciences*, 18, 1305–1321.

²⁷⁷ MacFadyen S, Zambatis N, Van Teeffelen AJA & Hui C. 2018. Long-term rainfall regression surfaces for the Kruger National Park, South Africa: A spatio-temporal review of patterns from 1981–2015. *International Journal of Climatology*, 38, 13, 5063–5078.

²⁷⁸ Rivers-Moore NA, Jewitt GPW & Weeks DC. 2005. Derivation of quantitative management objectives for annual instream water temperatures in the Sabie River using a biological index. *Water SA*, 31,4, 473–486.

²⁷⁹ Milan D, Heritage G, Tooth S & Entwistle N. 2018. Morphodynamics of bedrock-influenced dryland rivers during extreme floods: Insights from the Kruger National Park, South Africa. *Geological Society of America Bulletin*, 130, 11–12, 1825–1841.

²⁸⁰ Botai CM. et al. 2020. Hydroclimatic extremes in the Limpopo River Basin, South Africa, under changing climate. *Water*, 12, 12, 3299.

²⁸¹ *Ibid.*

²⁸² Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. *Environmental Development*, 55, 101216.

²⁸³ Urban M. et al. 2018. Surface moisture and vegetation cover analysis for drought monitoring in the southern Kruger National Park using Sentinel-1, Sentinel-2, and Landsat-8. *Remote Sensing*, 10, 1482.

²⁸⁴ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. *Environmental Development*, 55, 101216.

regularity, exemplified by the 2015–2016 event linked to El Niño²⁸⁵. This natural climate pattern, characterized by warmer-than-average sea surface temperatures in the central and eastern Pacific Ocean, disrupts rainfall and temperature regimes across southern Africa. The 2015–2016 El Niño produced one of the most severe meteorological droughts on record in the region, with an estimated return period of >200 years. This drought was considerably more intense than comparable past events, and anthropogenic warming approximately doubled the risk of its occurrence^{286,287}.

Further details on the climate profile of the Sabie and Sand River catchments, including temperature, rainfall and variability, are provided in Section 2.1.14.

3.4.2 Climate Change Impacts (CCB, GL1.2)

Impacts on community well-being

Current and anticipated changes in climate affect the well-being of communities in the Sabie and Sand River catchments and these impacts are expected to intensify with time²⁸⁸. Water scarcity and food insecurity linked to drought present immediate threats^{289,290} as rural households rely to varying degrees on natural water sources and rain-fed agriculture for staple food and income²⁹¹. Residents of the nearby Limpopo River Basin note that when rainfall patterns are stable, harvests are possible, but periods of low or erratic rainfall often result in reduced yields or crop failures²⁹². The 2015–2016 drought eliminated entire harvests in some areas, with communities around KNP losing two successive maize seasons^{293,294}. Poor or failed harvests reduce household food availability, income from crop sales and savings, as food and fodder must be purchased. Small-scale farmers without irrigation or crop insurance are particularly exposed to these impacts. A national assessment projected that under an increased warming scenario, African smallholder crop net revenues could decline by up to 90% by 2100²⁹⁵. However, the compounding effect of recurrent droughts and occasional floods is likely to undermine livelihoods well before this timeframe²⁹⁶.

While drought represents the primary climate threat, projected increases in extreme rainfall events present substantial additional risks through flooding. Flash floods are particularly dangerous in the semi-arid landscape, where hard-packed soils have limited water absorption capacity, causing rapid runoff that

²⁸⁵ Malherbe J, Smit IPJ, Wessels KJ & Beukes PJ. 2020. Recent droughts in the Kruger National Park as reflected in the extreme climate index. *African Journal of Range & Forage Science*, 37, 1, 1–17.

²⁸⁶ van Wilgen NJ, Goodall V, Holness S, Chown SL & McGeoch MA. 2016. Rising temperatures and changing rainfall patterns in South Africa's national parks. *International Journal of Climatology*, 36, 706–721.

²⁸⁷ Kolusu SR. et al. 2019. The El Niño event of 2015–2016: climate anomalies and their impact on groundwater resources in East and Southern Africa. *Hydrology and Earth System Sciences*, 23, 1751–1762.

²⁸⁸ dos Santos M. 2024. Climate Change, Air Pollution, and Human Health in the Kruger to Canyons Biosphere Region, South Africa, and Amazonas, Brazil: A Narrative Review. *Atmosphere*, 15, 562.

²⁸⁹ Urban M. et al. 2018. Surface moisture and vegetation cover analysis for drought monitoring in the Southern Kruger National Park using Sentinel-1, Sentinel-2, and Landsat-8. *Remote Sensing*, 10,9, 1486.

²⁹⁰ Adeola AM, Kruger A, Makgoale TE & Botai JO. 2022. Observed trends and projections of temperature and precipitation in the Olifants River Catchment in South Africa. *PLoS ONE*, 17, 8, e0271974.

²⁹¹ Berghald S, Mayer S & Böhlinger P. 2024. Revealing trends in extreme heatwave intensity: applying the UNSEEN approach to Nordic countries. *Environ. Res. Lett.* 19, 3, 034026.

²⁹² Mangani R. et al. 2025. The impact of past and current district-level climatic shifts on maize production and the implications for South African farmers. *Theoretical and Applied Climatology*, 156, 2.

²⁹³ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks. Potential implications for tourism in the Kruger National Park, *Environmental Development*, 33, 100485.

²⁹⁴ Malherbe J, Smit IP, Wessels KJ. et al. 2020. Recent droughts in the Kruger National Park as reflected in the extreme climate index. *African Journal of Range & Forage Science*, 37, 1, 1–17.

²⁹⁵ Mbokodo I, Bopape M-J, Chikoore H, Engelbrecht F & Nethengwe N. 2020. Heatwaves in the future warmer climate of South Africa. *Atmosphere*, 11, 7, 712.

²⁹⁶ dos Santos M. 2024 Climate Change, Air Pollution, and Human Health in the Kruger to Canyons Biosphere Region, South Africa, and Amazonas, Brazil: A Narrative Review. *Atmosphere*, 15, 562.

overwhelms drainage systems and threatens community safety²⁹⁷. Floodwaters in river systems trap people in low-lying areas, prevent vehicles from using flooded roads, or isolate areas between normally dry watercourses that fill rapidly during storms. Rural communities are especially vulnerable when traditional knowledge of flood patterns becomes unreliable under changing rainfall regimes. Children and elderly residents face heightened risks due to limited mobility during evacuation scenarios²⁹⁸. Floods also wash away bridges, damage or destroy roads and compromise water and sanitation infrastructure. The Sabie River flood in 2000 demonstrated the scale of potential damage, dramatically altering river channels and destroying riparian infrastructure²⁹⁹. Damaged roads isolate communities from markets, schools and health services for extended periods, while water infrastructure damage contaminates drinking water supplies and compromises sanitation systems, creating secondary health risks that strain already limited healthcare resources. Flood damage further disrupts local economic activities beyond agriculture, affecting small businesses, markets and transport networks. Recovery costs place additional strain on households, often requiring debt accumulation or depletion of savings intended for other purposes³⁰⁰. Emergency response capacity in rural areas is limited, placing further pressure on government services that are already stretched thin in their ability to provide basic water supply and flood management³⁰¹.

Water security for domestic use is also under threat. Across Africa, the proportion of the population exposed to water scarcity is likely to have increased from 47% in 2000 to 65% in 2025³⁰². The Sabie and Sand River catchments reflect this trend, as communities in the semi-arid project zone rely on rivers, boreholes or municipal schemes that are sensitive to rainfall³⁰³. Climate change is already increasing the frequency of water shortages in rural and peri-urban villages without reticulated supply. Women and girls, who are primarily responsible for water collection, face increased difficulties when local sources dry up, with longer walking distances and queues reducing the time available for schooling, household responsibilities and income-generating activities. These conditions also place pressure on government services, which are often required to deliver water using alternatives such as tanker trucks.

Rising temperatures will increase the number of days with extreme heat, leading to heat-related health risks and reduced work capacity, particularly for laborers and herders who work outdoors. When combined with dry vegetation, these hotter conditions also raise the risk of uncontrolled fires. Projections indicate a likely increase in fire-danger days in northeastern South Africa under future climate scenarios³⁰⁴, with bushfires threatening crops, grazing lands and homes, directly threatening community assets and safety in the project zone³⁰⁵.

These climatic pressures undermine livelihood stability and influence migration patterns. Households that rely partly on farming or natural resource collection increasingly seek alternative income sources, with many turning to labor migration³⁰⁶. Youth and able-bodied adults, often men, leave for cities such as

²⁹⁷ Milan D, Heritage G, Tooth S & Entwistle N. 2018. Morphodynamics of bedrock-influenced dryland rivers during extreme floods: insights from the Kruger National Park, South Africa. *Geological Society of America Bulletin*, 130, 11–12, 1825–1841.

²⁹⁸ dos Santos M. 2024. Climate change, air pollution, and human health in the Kruger to Canyons Biosphere Region, South Africa, and Amazonas, Brazil: a narrative review. *Atmosphere*, 15, 562.

²⁹⁹ Heritage G, Tooth S, Entwistle N & Milan D. 2014. Long-term flood controls on semi-arid river form: evidence from the Sabie and Olifants rivers, eastern South Africa. *IAHS Publications*. 367, 141–148.

³⁰⁰ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks: Potential implications for tourism in the Kruger National Park. *Environmental Development*. 33, 100485.

³⁰¹ Matthews S. 2018. Protecting South Africa's national parks against the threat of climate change. *The Water Wheel*, September/October 2018. *Water Research Commission*, 12–16.

³⁰² Botai CM. et al. 2020. Hydroclimatic extremes in the Limpopo River Basin, South Africa, under changing climate. *Water*, 12, 3299.

³⁰³ Aich V. et al. 2014. Comparing impacts of climate change on streamflow in four large African river basins. *Hydrology and Earth System Sciences*, 18, 1305–1321.

³⁰⁴ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in savanna national parks of South Africa. *Environmental Development*, 55, 101216.

³⁰⁵ *Ibid.*

³⁰⁶ Urban M. et al. 2018. Surface moisture and vegetation cover analysis for drought monitoring in the southern Kruger National Park using Sentinel-1, Sentinel-2, and Landsat-8. *Remote Sensing*, 10, 1482.

Johannesburg and Pretoria in search of work, fragmenting families and reducing the agricultural labor force³⁰⁷. Those left behind — frequently women, the elderly and children — must cope with worsening climate conditions with fewer resources and a reduced workforce. Without adaptation, community well-being will be increasingly undermined by reduced nutrition, loss of income, water insecurity, infrastructure and health risks and social dislocation³⁰⁸. These stresses will disproportionately affect vulnerable groups, including women, youth and the poor.

Impacts on biodiversity

Shifting vegetation dynamics

In South Africa, millions of hectares of savanna and grassland have experienced bush encroachment over the past century³⁰⁹. In the KNP Lowveld, species such as sickle bush and mopane are encroaching into former grasslands, fundamentally shifting them into new stable states that are less productive or useful, and which are seen as undesirable by land managers and ecologists. Woody encroachment threatens biodiversity by simplifying plant communities — fewer grasses and the dominance of hardy shrubs — and thereby changing the fauna assemblage by favoring browsers over grazers³¹⁰. Such changes to the fauna and flora are likely to result in the disruption of complex ecological interactions that sustain these ecosystems, with several unpredictable outcomes.

Extreme events, wildlife and tourism

The projected increase in extreme events such as periods of extreme heat, droughts and floods will challenge the resilience of the natural ecosystems and their resident wildlife. Droughts have historically impacted the region's biodiversity. During the 2015–2016 drought, water sources in KNP dried to the point that park management had to cull animals, mostly grazers and hippos, and many more died naturally^{311,312,313}. Extreme events are naturally occurring components of the ecological disturbance regime integral to maintaining animal and vegetation population dynamics. However, fenced ecosystems prevent wildlife from migrating away from climate-impacted areas, limiting their natural ability to adapt to extreme climatic events, which are predicted to increase in frequency within the project zone. In managed ecosystems typical of the nature reserves in the project zone, wildlife population crashes disrupt ecological plant-herbivore and predator-prey relationships³¹⁴.

Aquatic ecosystems in the Sabie and Sand River catchments are particularly vulnerable to extreme climatic events. Reduced river flows and increased water temperatures threaten fish and amphibian populations, and periodic drying of streams impacts aquatic insects that support the predator food webs³¹⁵. Conversely, flood events alter wetland habitats by scouring riverbanks and depositing sediments, while destroying nests and drowning wildlife unable to escape floodwaters. The flood of 2000 in the Sabie River demonstrates

³⁰⁷ Gillson L & Ekblom A. 2009. Untangling anthropogenic and climatic influence on riverine forest in the Kruger National Park, South Africa. *Vegetation History and Archaeobotany*, 18, 171–185.

³⁰⁸ Coldrey KM, Turpie JK, Midgley G, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36, e13941.

³⁰⁹ Bunting EL, Fullman T, Kiker G & Southworth J. 2016. Utilization of the SAVANNA model to analyze future patterns of vegetation cover in Kruger National Park under changing climate. *Ecological Modelling*, 342, 147–160.

³¹⁰ *Ibid.*

³¹¹ Malherbe J, Smit IPJ, Wessels KJ & Beukes PJ. 2020. Recent droughts in the Kruger National Park as reflected in the extreme climate index. *African Journal of Range & Forage Science*. 37, 1, 1–17.

³¹² *Ibid.*

³¹³ Urban M. et al. 2018. Surface moisture and vegetation cover analysis for drought monitoring in the southern Kruger National Park using Sentinel-1, Sentinel-2, and Landsat-8. *Remote Sensing*, 10, 1482.

³¹⁴ Archibald S. et al. 2005. Shaping the landscape: Fire–grazer interactions in an African savanna. *Ecological Applications*. 15, 1, 96–109.

³¹⁵ Mhlanga L, Oberholster PJ, Sibali LL, Gomo C, Musee N & Botha A-M. 2020. Impact of land-use and flow conditions on the phytoplankton of the Sabie River, South Africa. *Bothalia – African Biodiversity & Conservation*, 50, 1, a6.

how a single extreme event can unpredictably alter river geomorphology and riparian vegetation^{316,317}, often creating opportunities for invasive species to establish in disturbed areas^{318,319}.

Wildlife population crashes, as described above, have direct implications for nature-based tourism, which represents an economic driver for the region. Tourism in the Sabie and Sand River catchments and KNP relies on wildlife viewing opportunities, particularly the presence of large mammals and diverse bird populations. Drought-induced animal mortality reduces game viewing opportunities and limits tourism revenue for both private reserves and local communities dependent on tourism-based employment. The 2015–2016 drought demonstrated this vulnerability when reduced wildlife populations and degraded landscapes diminished visitor experiences and led to decreased tourism bookings in subsequent seasons. Aquatic ecosystem disruptions further affect tourism by reducing opportunities for activities including bird watching, wildlife photography, boating, fishing and nature walks along rivers and wetlands. As extreme events become more frequent and intense under climate change, the tourism industry faces increased volatility that threatens long-term economic sustainability. Local communities that rely on tourism-related employment – including guides, hospitality workers and craft producers – become more vulnerable to economic shocks when wildlife populations decline and landscapes become degraded, reducing the area's attractiveness to visitors. The projected intensification of extreme climatic events, therefore, threatens not only biodiversity conservation objectives but also the economic foundation that supports conservation funding and community livelihoods in the region.

Species range shifts and extinctions

Species range shifts and extinctions present long-term concerns, particularly in managed ecosystems. Climate envelope modelling by South African National Parks (SANParks) and South African National Biodiversity Institute (SANBI) based on global warming projections (~2.5–3 °C of warming mid-century scenario)³²⁰ predicted that the KNP could lose 24–59% of its mammal species, 28–40% of its birds, 21–45% of its reptiles and up to 70–80% of its insects, such as butterflies and other invertebrates^{321,322}. At greater warming predictions (~4–6 °C by 2100, a plausible outcome under current global trajectories), as many as two-thirds of all animal species in KNP could face extinction or localized extinction^{323,324}.

The Sabie and Sand River catchments lie at the transition between montane grassland upstream and lowveld savanna downstream³²⁵. Transition zones between different vegetation types are particularly sensitive to climate change because small shifts in temperature or precipitation cause the boundary between ecosystems to move, affecting which species can survive in specific locations. This sensitivity

³¹⁶ Milan D, Heritage G, Tooth S & Entwistle N. 2018. Morphodynamics of bedrock-influenced dryland rivers during extreme floods: Insights from the Kruger National Park, South Africa. *Geological Society of America Bulletin*, 130, 11–12, 1825–1841.

³¹⁷ Heritage G, Tooth S, Entwistle N & Milan D. 2014. Long-term flood controls on semi-arid river form: Evidence from the Sabie and Olifants rivers, eastern South Africa. *IAHS Publ*, 367, 141–148.

³¹⁸ Milan D, Heritage G, Tooth S & Entwistle N. 2018. Morphodynamics of bedrock-influenced dryland rivers during extreme floods: Insights from the Kruger National Park, South Africa. *Geological Society of America Bulletin*, 130, 11–12, 1825–1841.

³¹⁹ Heritage G, Tooth S, Entwistle N & Milan D. 2014. Long-term flood controls on semi-arid river form: Evidence from the Sabie and Olifants rivers, eastern South Africa. *IAHS Publ*, 367, 141–148.

³²⁰ Coldrey KM, Turpie JK, Midgley GF, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36, 5, e13941.

³²¹ Siyabona Africa. 2025. Kruger devastated by climate change. *Kruger National Park – South African Safari*. Available at: <https://www.krugerpark.co.za/krugerpark-times-5-7-kruger-devastated-by-climate-change-24943>.

³²² Coldrey KM, Turpie JK, Midgley GF, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36, 5, e13941.

³²³ Price J, Forstehäusler N, Graham E, Osborn TJ & Warren R. 2024. Report on the observed climate, projected climate, and projected biodiversity changes for Kruger National Park under differing levels of warming. Report of the Wallace Initiative.

³²⁴ Coldrey KM, Turpie JK, Midgley GF, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36, 5, e13941.

³²⁵ Gillson L & Ekblom A. 2009. Untangling anthropogenic and climatic influence on riverine forest in the Kruger National Park, South Africa. *Vegetation History and Archaeobotany*, 18, 171–185.

makes the catchment area vulnerable to climate-driven shifts in species distribution, as changing conditions may favor either grassland or savanna species depending on the direction of climate change. While wildlife and plant species naturally migrate in response to changing environmental conditions to remain within their suitable climate envelopes, projected climate change presents three constraints that threaten species persistence in the region. These constraints relate to the rate of change, the degree of change and anthropogenic barriers to movement, as described below.

First, the projected rate of climate change will likely exceed the migration capacity of many species, particularly plants and other sessile or low-mobility organisms. The project zone is no longer in a natural state but is managed as a converted landscape. This includes the exclusion of large herbivores and birds that would ordinarily disperse seeds of native species and the suppression or modification of fire regimes. These alterations further limit natural dispersal pathways and processes that would otherwise facilitate the gradual shifting of species ranges in response to climate change. As a result, even if suitable habitat exists elsewhere, the ability of native flora to expand its distribution into new areas is constrained.

Even mobile species may be unable to adapt to the rate of change, as suitable habitat conditions shift faster than natural dispersal and establishment processes can accommodate³²⁶. Second, the degree of projected climate change could surpass what species can compensate for through migration alone. Temperature increases of 3–6 °C and altered rainfall patterns represent environmental shifts that exceed the tolerance ranges of many native species, even if they could successfully migrate to other areas. For moisture-dependent plant species such as riparian forest trees and wetland vegetation, local extinction becomes likely if streamflow becomes increasingly intermittent, regardless of their ability to disperse^{327,328}. Anthropogenic modification of the catchment further exacerbates these risks by creating barriers that prevent species from following the elevation and climatic gradients necessary for climate adaptation. Settlements, agriculture, infrastructure and fencing fragment the landscape and block natural movement corridors, preventing access to higher elevations or alternative habitats that could serve as climate refugia. As a result, populations could become trapped in areas that are becoming climatically unsuitable. Plants particularly vulnerable include moisture-loving riparian species, while fauna will be affected by habitat loss despite their greater mobility. Other impacts of climate stress include shorter active periods during the day for hunting or foraging as temperatures rise. For example, rangers have observed that cheetahs avoid running when temperatures exceed ~50 °C³²⁹ illustrating that behavioral adaptations have limits under extreme conditions.

Indirect impacts through human adaptation

Climate change could indirectly impact biodiversity through human adaptation responses that encroach on nature. For example, new dams or increased water abstraction from the rivers for irrigation³² further disrupt river flow into the KNP, affecting aquatic and riparian wildlife. Moreover, declining crop yields and failures could cause communities to become more dependent on natural resources, with increased poaching or wild harvesting accelerating biodiversity loss. The climate change impacts described above – including shifting vegetation dynamics, extreme weather events, species range shifts and indirect effects through human adaptation responses – represent interconnected threats to biodiversity in the Sabie and Sand River catchments. While the precise magnitude and timing of these impacts remain uncertain, current

³²⁶ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks: Potential implications for tourism in the Kruger National Park. *Environmental Development*, 33, 100485.

³²⁷ Parr CL, Gray EF & Bond WJ. 2012. Cascading biodiversity and functional consequences of a global change-induced biome switch. *Diversity and Distributions*, 18, 5, 493-503.

³²⁸ Van Coller A, Rogers, K & Heritage G. 1997. Linking riparian vegetation types and fluvial geomorphology along the Sabie River within the Kruger National Park, South Africa. *African Journal of Ecology*, 35, 3, 194-212.

³²⁹ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. *Environmental Development*, 55, 101216.

research indicates that biodiversity will likely deteriorate under projected climate scenarios without proactive intervention^{330,331,332}.

3.4.3 Measures Needed and Designed for Adaptation (CCB, GL1.3)

Save the Sand introduces a set of integrated measures designed to help communities and biodiversity adapt to the specific climate risks identified in the project zone, including water scarcity, erratic rainfall, recurrent droughts, extreme heat, soil erosion, flooding and declining ecosystem resilience.

Addressing water scarcity and drought

Training in permaculture equips households and farmers with practical water-management strategies that directly reduce vulnerability to prolonged dry periods. Techniques such as rainwater harvesting³³³, greywater reuse, simple irrigation scheduling and household water storage improve water-use efficiency³³⁴, enabling households to sustain crop production and domestic supply even when rainfall is erratic³³⁵. These measures strengthen adaptation by reducing dependence on unreliable rainfall and buffering communities against future droughts³³⁶. Demonstrations at schools and community centres provide visible examples that encourage wider community uptake, improving resilience at scale. For biodiversity, increased infiltration and soil moisture retention resulting from mulching and improved soil structure enhance ecosystem water storage^{337,338}, allowing vegetation and associated fauna to persist through longer dry periods.

Reducing heat stress and supporting crop resilience

Trees planted through project activities create shaded microclimates that reduce understory temperatures by 2–4 °C^{339,340}. This adaptation directly mitigates the projected increases in extreme heat, lowering stress on crops, livestock and people. Deeper-rooting species access water reserves during dry periods, maintaining vegetation cover and providing forage when surface soils are depleted³⁴¹. These microclimate effects also enhance biodiversity adaptation by maintaining cooler, more stable habitats that

³³⁰ Trisos CH. et al. 2022. Africa. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H-O Pörtner, DC Roberts, M Tignor, ES Poloczanska, K Mintenbeck, A Alegría, M Craig, S Langsdorf, S Löschke, V Möller, A Okem, B Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 1285–1455.

³³¹ Wudu K. et al. 2023. The impacts of climate change on biodiversity loss and its remedial measures using nature based conservation approach: a global perspective. *Biodiversity and Conservation*, 32, 3681–3701.

³³² Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. *Environmental Development*, 55, 101216.

³³³ *Ibid.*

³³⁴ Thomas TS, Schlosser CA, Strzepek K, Robertson RD & Arndt C. 2022. Using a large climate ensemble to assess the frequency and intensity of future extreme climate events in Southern Africa. *Frontiers in Climate*, 4:787721.

³³⁵ Botha JJ, van Rensburg LD, Anderson JJ, Hensley M & Baiphethi MN. 2012. Alleviating household food insecurity through in-field rainwater harvesting. *Irrigation and Drainag.*, 61, S1, 82–94.

³³⁶ Heritage G, Birkhead A, Davies T, Gibbins C, Entwistle N & Milan D. 2015. Long-term flood controls on semi-arid river form: evidence from the Sabie and Olifants Rivers, South Africa. *Proceedings of the International Association of Hydrological Sciences*, 367, 141–147.

³³⁷ MacFadyen S, Zambatis N, Van Teeffelen AJA & Hui C. 2018. Long-term rainfall regression surfaces for the Kruger National Park, South Africa: a spatio-temporal review of patterns from 1981–2015. *International Journal of Climatology*, 38(5):2279–2294.

³³⁸ Heritage G, Tooth S, Entwistle N & Milan D. 2014. Long-term flood controls on semi-arid river form: evidence from the Sabie and Olifants rivers, eastern South Africa. *Proceedings of the International Association of Hydrological Sciences*, 367:141–146.

³³⁹ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in savanna national parks of South Africa. *Environmental Development*, 55,101216.

³⁴⁰ Mbokodo I, Bopape MJ, Chikoore H, Engelbrecht F & Nethengwe N. 2020. Heatwaves in the future warmer climate of South Africa. *Atmosphere*, 11, 7, 712.

³⁴¹ Everson CS, Burger C, Olbrich BW & Gush MB. 2000. Verification of estimates of water use from riverine vegetation on the Sabie River in the Kruger National Park. Water Research Commission Report 877/1/01, Pretoria.

buffer vulnerable species from heat extremes³⁴². The tree custodian program ensures that planted trees survive the establishment phase, thereby securing these long-term adaptation benefits.

Preventing soil erosion and flood damage

Projected increases in intense rainfall events (>200 mm in 24 hours) threaten to erode soils and damage croplands. Project measures such as agroforestry, mulching and organic matter enrichment improve soil stability and structure, strengthening root systems and reducing erosion risk³⁴³. These measures allow rainfall to infiltrate rather than run off, reducing flood damage, protecting water quality and securing arable land for community use³⁴⁴. For biodiversity, stabilized soils protect riverbanks and aquatic habitats from sedimentation³⁴⁵, thereby safeguarding freshwater species that are vulnerable to extreme rainfall and floods.

Enhancing food security and livelihood diversification

Livelihood diversification is an important adaptation strategy for communities facing increasingly unreliable rainfall and crop failures³⁴⁶. By combining staple crops with fruit and nut trees, households reduce the risk of total harvest failure under erratic conditions. While staple crop yields are expected to increase by 5–15% under improved soil moisture management³⁴⁷, tree crops provide supplementary food and income within 3–5 years³⁴⁸. By this stage, 40–60% of households are projected to earn additional income from agroforestry products³⁴⁹. These diversified systems enhance resilience by reducing reliance on a single harvest, spreading climate risk and ensuring a steady food supply³⁵⁰.

Strengthening ecosystem services

The project's integrated agroforestry and permaculture measures enhance ecosystem services critical for climate adaptation. Trees and groundcover improve carbon sequestration³⁵¹, regulate local water cycles³⁵² and increase habitat connectivity³⁵³, helping ecosystems withstand pressures from shifting species ranges and extreme events³⁵⁴. By restoring vegetative cover and creating microhabitats, the project contributes to

³⁴² Kolusu SR, Shamsudduha M, Todd MC, Taylor RG, Seddon D, Kashaigili JJ, Ebrahim GY, Cuthbert MO, Sorensen JPR, Villholth KG, MacDonald AM & MacLeod DA. 2019. The El Niño event of 2015–2016: climate anomalies and their impact on groundwater resources in East and Southern Africa. *Hydrology and Earth System Sciences*, 23:1751–1762.

³⁴³ Urban M. et al. 2018. Surface moisture and vegetation cover analysis for drought monitoring in the southern Kruger National Park using Sentinel-1, Sentinel-2 and Landsat-8. *Remote Sensing*, 10, 1482.

³⁴⁴ *Ibid.*

³⁴⁵ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks: Potential implications for tourism in the Kruger National Park. *Environmental Development*, 33:100485.

³⁴⁶ Adeola AM, Kruger A, Makgoale TE & Botai JO. 2022. Observed trends and projections of temperature and precipitation in the Olifants River Catchment in South Africa. *PLoS ONE*, 17(8):e0271974.

³⁴⁷ Crais C. 2003. Maize and the making of South Africa's agrarian landscape. *Journal of Southern African Studies*, 29, 613–632.

³⁴⁸ Muzata S. 2025. Africa's smallholder farmers key to global food security. CGIAR. Available at: <https://www.cgiar.org/news-events/news/africas-smallholder-farmers-key-to-global-food-security>. Accessed on 26 September 2025.

³⁴⁹ Coldrey KM, Turpie JK, Midgley G, Scheiter S, Hannah L, Roehrdanz PR & Foden WB. 2022. Assessing protected area vulnerability to climate change in a case study of South African national parks. *Conservation Biology*, 36:e13941.

³⁵⁰ Botai CM. et al. 2020. Hydroclimatic extremes in the Limpopo River Basin, South Africa, under changing climate. *Water*, 12(12):3299.

³⁵¹ Dos Santos M. 2024. Climate change, air pollution, and human health in the Kruger to Canyons Biosphere Region, South Africa, and Amazonas, Brazil: A narrative review. *Atmosphere*, 15:562.

³⁵² Wigley-Coetsee. et al. 2022. Reflecting on research produced after more than 60 years of exclosures in the Kruger National Park. *Koedoe*. 64(1): a1674.

³⁵³ Mashula N, Chapungu L & Nhamo G. 2025. Extreme heat trends and impacts in Savanna national parks of South Africa. *Environmental Development*, 55:101216.

³⁵⁴ Milan D, Heritage G, Tooth S & Entwistle N. 2018. Morphodynamics of bedrock-influenced dryland rivers during extreme floods: Insights from the Kruger National Park, South Africa. *Geological Society of America Bulletin*, 130, 1825–1841.

maintaining biodiversity³⁵⁵ resilience in response to projected bush encroachment³⁵⁶, species losses and ecosystem disruption³⁵⁷.

Social inclusion, knowledge transfer and market access

The project also advances adaptation by empowering marginalized groups — particularly women, youth and poorer households — to participate in and benefit from project activities. By earning supplementary income from fruit and nut trees, these groups reduce their reliance on climate-sensitive livelihoods and gain greater financial security during climate shocks. Training in permaculture and agroforestry builds local knowledge and skills that enhance adaptive capacity, while deliberate intergenerational knowledge transfer ensures that younger community members learn sustainable practices that will remain effective under future climate scenarios. Support for market access further strengthens adaptation by connecting households to diversified income opportunities, reducing dependence on single harvests and enabling communities to absorb climate-related economic shocks. Together, these social and institutional measures complement the ecological interventions, ensuring that adaptation outcomes are inclusive and durable.

4 COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CCB, CM1.1)

The without-project scenario is informed by secondary data, including census and government datasets. Further baseline assessments will be conducted prior to the project commencing to confirm community conditions and socio-economic indicators.

Human settlement in the project area is characterized by small to medium-sized towns surrounded by clustered villages, scattered rural homesteads and agricultural land³⁵⁸. Most of the villages and rural homesteads are concentrated along road networks and river systems. Governance in these areas includes three legislated tiers — national, provincial and local — and traditional authorities³⁵⁹. Access to basic services such as piped water, sanitation, electricity, healthcare and education varies across settlements and is generally limited in most rural areas³⁶⁰. Sources of income vary considerably and include a combination of formal employment — in both near and distant locations — subsistence and small-scale commercial farming and informal sector activities.

Community well-being

Provinces in South Africa are divided into districts and then local municipalities. The project zone is situated mostly within the Bushbuckridge Local Municipality of the Ehlanzeni District Municipality (EDM) in Mpumalanga. This subsection details community well-being metrics for EDM and Bushbuckridge Local Municipality.

³⁵⁵ Dube K & Nhamo G. 2020. Evidence and impact of climate change on South African national parks: Potential implications for tourism in the Kruger National Park. *Environmental Development*, 33:100485.

³⁵⁶ Wigley-Coetsee C. et al. 2022. Reflecting on research produced after more than 60 years of exclusions in the Kruger National Park. *Koedoe*, 64(1):a1674.

³⁵⁷ MacFadyen S, Zambatis N, Van Teeffelen AJA & Hui C. 2018. Long-term rainfall regression surfaces for the Kruger National Park, South Africa: a spatio-temporal review of patterns from 1981–2015. *International Journal of Climatology*, 38(5):2279–2294.

³⁵⁸ Department of Cooperative Governance and Traditional Affairs. 2020. Ehlanzeni District: Profile and Analysis, District Development Model. Pretoria: Republic of South Africa. Retrieved from: https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf

³⁵⁹ Republic of South Africa. 2019. Traditional and Khoi-San Leadership Act (No. 3 of 2019). Pretoria: Government Gazette

³⁶⁰ Mpumalanga Provincial Government. 2023. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2023_Final.pdf.

Ehlanzeni District Municipality

The EDM is a predominantly rural area comprising towns, peri-urban settlements and dispersed villages. Livelihoods are derived from subsistence and small-scale commercial farming, informal sector activities, formal employment in nearby towns and jobs in adjacent nature reserves. The table below presents selected socio-economic and well-being indicators for the district alongside national figures.

The data indicate unemployment, poverty, low household incomes, limited access to services and persistent health vulnerabilities within the district. These conditions constrain economic opportunities, restrict human capacity and reduce household resilience, with residents generally experiencing greater disadvantage than the national average across most measures. Poverty, unemployment and inequality are pronounced, with these conditions likely to increase dependence on social grants to meet basic household needs such as food, utilities and education³⁶¹. Additionally, service delivery gaps are present, reducing quality of life and increasing time burdens, particularly for women and youth. Educational attainment and literacy remain limited, which constrains access to employment opportunities and perpetuates intergenerational poverty. Public health constraints are evident in Human Immunodeficiency Virus (HIV) prevalence, which reduces household labor capacity and increases vulnerability considerably. Collectively, these factors determine the district’s low Human Development Index (HDI) and highlight the scale of sustained support required to improve living standards, expand livelihood options and promote inclusive growth within the project area.

Category	Indicator	Ehlanzeni District Municipality	South Africa	Year
Employment & Poverty	Average annual household income	~ZAR30,000 (US\$1,700) ³⁶²	~ZAR240,000 (US\$13,800) ³⁶³	2020; 2023
	Percentage of individuals receiving grants	~20% ³⁶⁴	39% ³⁶⁵	2023
	Unemployment rate	38% ³⁶⁶	33% ³⁶⁷	2022

³⁶¹ Winchester MS, King B & Rishworth A. 2021. “It’s not enough:” Local experiences of social grants, economic precarity, and health inequity in Mpumalanga, South Africa. *Wellbeing, Space and Society*, 2, 100044.

³⁶² Department of Cooperative Governance and Traditional Affairs. 2020. Profile and Analysis: Ehlanzeni District. Republic of South Africa. Retrieved from: https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf

³⁶³ Statistics South Africa. 2025. South African Households Spend R3 Trillion Annually. Republic of South Africa. Available at: <https://www.statssa.gov.za/?p=17981>. Accessed on 26 September 2025.

³⁶⁴ Ehlanzeni District Municipality. 2025. Ehlanzeni District Municipality’s Draft Integrated Development Plan (IDP) and Budget Review- 2025/26 FY. Republic of South Africa. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2025/04/Draft-IDP-Budget-2025-26.pdf>

³⁶⁵ Statistics South Africa. 2023. General Household Survey. Republic of South Africa. Retrieved from: <https://www.statssa.gov.za/publications/P0318/P03182023.pdf>

³⁶⁶ Ehlanzeni District Municipality. 2024. Draft Integrated Development Plan and Budget Review 2024/25. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2024/04/Draft-IDP-Budget-2024-25-30-March-2024-3.pdf>

³⁶⁷ Mpumalanga Provincial Government. 2023. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2023_Final.pdf.

	Youth unemployment	53% ³⁶⁸	46% ³⁶⁹	2022; 2025
	Population living below the lower-bound poverty line (LBPL)	55% ³⁷⁰	47% ³⁷¹	2021
	Gini-coefficient	0.61 ^{372,373}	0.63 ³⁷⁴	2021
Education	Adults (20+) with no schooling	14% ³⁷⁵	7% ³⁷⁶	2022
	Adults (20+) with secondary education	41% ³⁷⁷	38% ³⁷⁸	2022
	Adults (20+) with tertiary education	8% ³⁷⁹	12% ³⁸⁰	2022
	Adult (20+) literacy rate	86% ³⁸¹	90% ³⁸²	2022

³⁶⁸ Ehlanzeni District Municipality. 2024. Draft Integrated Development Plan and Budget Review 2024/25. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2024/04/Draft-IDP-Budget-2024-25-30-March-2024-3.pdf>

³⁶⁹ Statistics South Africa. 2025. South Africa's Youth in the Labour Market: A Decade Review. Republic of South Africa. Available at: <https://www.statssa.gov.za/?p=18398>. Accessed on 26 September 2025.

³⁷⁰ Mpumalanga Provincial Government. 2023. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Available at: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2023_Final.pdf.

³⁷¹ *Ibid.*

³⁷² Mpumalanga Provincial Government. 2023. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Available at: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2023_Final.pdf.

³⁷³ The Gini coefficient quantifies income distribution within a population using household income data. A value of 0 represents perfect equality, while 1 represents perfect inequality. Values above 0.6 indicate severe income inequality, with wealth concentrated among a small proportion of households and most residents earning very little.

³⁷⁴ Mpumalanga Provincial Government. 2023. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2023_Final.pdf.

³⁷⁵ Statistics South Africa. 2023. Municipal Fact Sheet. Census 2022. Retrieved from: https://census.statssa.gov.za/assets/documents/2022/Census_2022_Municipal_factsheet-Web.pdf

³⁷⁶ *Ibid.*

³⁷⁷ *Ibid.*

³⁷⁸ *Ibid.*

³⁷⁹ *Ibid.*

³⁸⁰ *Ibid.*

³⁸¹ Statistics South Africa. 2023. Municipal Fact Sheet. Census 2022. Retrieved from:

https://census.statssa.gov.za/assets/documents/2022/Census_2022_Municipal_factsheet-Web.pdf

³⁸² *Ibid.*

Basic Services	Households with piped water inside the dwelling	35% ³⁸³	83% ³⁸⁴	2022
	Households with flush toilets connected to sewerage	36% ³⁸⁵	71% ³⁸⁶	2022
	Households with weekly refuse removal	35% ³⁸⁷	67% ³⁸⁸	2022
Health & Human Development	HIV prevalence	37% ³⁸⁹	30% ³⁹⁰	2019
	HDI	0.60 ³⁹¹	0.70 ³⁹²	2022

Bushbuckridge Local Municipality

The Project Proponent has prioritized Bushbuckridge Local Municipality for detailed demographic and contextual analysis, as initial project activities are planned within its jurisdiction. The delineated project area partially extends into the municipalities of Thaba Chweu, the City of Mbombela and Nkomazi – located in EDM. These will be described in future updates of the Project Development Document (PDD) once project activity instances (PAIs) are confirmed in their respective areas.

Bushbuckridge Local Municipality includes areas formerly designated as the Apartheid homelands of Gazankulu and Lebowa³⁹³. Settlement patterns in the region were determined by ethnic zoning, forced relocations and conservation-related displacement during Apartheid (1948–1994), which restricted Black communities to designated areas³⁹⁴. Traditional leadership structures were incorporated into state-controlled governance and the area was divided into ethnic regional authorities³⁹⁵. These historical processes continue to affect land tenure, governance arrangements and local socio-economic conditions.

³⁸³ Statistics South Africa. 2023. Municipal Fact Sheet. Census 2022. Retrieved from: https://census.statssa.gov.za/assets/documents/2022/Census_2022_Municipal_factsheet-Web.pdf.

³⁸⁴ *Ibid.*

³⁸⁵ *Ibid.*

³⁸⁶ *Ibid.*

³⁸⁷ *Ibid.*

³⁸⁸ *Ibid.*

³⁸⁹ Department of Health. 2021. The 2019 National Antenatal HIV Sentinel Survey (ANCHSS): Key Findings. Republic of South Africa. Retrieved from: https://knowledgehub.health.gov.za/system/files/elibdownloads/2023-04/Antenatal%2520survey%25202019%2520report_FINAL%2520-%2520formatted%2520MS%252007July.pdf

³⁹⁰ *Ibid.*

³⁹¹ Ehlanzeni District Municipality. 2024. Draft Integrated Development Plan and Budget Review 2024/25. Retrieved from: <https://www.ehlanzeni.gov.za/wp-content/uploads/2024/04/Draft-IDP-Budget-2024-25-30-March-2024-3.pdf>

³⁹² United Nations Development Programme. 2022. South Africa National Human Development Report 2022. Retrieved from: https://www.undp.org/sites/g/files/zskgke326/files/2023-07/sa-nhdr-2022_web_0.pdf

³⁹³ Narsiah S & Maharaj B. 1999. Borders of Dissent in South Africa: The Bushbuckridge Saga. Transformation (40). Retrieved from: <https://transformationjournal.org.za/wp-content/uploads/2017/03/tran040003.pdf>.

³⁹⁴ Phillips L. 2017. History of South Africa's Bantustans. Oxford Research Encyclopedias, African History. Department of History, New York University. Retrieved from: <https://oxfordre.com/africanhistory/display/10.1093/acrefore/9780190277734.001.0001/acrefore-9780190277734-e-80?print=pdf>

³⁹⁵ *Ibid.*

As of 2025, the municipality remains predominantly rural, comprising dispersed settlements and villages and several urbanizing centers, including: i) Bushbuckridge town; ii) Mkhuhlu; iii) Thulamahashe; iv) Acornhoek; v) Dwarsloop; vi) Maviljan; and vii) Shatale³⁹⁶ (see Figure 15 in Section 2.1.16). The socio-economic indicators in the table below highlight persistent development limitations across the municipality. These indicators demonstrate that residents within the municipality experience considerable socio-economic constraints linked to its predominantly rural characteristics and historical marginalization of communities in the area. Employment opportunities are limited, as indicated by considerable unemployment for residents, and in particular for young people. Poverty is prevalent and household incomes are reduced, leading to large numbers of residents reliant on state support and increasing inequality. Educational attainment is limited, with a considerable proportion of adults without formal schooling and literacy rates below national levels. Service provision is inadequate, with many households without piped water, flush sanitation or regular waste removal. Furthermore, public health challenges include HIV prevalence, which contributes to the municipality's decreased Human Development Index. Collectively, these indicators demonstrate the limitations that exist for residents in the municipality, which affect local development and social resilience in the area, highlighting the need for sustained livelihood opportunities.

Category	Indicator	Bushbuckridge Municipality	Local	Year
Employment & Income	Employment rate		52% ³⁹⁷	2022
	Youth unemployment		65% ³⁹⁸	2022
	Average household income	~ZAR9,400 (US\$540) per month ³⁹⁹		2021
	Gini-coefficient		0.58 ⁴⁰⁰	2020
Poverty & Social Protection	Population living below LBPL		62% ⁴⁰¹	2022

³⁹⁶ Bushbuckridge Local Municipality. 2024. Annual Report 2023–2024. Retrieved from: https://lg.treasury.gov.za/supportingdocs/MP325/MP325_Annual%20Report%20Final_2024_Y_20250313T142217Z_camyathi.pdf.

³⁹⁷ Bushbuckridge Local Municipality. 2024. Annual Report 2023–2024. Retrieved from: https://lg.treasury.gov.za/supportingdocs/MP325/MP325_Annual%20Report%20Final_2024_Y_20250313T142217Z_camyathi.pdf.

³⁹⁸ *Ibid.*

³⁹⁹ Republic of South Africa National Treasury. 2021. Municipal Socio-Economic Profiles. Retrieved from: https://lg.treasury.gov.za/ibi_apps/rs/ibfs/WFC/Repository/Public/Municipal_Socio-Economic_Profiles/Profiles/Municipal_Profiles/Mpumalanga/Bushbuckridge.pdf.

⁴⁰⁰ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁴⁰¹ *Ibid.*

	Social grant beneficiaries	~290,000 including ~225,000 with child support ⁴⁰²	2024
Education	Adults 20+ with no schooling	15% ⁴⁰³	2022
	Adults 20+ with secondary education	40% ⁴⁰⁴	2022
	Adults 20+ with tertiary education	5% ⁴⁰⁵	2022
	Adult literacy rate	66% ⁴⁰⁶	2019
Basic Services	Households with flush toilets connected to sewerage	23% ⁴⁰⁷	2022
	Households with weekly refuse removal	21% ⁴⁰⁸	2022
	Households with piped water inside dwelling	26% ⁴⁰⁹	2022
Health & Human Development	HIV Prevalence	31% ⁴¹⁰	2013
	HDI	0.55 ⁴¹¹	2019

⁴⁰² Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf.

⁴⁰³ *Ibid.*

⁴⁰⁴ *Ibid.*

⁴⁰⁵ *Ibid.*

⁴⁰⁶ Republic of South Africa National Treasury. 2021. Municipal Socio-Economic Profiles. Available at: https://lg.treasury.gov.za/ibi_apps/rs/ibfs/WFC/Repository/Public/Municipal_Socio-Economic_Profiles/Profiles/Municipal_Profiles/Mpumalanga/Bushbuckridge.pdf.

⁴⁰⁷ Statistics South Africa. 2025. Bushbuckridge Municipality. Available at: <https://census.statssa.gov.za/#/province/8/2>. Accessed on 26 September 2025.

⁴⁰⁸ *Ibid.*

⁴⁰⁹ *Ibid.*

⁴¹⁰ Bushbuckridge Local Municipality. 2023. Draft Integrated Development Plan 2022–2023. Retrieved from: <https://www.bushbuckridge.gov.za/images/files/2023/07/06/347/DRAFT-IDP-BLM-2022-23.pdf>.

⁴¹¹ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

Environmental pressures – including water scarcity, land-use change, woodland clearance and wetland modification – have altered ecosystem service delivery in the Bushbuckridge Municipality, with implications for rural well-being^{412,413}. Most rural households remain dependent on natural provisioning services such as water, fuelwood, edible plants, medicinal resources and livestock grazing, which support food production and health⁴¹⁴. Where livelihoods rely on rain-fed agriculture or wild-harvested products, reductions in these natural provisioning services limit food security, income stability and adaptive capacity⁴¹⁵. Additionally, vulnerability is spatially and economically uneven. Poor and remote households – with limited infrastructure or market access – are most affected. Continued declines in ecosystem services, such as flood attenuation, soil retention and access to sacred or communal sites, are expected to disproportionately reduce physical and psychological well-being within these communities⁴¹⁶. Several sectors contribute to Employment in the Bushbuckridge Municipality. In 2022 these were: i) 37.4% in community services; ii) 24.4% in trade; iii) 9.5% in private households; iv) 7.7% in agriculture; v) 6.7% in construction; vi) <5% each in transport, manufacturing, utilities; and vii) 0.6% in mining⁴¹⁷.

The state-owned Kruger National Park and several private nature reserves are present within the Bushbuckridge Municipality which is also situated within the United Nations Educational, Scientific and Cultural Organization-recognized Kruger to Canyons Biosphere Reserve⁴¹⁸. As a result, Mpumalanga's tourism sector was estimated to contribute 4–7% to provincial gross domestic product and 4–6% to provincial employment in 2020⁴¹⁹. These employment patterns highlight the dependence of local communities on surrounding ecosystems for employment opportunities. Furthermore, it indicates that as natural resources decline, households are likely to experience worsening food and income security resulting from climate shocks and reduced ability to adapt to these impacts.

Community diversity and characteristics

Black African communities comprise 99% of the population in Bushbuckridge Local Municipality⁴²⁰, represented by four predominant cultural groups: i) Shangaan/vaTsonga; ii) Mapulana; iii) amaSwati; and iv) Shangaan from Mozambique who settled in the eastern regions of Bushbuckridge after the 1975–1989 civil war in Mozambique⁴²¹. In 2022, 59% of residents spoke Xitsonga and 25% spoke Sepedi, with smaller proportions speaking SiSwati, Sesotho, isiZulu and other languages⁴²². Women constitute 54% of the population and men 46%, with 53% of households headed by women⁴²³. Additionally, 42% of the

⁴¹² Pollard S, Biggs H & Du Toit DR. 2014. A systemic framework for context-based decision making in natural resource management: reflections on an integrative assessment of water and livelihood security outcomes following policy reform in South Africa. *Ecology and Society*. 19(2):63.

⁴¹³ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁴¹⁴ Hove J, Mabetha D, van der Merwe M, Twine R, Kahn K, Witter S & D'Ambruoso L. 2023. Participatory action research to address lack of safe water, a community-nominated health priority in rural South Africa. *PLoS ONE*, 18, 7.

⁴¹⁵ Thabane VN, Agholor IA, Sithole MZ, Morepje MT, Msweli NS & Mgwanya LI. 2024. Socio-Demographic Determinants of Climate-Smart Agriculture Adoption Among Smallholder Crop Producers in Bushbuckridge, Mpumalanga Province South Africa. *Climate*. 12 (12):202.

⁴¹⁶ Pollard S, Biggs H & Du Toit DR. 2014. A systemic framework for context-based decision making in natural resource management: reflections on an integrative assessment of water and livelihood security outcomes following policy reform in South Africa. *Ecology and Society*. 19(2):63.

⁴¹⁷ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁴¹⁸ *Ibid*.

⁴¹⁹ Mpumalanga Provincial Government. 2022. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2022_Final.pdf

⁴²⁰ OpenUp. 2024. Bushbuckridge Local Municipality: Population and demographics. Wazimap. Available at: <https://next.wazimap.co.za/?geo=MP325#category-38>. Accessed on 26 September 2025.

⁴²¹ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁴²² OpenUp. 2024. Bushbuckridge Local Municipality: Population and demographics. Wazimap. Available at: <https://next.wazimap.co.za/?geo=MP325#category-38>. Accessed on 26 September 2025.

⁴²³ *Ibid*.

population was below the age of 19, indicating a large proportion of dependents relative to the working age population⁴²⁴.

There are ten traditional councils within the Bushbuckridge Local Municipality (see Figure 15 in Section 2.1.16), where traditional leaders – including chiefs (*kgosi*) and headmen (*ndunas*) – retain formal authority over land administration, dispute resolution and community representation^{425,426}. Chiefs oversee multiple villages and hold decision-making power over land allocation, inheritance and the acceptance of external interventions, while headmen operate at the village level to facilitate local governance and mediate community matters.

Traditional knowledge systems are evident in the use of native plants and natural resources. For example, several wild fruit species are harvested for local consumption – such as marula (*Sclerocarya birrea*), jackalberry (*Diospyros mespiliformis*), Kei apple (*Dovyalis caffra*) and pepperbark (*Warburgia salutaris*) – which are eaten or used medicinally⁴²⁷. Furthermore, marula is culturally significant in many South African communities⁴²⁸, being used in ancestral practices, traditional rituals and communal gatherings. Several groups use fruits, leaves, roots and bark in ceremonies linked to fertility, protection, divination and social cohesion⁴²⁹. Such traditions are considered a symbol of continuity between people, nature and ancestral belief systems.

Wild resources continue to provide a subsistence buffer, reducing household expenditure and mitigating shocks such as income loss and drought⁴³⁰. Most households collect firewood, wild foods, medicinal plants and construction materials⁴³¹. Additionally, subsistence farming is prevalent and commonly cultivated crops include maize, peanuts, pumpkin and cowpeas⁴³². However, rural–urban migration and reduced agricultural engagement among youth demonstrate an increasing preference for education and employment in urban areas⁴³³. Cash income is now primarily derived from wage labor, remittances and social grants, while farming and natural resource use are primarily for household consumption⁴³⁴. This household consumption highlights potential opportunities for communities and community groups, as project activities are expected to complement existing farming practices, patterns of natural resource use and the cultural significance of native trees.

⁴²⁴ OpenUp. 2024. Bushbuckridge Local Municipality: Population and demographics. Wazimap. Available at: <https://next.wazimap.co.za/?geo=MP325#category-38>. Accessed on 26 September 2025.

⁴²⁵ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁴²⁶ Claassens A & Cousins B. 2013. Land, Power & Custom: Controversies generated by South Africa's Communal Land Rights Act. Legal Resources Centre. UCT Press. Available at:

<https://openuctpress.uct.ac.za/uctpress/catalog/view/40/67/175>. Accessed on 26 September 2025.

⁴²⁷ Shai KN, Ncama K, Ndhlovu PT, Struwig M & Aremu AO. 2020. An Exploratory Study on the Diverse Uses and Benefits of Locally-Sourced Fruit Species in Three Villages of Mpumalanga Province, South Africa. *Food*, 9, 11, 1581.

⁴²⁸ Hlangwani E, Hiwilepo-van Hal P, Moganedi KLM & Dlamini BC. 2023. The future of African wild fruits – a drive towards responsible production and consumption of the marula fruit. *Frontiers in Sustainable Food Systems*, 7, 1294437.

⁴²⁹ *Ibid.*

⁴³⁰ Ragie FH, Olivier DW, Hunter LM, Erasmus BFN, Vogel C, Collinson M & Twine W. 2020. A portfolio perspective of rural livelihoods in Bushbuckridge, South Africa. *South African Journal of Science*, 116, 9–10.

⁴³¹ Pollard S, Biggs H & Du Toit DR. 2014. A systemic framework for context-based decision making in natural resource management: reflections on an integrative assessment of water and livelihood security outcomes following policy reform in South Africa. *Ecology and Society*, 19, 2, 63.

⁴³² Ragie FH, Olivier DW, Hunter LM, Erasmus BFN, Vogel C, Collinson M & Twine W. 2020. A portfolio perspective of rural livelihoods in Bushbuckridge, South Africa. *South African Journal of Science*, 11, 9-10.

⁴³³ *Ibid.*

⁴³⁴ *Ibid.*

4.1.2 Interactions between Communities and Community Groups (VCS, 3.19; CCB, CM1.1)

Community interactions in the project area are influenced by both customary governance systems, traditional tribal relationships and statutory governance frameworks established by government institutions. These systems define how land is allocated, how disputes are resolved and how decisions about land use are made — influencing the way communities and community groups relate to one another. Additionally, shared livelihood practices between communities within the project area link people across these structures through common experiences, objectives and livelihood concerns.

Customary governance remains an influential system in the project area, with traditional authorities remaining respected across communities. Chiefs hold authority over most residential and cropland areas under their jurisdiction and allocate farming plots, mediate disputes and provide consent for land use activities. This authority is reinforced at the village level by headmen, who manage daily governance and maintain connections between households and upper levels of leadership, yet decision-making often varies in formality and inclusivity. Statutory governance functions in parallel through institutions such as Communal Property Associations (CPAs), which manage land allocated through government restitution processes. CPAs operate with constitutions that require collective decision-making, which typically overlap with the responsibilities of traditional leaders. Simultaneously, some households own land under private tenure arrangements and frequently inherit land directly from family members. Together, these tenure systems create a complex governance landscape in which land rights are administered through a combination of customary, statutory and household-based structures.

Social dynamics further influence participation in governance and resource use. Women — who head 53% of households⁴³⁵ — are often responsible for natural resource harvesting, including fruit, nuts and medicinal plants⁴³⁶. Despite this, the majority of formal governance forums are male-dominated — except for the Mnisi traditional authority, which is women-led⁴³⁷ — highlighting the barriers to women’s participation in land use and decision-making. Additionally, youth provide household income and labor for farming, but are under-represented in leadership, with unemployment increasing migration and dependence on social grants⁴³⁸.

In practice, communities and groups interact directly through land-use governance and livelihood activities. Access to land for farming, grazing and settlement requires negotiation across tenure systems, while household provisioning and labor depend on cooperation within and between demographic groups. The project is intended to strengthen these interactions by employing community liaisons with longstanding social ties to the area who will maintain communication with households, chiefs, headmen and CPAs. Additionally, this is expected to support the perspectives of women, youth and other under-represented groups and ensure inclusive participation in project activities and livelihood initiatives.

4.1.3 High Conservation Values (CCB, CM1.2)

High conservation values (HCVs) were initially assessed with input from community liaisons who are residents within the project area and are familiar with local conditions. These HCVs will be validated and refined during Phase Two of the Stakeholder Engagement and Free, Prior and Informed Consent (FPIC) process using participatory mapping processes and community-led discussions to ensure that local

⁴³⁵ OpenUp. 2024. Bushbuckridge Local Municipality: Population and demographics. Wazimap. Available at: <https://next.wazimap.co.za/?geo=MP325#category-38>. Accessed on 26 September 2025.

⁴³⁶ Mothupi FM & Shackleton M. 2025. Traditional knowledge and consumption of wild edible plants in rural households, Limpopo Province, South Africa. *Journal of Ethnobiology and Ethnomedicine*, 21, 23.

⁴³⁷ Mnisi tribal authority. 2025. Information shared during FPIC stakeholder engagement with C4 EcoSolutions (Pty) Ltd., May 2025.

⁴³⁸ Rusere F, Li Q, Hunter L, Collinson M, Ouma S, Twine W & Samimi C. 2025. Relationships between rural migration and perceptions of environmental change: Insights from Bushbuckridge, South Africa. *Journal of Rural Studies*, 119, 103819.

knowledge informs the identification of HCVs. The Project Proponent will ensure that these discussions are held with a representative portion of community members across all groups. These discussions will involve in-person meetings facilitated by community liaisons using translated materials and accessible formats, ensuring that local perspectives on ecological, cultural and livelihood values are fully incorporated into the HCV assessment.

HCV	HCV 4: Areas that provide critical ecosystem services
Qualifying Attribute	<p>HCV 4 refers to areas that are necessary for maintaining environmental stability and supporting human life. This includes services such as watershed protection, erosion control and barriers against natural disasters such as floods or fire. These services are considered critical when the loss or degradation of the ecosystem would have severe negative impacts on communities or biodiversity.</p> <p>In the project area, the Sabie and Sands Rivers – and their tributaries – provide ecosystem services to the greater communities and their agricultural operations. These services are listed below.</p> <ul style="list-style-type: none"> • Hydrological services such as water flow regulation – particularly in the dry season – water purification, flood attenuation, ground water recharge and infiltration for downstream protected areas. These are particularly important in the project area, as most people do not have access to reticulated water for their domestic and agricultural needs. • Soil stabilization, particularly on riverbanks and agricultural areas. • Regional-, local- and micro-climate enhancement provided by vegetation cover, such as trees. • Pollination services by insect, bird and small mammal populations supported by native habitats.
Focal Area	<p>All areas of remnant native woody ecosystems, particularly along riverbanks and adjacent to agricultural and residential areas.</p> <p>Residential, agricultural or natural areas in upper catchments of the Sabie and Sand Rivers and their tributaries, particularly those that are upstream of settlements that rely on water abstraction for their domestic and agricultural needs.</p>
HCV	HCV 5: Areas that are fundamental for the livelihoods of communities
Qualifying Attribute	<p>HCV 5 refers to areas that are important for the livelihoods of communities, especially subsistence needs. These include forests or wetlands that provide clean water, food – such as fish, fruit or game – medicinal plants, fuelwood and building materials. These provisions of HCV 5 are considered irreplaceable or difficult to substitute, especially for marginalized groups.</p> <p>In the project area, fuelwood, timber wood, wild foods and medicines are provided by the natural ecosystems surrounding the residential and agricultural areas. These supplement the livelihoods of many people in the project area, particularly for those who cannot afford to buy everything they need. For example, fuelwood is commonly required by communities in areas that do not have electrical supply.</p> <p>In areas where livestock – such as cattle, sheep or goats – contribute to the livelihoods of local communities, the primary and secondary grassy ecosystems provide fodder throughout the year.</p>

Focal Area	All areas of remnant native woody or grassy ecosystems, particularly those adjacent to agricultural and residential areas. In agricultural areas, fallow lands with grassy cover also contribute fodder.
HCV	HCV 6: Areas that are critical for the traditional cultural identity of communities
Qualifying Attribute	<p>HCV 6 refers to areas important for the cultural identity, traditions or spiritual practices of local communities. These include sacred sites, burial grounds, ritual spaces or landscapes associated with cultural narratives and heritage. Unlike HCV 5, which focuses on material needs, HCV 6 is concerned with the intangible, symbolic and spiritual connections between people and the land.</p> <p>Within the project area, some sites are accessed for traditional cultural practices such as circumcision, burials or other rites.</p>
Focal Area	Although there are specific sites associated with the variety of cultural practices in the project area, most of these remain unlocated due to the information not being publicized in any way. Many of the practices are secretive by nature.

4.1.4 Without-Project Scenario: Community (CCB, CM1.3)

Without the project, socio-economic challenges in the project area are expected to persist and likely worsen. Unemployment levels have remained elevated over the last decade and have shown no considerable changes between 2011 (51%)⁴³⁹ and 2022 (52%)⁴⁴⁰. Additionally, many households continue to rely on social grants and youth outmigration to urban centers, which is expected to increase as residents search for alternative employment outside the project area^{441,442,443}. These patterns are likely to exacerbate poverty and inequality, reduce local economic activity and increase household dependency on uncertain income sources. Additionally, constrained access to education is ongoing, with functional literacy decreasing from 2011 (74%)⁴⁴⁴ to 2019 (66%)⁴⁴⁵. This is exacerbated by the limited options available for secondary and tertiary education and vocational training in the project area⁴⁴⁶. These conditions will further restrict opportunities, leaving the workforce ill-equipped to participate in emerging markets and perpetuating increased levels of unemployment, particularly among women and young people, who make up the majority of the population⁴⁴⁷.

⁴³⁹ Bushbuckridge Local Municipality. 2023. Integrated Development Plan 2023/27. Retrieved from:

https://lg.treasury.gov.za/supportingdocs/MP325/MP325_IDP%20Final_2024_Y_20230608T145015Z_camnyathi.pdf

⁴⁴⁰ Bushbuckridge Local Municipality. 2024. Annual Report 2023–2024. Retrieved from:

https://lg.treasury.gov.za/supportingdocs/MP325/MP325_Annual%20Report%20Final_2024_Y_20250313T142217Z_camnyathi.pdf

⁴⁴¹ Department of Cooperative Governance and Traditional Affairs. 2020. Ehlanzeni District: Profile and Analysis, District Development Model. Pretoria: Republic of South Africa. Retrieved from: https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf

⁴⁴² Mpumalanga Provincial Government. 2022. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://www.cogta.gov.za/ddm/wp-content/uploads/2020/07/Take3_Final-Edited-Ehlanzeni-DM_07July2020-FINAL.pdf

https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2022_Final.pdf

⁴⁴³ Rusere F, Li Q, Hunter L, Collinson M, Ouma S, Twine W & Samimi C. 2025. Relationships between rural migration and perceptions of environmental change: Insights from Bushbuckridge, South Africa. *Journal of Rural Studies*, 119, 103819.

⁴⁴⁴ Bushbuckridge Local Municipality. 2016. Draft Integrated Development Plan 2016/17. Retrieved from:

<https://cogta.mpg.gov.za/IDP/2016-17%20IDPs/Ehlanzeni/Bushbuckridge2016-17.pdf>

⁴⁴⁵ Republic of South Africa National Treasury. 2021. Municipal Socio-Economic Profiles. Retrieved from:

https://lg.treasury.gov.za/ibi_apps/rs/ibfs/WFC/Repository/Public/Municipal_Socio-Economic_Profiles/Profiles/Municipal_Profiles/Mpumalanga/Bushbuckridge.pdf

⁴⁴⁶ Bushbuckridge Local Municipality. 2016. Draft Integrated Development Plan 2016/17. Retrieved from:

<https://cogta.mpg.gov.za/IDP/2016-17%20IDPs/Ehlanzeni/Bushbuckridge2016-17.pdf>

⁴⁴⁷ Bushbuckridge Local Municipality. 2023. Integrated Development Plan 2023/27. Retrieved from:

https://lg.treasury.gov.za/supportingdocs/MP325/MP325_IDP%20Final_2024_Y_20230608T145015Z_camnyathi.pdf

Climate resilience is also expected to remain limited due to ongoing land degradation, water scarcity and biodiversity loss⁴⁴⁸. The continued decline of provisioning ecosystem services — such as fuelwood, wild foods, medicinal plants, grazing areas and clean water — is likely to undermine household livelihoods, health and food security^{449,450}. Simultaneously, reductions in regulating services such as soil retention, flood control and wetland functioning will increase vulnerability to climate shocks⁴⁵¹. These impacts will have a disproportionate impact on poor and remote households with limited infrastructure, market access or adaptive capacity, increasing exposure to droughts, floods and other climate extremes⁴⁵².

Without diversification into sustainable, climate-resilient livelihood activities, communities will experience declining well-being and limited capacity to respond to environmental and economic changes⁴⁵³. This will disproportionately affect women who — despite their role in resource use and household provisioning — have less access to land, capital and labor mobilization⁴⁵⁴, and remain excluded from decision-making forums. Additionally, youth will continue to be excluded from economic opportunities, leading to further outmigration and diminishing local capacity. Furthermore, cultural and spiritual practices tied to natural resources and sacred sites will also be exposed to environmental degradation, which reduces access to materials and places of cultural significance⁴⁵⁵. Collectively, these dynamics are expected to perpetuate cycles of poverty, deepen social inequality and increase dependence on external assistance in the absence of project intervention.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CCB, CM2.1)

Project activities are expected to deliver sustained benefits to communities and catalyze inclusive socio-economic development across the residential and rural landscapes. Outcomes include the creation of employment opportunities, direct investment in community-based agroforestry systems and the payments to tree custodians for the maintenance of planted trees, as outlined in the project's Benefit Sharing Mechanism (see Section 2.4.8). These outcomes will be realized through a combination of direct income opportunities and training for smallholder production are expected that facilitate entrepreneurship in the project area.

Resources will be provided to communities in several ways: i) through wages for propagating, planting and maintenance work; ii) training for tree custodians in agroforestry and permaculture, delivered by organizations such as Farmer Empowerment, Agricultural Development & Transformation South Africa (FEADT-SA), the Good Work Foundation (GWF) and the Ten Trees Project; and iii) small-scale provision of vegetable seeds for home gardens, where feasible. By prioritizing local communities for employment and

⁴⁴⁸ Rusere F, Li Q, Hunter L, Collinson M, Ouma S, Twine W & Samimi C. 2025. Relationships between rural migration and perceptions of environmental change: Insights from Bushbuckridge, South Africa. *Journal of Rural Studies*, 119, 103819.

⁴⁴⁹ Coetzer-Hanack KL, Witkowski ETF & Erasmus BFN. 2016. Thresholds of change in a multi-use conservation landscape of South Africa: historical land-cover, future transformation and consequences for environmental decision-making. *Environmental Conservation*, 43, 3, 253–262.

⁴⁵⁰ Shai KN, Ncama K, Ndhlovu PT, Struwig M & Aremu AO. 2020. An Exploratory Study on the Diverse Uses and Benefits of Locally-Sourced Fruit Species in Three Villages of Mpumalanga Province, South Africa. *Food*, 9, 11, 1581.

⁴⁵¹ Robinson K. 2017. Ehlanzeni District Municipality Wetland Report. Local Action for Biodiversity (LAB): Wetlands South Africa. Retrieved from: https://africa.iclei.org/wp-content/uploads/2020/01/2017_Report_LAB_Ehlanzeni-district-municipality-wetland-report.pdf

⁴⁵² Ragie FH, Olivier DW, Hunter LM, Erasmus BFN, Vogel C, Collinson M & Twine W. 2020. A portfolio perspective of rural livelihoods in Bushbuckridge, South Africa. *Southern African Journal of Science*, 116.

⁴⁵³ Rusere F, Li Q, Hunter L, Collinson M, Ouma S, Twine W & Samimi C. 2025. Relationships between rural migration and perceptions of environmental change: Insights from Bushbuckridge, South Africa. *Journal of Rural Studies*, 119, 103819.

⁴⁵⁴ Rusere F, Mkuhlani S, Soropa G, Hunter L, Twine W & Samimi C. 2025. Agrarian transitions in rural Bushbuckridge, Mpumalanga province, South Africa: understanding dynamics and determinants. *Frontiers in Sustainable Food Systems*, 9.

⁴⁵⁵ Mchale MR. et al. 2018. Democratization of ecosystem services—a radical approach for assessing nature's benefits in the face of urbanization. *Ecosystem Health and Sustainability*, 4, 5.

training, financial flows are expected to remain within participating communities and generate multiplier effects across households and small enterprises. These measures are complemented by capacity-building, enabling community members to gain immediate and long-term improvements in skills, productivity and livelihoods.

Anticipated impacts were assessed using the Sustainable Livelihoods Approach^{456,457,458}, which evaluates human, social, natural, physical and financial assets as determinants of resilience and well-being. This approach will be used to assess impacts in relation to community realities and aspirations. The design of interventions was co-created through participatory consultations with traditional authorities, women, youth, local households, community liaisons and smallholder farmers. The resulting interventions – described in the tables below – are designed to increase livelihood resilience, diversify incomes and secure long-term stewardship of both ecological and economic resources in the project area.

Community group	Traditional authorities
Impact(s)	<p>Governance capital: Strengthened role in local decision-making and recognition in project governance structures.</p> <p>Social capital: Strengthened traditional custodianship of land and resources through participation in benefit-sharing and stewardship processes.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> • Direct benefits through recognition, influence and capacity-building. • Indirect socio-cultural benefits through increased legitimacy and trust.
Change in well-being	<ul style="list-style-type: none"> • Providing formal seats on benefit-sharing committees will support their participation in directing community priorities. • Recognizing customary land governance will increase legitimacy and local trust. • Participating in stewardship bodies will provide a long-term role in managing natural resources and strengthen accountability to their constituencies.
Community group	Nursery owners and operators
Impact(s)	<p>Human capital: Expanded skills in seedling and sapling production as well as business development.</p> <p>Financial capital: Increased revenue from sustained demand for tree planting.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> • Direct benefits through skills development, livelihood opportunities and reliable market demand.

⁴⁵⁶ Natarajan N, Newsham A, Rigg J & Suhardiman D. 2023. A sustainable livelihoods framework for the 21st century. *World Development*, 169, 106201.

⁴⁵⁷ Kollmair M & Gamper St. 2002. The sustainable livelihoods approach. Input paper for the Integrated Training Course of NCCR North-South, Aeschiried, Switzerland (9–20 September 2002). Zurich: Development Study Group, University of Zurich (IP6).

⁴⁵⁸ Vanclay F. 2003. International principles for social impact assessment. *Impact Assessment and Project Appraisal*, 21, 1, 5–11.

	<ul style="list-style-type: none"> • Low risk if seedling supply remains aligned with project demand.
Change in well-being	<ul style="list-style-type: none"> • Improved household income and job stability. • Increased and diversified income opportunities from fruit and nut sales, value-added processing and micro-enterprises.
Community group	Women
Impact(s)	<p>Human capital: Increased skills and knowledge through training in residential tree planting, agroforestry, water-smart agriculture and small enterprise development.</p> <p>Financial capital: Diversified income resulting from participating in project activities.</p> <p>Social capital: Increased inclusion in community decision-making and leadership roles, strengthening women's representation in project committees and benefit-sharing structures.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> • Direct benefits through skills development, livelihood opportunities and formal representation. • Long-term empowerment with low risk if equitable participation is maintained.
Change in well-being	<ul style="list-style-type: none"> • Improved food security and household nutrition through residential and agroforestry tree planting. • Increased and diversified income opportunities from fruit and nut sales, value-added processing and micro-enterprises. • Strengthened agency, confidence and leadership through active roles in benefit-sharing, monitoring and project governance committee, contributing to more equitable community decision-making.
Community group	Youth
Impact(s)	<p>Human capital: Practical training in tree planting, agroforestry, permaculture, nursery management, climate-smart agriculture and value-added processing.</p> <p>Financial capital: Expanded income opportunities through seasonal and permanent employment in planting, maintenance, processing and small enterprise ventures.</p> <p>Social capital: Strengthened networks, participation in youth groups and cooperatives, increased community recognition and platforms for leadership and collective action.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> • Direct benefits through employment and skills development. • Indirect benefits through reduced out-migration, improved livelihood stability and greater capacity retention.

Change in well-being	<ul style="list-style-type: none"> Increased access to local employment and reduced vulnerability to poverty and the need to migrate in search of work. Expanded opportunities to establish small enterprises, such as seedling supply, processing of fruits and nuts and service provision to cooperatives. Strengthened long-term prospects within their communities, with improved skills, income stability and greater participation in local economic development.
Community group	Community liaisons
Impact(s)	<p>Human and social capital: Strengthened capacity as trusted facilitators of engagement, grievance resolution and participatory monitoring.</p> <p>Financial capital: Stable income through formal roles as local coordinators.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> Direct benefits in income and skills. Moderate risks related to mediating sensitive issues, requiring support and safeguards to maintain impartiality.
Change in well-being	<ul style="list-style-type: none"> Increased social recognition and strengthened roles as respected intermediaries within their communities. Stable additional income that supports household well-being and resilience. Development of transferable skills in facilitation, record-keeping and conflict resolution that provide long-term livelihood opportunities beyond the project.
Community group	Community Property Associations
Impact(s)	Human capital: Enhanced institutional roles in formalizing land-use agreements and overseeing transparent allocation of benefit-sharing revenues.
Type of benefit/cost/risk	<ul style="list-style-type: none"> Direct benefits in governance authority and financial resources. Moderate risks of governance challenges or elite capture, mitigated through participatory oversight and transparent reporting.
Change in well-being	<ul style="list-style-type: none"> Secure tenure arrangements and agreements that increase community negotiating power and legal recognition. Strengthened organizational capacity through participation in planning, administration and oversight processes. Direct access to restoration-linked revenues and support services that strengthen collective assets, enabling CPAs to improve member livelihoods and reinvest in community priorities.
Community group	Smallholder farmers

Impact(s)	<p>Natural and physical capital: Improved soil fertility, erosion control and on-farm microclimates from agroforestry systems.</p> <p>Financial and livelihood capital: Increased yields and diversified production of fruits, nuts and non-timber products. Income benefits may include direct sales, barter trade and sustenance from produce.</p> <p>Social capital: Strengthened community ties through cooperative activities, knowledge sharing and increased participation in decision-making processes.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> • Direct benefits through productivity and income diversification. • Manageable risks linked to the implementation of new practices, mitigated through training and extension support. • Benefits sharing and capacity building facilitate long-term engagement.
Change in well-being	<ul style="list-style-type: none"> • Increased household food security and resilience to climate shocks through more reliable yields. • Access to technical training and extension services that enhance long-term farming capacity. • More stable and diversified incomes, enabling farmers to invest in household needs such as education, housing and healthcare. This is expected to reduce vulnerability to external shocks.
Community group	Tree custodians
Impact(s)	<p>Natural capital: Responsibility for nurturing project-planted trees on their property, with support through training and ongoing support.</p> <p>Financial capital: Incentives based on tree survival and the sale of agroforestry products, adding to food security and income diversification.</p>
Type of benefit/cost/risk	<ul style="list-style-type: none"> • Direct benefits in ecological improvements and financial incentives. • Minimal labor or input costs due to project support.
Change in well-being	<ul style="list-style-type: none"> • Improved household environments through shade, microclimate regulation and enhanced soil health. • Potential for future harvests of fruits, nuts, or non-timber products, adding to food security and income. • Strengthened sense of ownership and participation in restoration, reinforcing long-term stewardship and positioning households to benefit from carbon-linked incentives.

4.2.2 Negative Community Impact Mitigation (VCS, 3.19; CCB, CM2.2)

The project is expected to improve community well-being and protect HCVs associated with ecosystem services and cultural practices. While no significant negative impacts are anticipated, the project applies the precautionary principle⁴⁵⁹ by proactively identifying potential risks and integrating mitigation measures across all phases of implementation.

Project activities will not be implemented in areas of cultural significance and ongoing consultation with traditional leaders and communities will safeguard against unintended encroachment. To address potential social risks such as inequitable participation, elite capture or disproportionate labor burdens on women, gender-responsive consultation processes, inclusive benefit-sharing structures and grievance redress

⁴⁵⁹ The precautionary principle, drawn from Principle 15 of the 1992 Rio Declaration, states that where there is uncertainty about potential harm, actions are taken to avoid or minimize risks even if some cause-and-effect relationships are not fully established scientifically.

mechanisms will be implemented. Youth and women will be given dedicated spaces for participation to ensure equitable access to opportunities and decision-making.

Environmental safeguards are also included in the design of project activities. No planting will occur in wetlands or sensitive habitats, eliminating risks of harmful discharges to water, soil or air. Monitoring protocols will track survival rates, land-use impacts and feedback from participating households, ensuring adaptive management where issues arise.

Through these measures, safeguards will maintain the integrity of community well-being and HCVs while minimizing risks. They will remain in place throughout implementation, with adaptive responses applied as needed to ensure that vulnerable groups – including women, children and marginalized households – are protected and that all community members have the opportunity to benefit from project outcomes.

4.2.3 Net Positive Community Well-Being (VCS, 3.19; CCB, CM2.3, GL1.4)

Without project interventions, land degradation – specifically through soil erosion, water scarcity and declining agricultural productivity – is expected to continue, reinforcing cycles of poverty, unemployment and outmigration. These dynamics limit household food security, restrict income diversification and decrease resilience to climate and other shocks, particularly for women, youth and vulnerable households. In contrast, the project is expected to mitigate these trends and positively impact the well-being of all identified community groups: i) smallholder farmers will gain from improved and more stable yields; ii) women will benefit from secure roles in agroforestry production and decision-making committees; iii) youth will access employment and entrepreneurial opportunities; and iv) traditional leaders and CPAs will strengthen their institutional legitimacy and financial capacity through transparent benefit-sharing arrangements. Additionally, by implementing a permaculture-driven approach, each participating household will be trained to grow productive food or medicinal species in their homestead. This permaculture design is expected to improve soil fertility, water retention and biodiversity. Furthermore, the integration of agroforestry systems into croplands will directly increase food availability, improve household nutrition and provide surplus produce for sale or barter, thereby supporting both subsistence and cash incomes.

Capacity-building activities such as project-linked training and education will equip individuals with practical skills in silviculture, agroforestry, sustainable agriculture, nursery management, enterprise development and conservation practices. Participants will receive training in permaculture with hands-on demonstration learning to support households in tree care and ensure tree survival and proper maintenance. This will capacitate communities while enabling participation across gender and age groups. Financial benefits will be reinforced through new income streams linked to the fruit and nut trade and entrepreneurship. Opportunities for individuals to develop physical assets such as small-scale nurseries, processing facilities and improved agricultural systems will expand as capacity and income sources are developed.

Collectively, these activities ensure that the project delivers net-positive outcomes relative to the without-project scenario. Moreover, they directly support climate change adaptation (CCB GL1.4) by strengthening livelihood resilience, reducing exposure to climate risks and enhancing adaptive capacity across human, social, natural, physical and financial capital. As such, the project is expected to improve quality of life for local communities as well as facilitate long-term development and ecological benefits that are sustainable, equitable and climate resilient.

4.2.4 High Conservation Values Protected (CCB, CM2.4)

The project activities are not expected to negatively affect any HCVs related to community well-being and areas of cultural, ecological or social significance – such as sacred sites, burial grounds and communal gathering areas – will be avoided. Some of these locations were highlighted during consultations with traditional leaders, elders and community representatives, and the identification of additional sites will

remain an ongoing process incorporated into the onboarding of project participants to ensure that locally valued areas are respected and protected.

By operating within existing residential and agricultural zones as well as communally managed areas, continued access to livelihood resources – including grazing areas, fuelwood, wild foods and medicinal plants – will be maintained. These resources contribute to current household well-being and the ecosystems that provide them are expected to benefit from project activities. Furthermore, by conducting residential tree planting, agroforestry and reforestation, the project is expected to improve ecosystem services that support community HCVs. Tree planting and agroforestry practices are likely to improve soil structure and infiltration, increasing groundwater recharge and reducing surface runoff. As a result, the project is designed to both protect the integrity of HCVs linked to community well-being and enhance the landscape functions that sustain them. Safeguards will remain throughout implementation, with ongoing monitoring and grievance redress mechanisms to ensure that community rights, access and cultural values are upheld.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.1)

The project is expected to generate a variety of positive outcomes that extend beyond the communities directly involved within the Sabie and Sand River catchments. These benefits are expected to extend to several stakeholders involved in governance, environmental management, technical support, education, enterprise development and conservation. By supporting governance institutions such as the Bushbuckridge Local Municipality, Ehlanzeni District Municipality and the Department of Forestry, Fisheries and the Environment (DFFE), the project aligns with regional land-use planning frameworks and municipal Integrated Development Plans influenced by the Spatial Planning and Land Use Management Act. This alignment will improve local planning capacity and further regional land restitution and sustainable development goals. Collaboration with DFFE's national 10 Million Trees Initiative increases access to seedlings, propagation networks and distribution systems, extending restoration benefits beyond the project area across multiple provinces.

Training and education partners, including the GWF, FEADT-SA and the Ten Trees Project, will use practical demonstration sites and project-linked curricula to boost skills and knowledge among local communities and stakeholders. Technical partners such as C4 EcoSolutions (Pty) Ltd. benefit from long-term implementation contracts, increased expertise in climate and biodiversity finance and opportunities to showcase replicable restoration models. The Global Water Partnership South Africa applies its Integrated Water Resources Management framework at scale, contributing to climate-resilient catchment governance and measurable improvements in water security. Conservation stakeholders incorporate the project activities into broader landscape and biodiversity initiatives such as the Kruger to Canyons Biosphere Reserve. By enhancing ecological corridors adjoining the Kruger National Park and other protected areas, the project supports tourism economies while promoting biodiversity conservation and landscape resilience. Innovation and enterprise partners – such as the Lotus Impact Foundation, Root and Ground, Innovation Africa and the Mpumalanga Green Cluster Agency – are given opportunities to facilitate catalytic finance, advance propagation technologies, promote clean energy solutions and develop green enterprise models. These initiatives connect ecological restoration with economic and technological development, fostering sustainable growth. Overall, collaboration among these stakeholders is expected to strengthen institutional capacity, increase stakeholder visibility and improve impact delivery, ensuring ongoing benefits beyond the lifetime of the project.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.2)

No negative impacts on other stakeholders are anticipated. Nonetheless, the Project Proponent recognizes that overlapping mandates — for example, between CPAs and traditional authorities, or between customary governance systems and municipal planning processes — may give rise to coordination challenges. To mitigate these risks, clear benefit-sharing and decision-making structures will be established, supported by regular stakeholder consultations and transparent reporting mechanisms. Grievance and feedback channels will remain open to all stakeholders to address disputes, thereby ensuring that participation remains constructive and voluntary while preventing duplication of roles or exclusion of rights-holders.

4.3.3 Net Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.3)

The net impacts on other stakeholders are expected to be positive. The Project Proponent facilitates platforms for collaboration between customary authorities, CPAs, municipalities and sectoral organizations, thereby strengthening institutional linkages across the landscape. By generating shared benefits such as training opportunities, governance capacity, restoration-linked revenues and improved ecological services, the project activities enhance the ability of stakeholders to fulfil their mandates. Participation is voluntary and based on formalized agreements, ensuring that stakeholders engage with shared interest and common value. Collectively, these impacts will support networks of governance, conservation and rural development, while promoting the project as a long-term partner in strengthening resilience and sustainability across the region.

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CCB, CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

The Community Monitoring Plan outlines the approach for collecting, analyzing and reporting information on the social and livelihood impacts of the project for stakeholders identified in Section 2.3 and listed in Appendix 1. The monitoring framework is informed by the Social and Biodiversity Impact Assessment methodology⁴⁶⁰, adapted to ensure practicality and alignment with the project's objectives and intended community outcomes. Monitoring focuses on community well-being and resilience, with attention to: i) sustainable agroforestry and climate-resilient land use; ii) livelihoods, income and food security; iii) gender equity and youth inclusion; iii) capacity development and institutional strengthening; and iv) access to natural resources.

The plan monitors differentiated community groups named in Section 2.3 and Appendix 1, including smallholder households, farm workers, landless laborers, women, youth, traditional leaders/custodians, community-based organizations, local contractors and vulnerable households. Indicators are directly linked to the project's objectives and to predicted outputs and outcomes in the project causal model, focusing on well-being and resilience. To track project outcomes, the monitoring team will use several participatory and empirical methods that include community perspectives with verifiable data. These methods include:

- household surveys and participatory sessions, which capture perceptions, priorities and local knowledge;
- field-based assessments to provide direct evidence on land use, resource conditions and environmental change;
- administrative records — such as employment and training logs — to provide verifiable participation and benefit-sharing data; and

⁴⁶⁰ Richards M. 2011. Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 2 – Social Impact Assessment Toolbox. Climate, Community & Biodiversity Alliance and Forest Trends with Rainforest Alliance and Fauna & Flora International. Washington, DC. Retrieved from: https://s3.amazonaws.com/CCBA/SBIA_Manual/SBIA_Part_2.pdf.

- feedback tools – such as, *inter alia*, the WhatsApp chatbot – to facilitate continuous, two-way engagement with stakeholders across the project area.

Surveys use stratified sampling by community/ward and livelihood group, with disaggregation by gender and age for all people-centered indicators. Panel households are revisited at each round to track change over time; replacement rules apply where panel attrition occurs. Qualitative enquiries (gender-segregated focus groups and key informant interviews) are conducted per stratum to contextualize quantitative results.

Together, these methods create a monitoring system that is intended to be inclusive, participatory and evidence driven. Affected groups participate in structured evaluation through community scorecards and validation meetings held at least annually – with targeted women-only and youth sessions. Findings and agreed actions are recorded in a feedback log and integrated into the project’s adaptive-management register. Grievances raised through the WhatsApp chatbot, meetings or in person are logged and tracked to resolution within defined service-level timelines. Validation of monitoring results by communities and their incorporation into adaptive management practices, will ensure that activities remain responsive to local conditions and aligned with community objectives.

Category	Outcomes	Indicator	Data collection method	Stakeholder type	Frequency
Sustainable agroforestry and climate-resilient land use	Increased diversification of crop production	<ul style="list-style-type: none"> • Number of different crops per household 	<ul style="list-style-type: none"> • Household baselines and follow-up surveys • FEADT-SA database • Field observations 	Communities and community groups	Annual
	Improved agricultural yields reported by project participant.	<ul style="list-style-type: none"> • Crop-specific yield (kg per capita) • % of households with increased yield for at least one priority crop 	<ul style="list-style-type: none"> • Household baseline and follow-up surveys • Project records • Field observations 	Communities	Annual
	Adoption of integrated traditional and modern farming methods	<ul style="list-style-type: none"> • % of households using at least one recommended practice • Mean number of practices per household • Mapped area (ha) implementing new practices 	<ul style="list-style-type: none"> • Household baseline and follow-up surveys • GIS Mapping 	All stakeholders	Annual
	An increased number of individuals in the project area adopting	<ul style="list-style-type: none"> • % of households reporting at least one agroforestry practice • Area (ha) where agroforestry practices 	<ul style="list-style-type: none"> • Household baseline and follow-up surveys • Project records • Field observations 	Communities	Annual

	agroforestry practices	have been implemented			
Food security	Improved year-round household food availability	<ul style="list-style-type: none"> Household Dietary Diversity Score (HDDS) % households reporting year-round sufficiency % of households where $\geq 25\%$ of food comes from own production Qualitative score on household food stocks Qualitative summary of household perceptions 	<ul style="list-style-type: none"> HDDS framework Field observations Focus-group discussions 	Communities	Every two years
	Increased capacity in climate-smart agriculture and agroforestry for project participants.	<ul style="list-style-type: none"> Number of participants trained Number of training events held Number of extension materials and knowledge products distributed and received 	<ul style="list-style-type: none"> Training registers Extension materials GWF records Project databases 	Communities	Bi-annual
Training	Enhanced skills and knowledge among female project participants	<ul style="list-style-type: none"> Number and % of women enrolled in training activities Number and % of women with improved knowledge and skills, based on post-training test scores Number and % of women applying at least one new agricultural technique Number and % of women holding leadership and supervisory roles 	<ul style="list-style-type: none"> Training registers Participation surveys FEADT-SA databases GWF records Leadership and supervisory roles 	Communities	Annual
	Improved skills and knowledge in climate-smart agriculture and agroforestry among youth	<ul style="list-style-type: none"> Number of youth attending training events Number and % of youth applying at least one new agricultural technique Mean number of agricultural 	<ul style="list-style-type: none"> Training records FEADT-SA database Project participation surveys GWF records 	Community groups	Annual

		<ul style="list-style-type: none"> techniques being applied by youth Number and % of youth with improved knowledge and skills, based on post-training test scores Number and % of youth holding leadership and supervisory roles 			
Employment	Increased local employment generated by project activities ^{461, 462}	<ul style="list-style-type: none"> Number of people employed through project activities % of project employees previously unemployed Average wage of project employees, compared to South Africa's minimum wage 	<ul style="list-style-type: none"> Contractor records Intake questionnaires Average wage 	Communities and community groups	Bi-annual
	Increased local enterprise development and business opportunities	<ul style="list-style-type: none"> Number and value of contracts issued through project activities % of project-related enterprises reporting increased revenue as a result of activities % of households reporting income from project-related businesses 	<ul style="list-style-type: none"> Procurement and contractor records Enterprise questionnaires and surveys Household surveys 	All stakeholders	Annual

Monitoring assesses the effectiveness of measures taken to maintain or enhance HCVs related to community well-being, including access to land and water resources, cultural values and traditional custodianship. Several indicators – such as crop diversification, adoption of climate-smart farming practices and food security – serve as explicit measures of adaptation benefits for communities in line with Climate, Community and Biodiversity (CCB) standards Gold Level (GL1). Indicators relating to employment, smallholder income and the participation and leadership of women and youth provide measures of well-being impacts and risks consistent with CCB GL2.

Quality assurance and control for community monitoring follows the same project-wide framework applied to climate and biodiversity indicators (see Section 3.3.2). Stratified sampling, panel household design and replacement rules ensure statistical robustness. Community validation meetings, scorecards and

⁴⁶¹ Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.

⁴⁶² Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the United Nations System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])

feedback logs provide an additional layer of verification, ensuring that monitoring results are both accurate and representative of community perspectives.

4.4.2 Monitoring Plan Dissemination (CCB, CM4.3)

The dissemination strategy for monitoring plans and results is described in Section 3.4.2, which outlines how monitoring documents are made publicly available through the Verra registry and the project website and how non-technical summaries are translated and distributed through locally appropriate channels, including printed formats, radio broadcasts, WhatsApp chatbot and stakeholder engagement events.

For the community monitoring plan, dissemination will follow this strategy, with additional emphasis on ensuring accessibility for community audiences. Printed summaries and posters will be left at traditional councils, Community Property Associations, municipal offices, non-governmental organizations, schools and clinics. Each dissemination cycle will include a feedback session and a simple response log to ensure that comments and concerns are documented and addressed through the project's grievance and adaptive-management procedures.

4.5 Optional Criterion: Exceptional Community Benefits

4.5.1 Exceptional Community Criteria (CCB, GL2.1)

South Africa is classified as a high human development country, with a HDI score of 0.707 as of 2019^{463,464}. Despite this national rating, poverty remains widespread with ~47% of the population living below the LBPL⁴⁶⁵. In Mpumalanga province – where the project is located – the HDI is lower, at 0.682, placing it in the medium human development category⁴⁶⁶. Within the province, Bushbuckridge Local Municipality records some of the most elevated poverty levels in the country. In 2022, 62% of the population lived below the LBPL⁴⁶⁷, compared to 60% in 2016⁴⁶⁸; – the LBPL was defined as ZAR1,100 (US\$60) per person per month in 2024⁴⁶⁹. The project activities are expected to improve these conditions by strengthening sustainable livelihood opportunities, promoting inclusive economic participation and contributing to poverty reduction and increased community resilience in the project area. Project participants will be direct beneficiaries of these activities, which will be secured by legally recognized land management rights in the form of Permission to Occupy (PTO), lease agreements and land-use agreements. Direct participation in tree planting and other project-related activities provides both recognition of these rights and an immediate income stream, ensuring that households are financially incentivized and legally empowered to take part in project activities and benefits.

⁴⁶³ Statistics South Africa. 2023. Census 2022 Provinces at a glance (Report No. 03-01-43). Pretoria: Statistics South Africa. Available at: https://census.statssa.gov.za/assets/documents/2022/Provinces_at_a_Glance.pdf. Accessed on 26 September 2025.

⁴⁶⁴ United Nations Development Programme. 2022. South Africa National Human Development Report 2022. Retrieved from: https://www.undp.org/sites/g/files/zskgke326/files/2023-07/sa-nhdr-2022_web_0.pdf

⁴⁶⁵ Mpumalanga Provincial Government. 2023. Socio-economic review and outlook for Mpumalanga. Department of Economic Development and Tourism. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2023_Final.pdf.

⁴⁶⁶ Emakhazeni Local Municipality. 2020. 2020/21 Integrated Development Plan (IDP) Review: Final. Belfast: Emakhazeni Local Municipality. Retrieved from: https://www.cogta.gov.za/cgta_2016/wp-content/uploads/2021/02/Emakhazeni-2020-21-reviewed-IDP-1.pdf

⁴⁶⁷ Bushbuckridge Local Municipality. 2024. Integrated Development Plan 2024–2025. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/06/20/671/FINAL_IDP_2024-25.pdf

⁴⁶⁸ Bushbuckridge Local Municipality. 2023. Annual Report for the year ended 30 June 2023. Bushbuckridge: Bushbuckridge Local Municipality. Retrieved from: https://www.bushbuckridge.gov.za/images/files/2024/05/23/665/BLM_Annual_Report_20222023.pdf

⁴⁶⁹ Statistics South Africa. 2024. National Poverty Lines 2024 (Statistical Release P0310.1). Pretoria: Stats SA. Retrieved from: <https://www.statssa.gov.za/publications/P03101/P031012024.pdf>

4.5.2 Short-term and Long-term Community Benefits (CCB, GL2.2)

Project activities are expected to strengthen local capacity and promote sustainable land management, while enabling early participation through pilot initiatives and training. These activities will provide short-term benefits, including skills development, employment and diversified subsistence production, while long-term benefits emerge as trees mature, providing sustained harvests, improved soil quality and additional livelihood opportunities. These direct benefits are reinforced by social benefits derived from training, entrepreneurship and environmental education, all of which reduce vulnerability to climate and economic shocks. Formalized participation agreements ensure equitable household access to resources, revenues and decision-making for the duration of the project. The following section summarizes these short- and long-term benefits, which have been categorized into their respective thematic areas.

Short-Term Benefits (Years 1–5)

Sustainable agroforestry and land use

- Project participants will be trained to diversify crop production through permaculture, reducing dependence on single staple crops.
- Communities will receive training and support to implement climate-smart techniques – such as mulching, intercropping and water conservation – that combine traditional knowledge with modern methods.
- Project nurseries will be established, supplying sapling for planting campaigns and providing early sources of employment.

Employment and livelihoods

- Seasonal and short-term jobs will be created through nursery operations, tree planting and monitoring.
- Project participants will receive payments for the maintenance of planted trees.
- Wages from these jobs will provide immediate household income, reducing financial pressure and demonstrating the project's tangible benefits.
- Women and youth will be guaranteed equal access to employment opportunities, with targeted recruitment and support measures to overcome structural barriers. This approach ensures their full participation in the local labor force and improves equity in project benefits.

Training and capacity-building

- Participants will receive training in sustainable land management, tree establishment and climate-smart agriculture such as permaculture.
- Women will have equal access to training, with dedicated programs and mentoring to address structural barriers and expand future livelihood opportunities.
- Vocational programs will expand enterprise and employment opportunities for community members, with equal access for women, men, youth and the elderly. Dedicated outreach and support will ensure that women and other historically under-represented groups are able to participate fully.

Education

- Environmental education sessions in schools and community centers will build awareness of the links between climate change, land degradation and sustainable farming, fostering a culture of stewardship among youth and community members.
- School partnerships and eco-clubs will encourage youth leadership and integrate sustainability topics into curricula.
- Community-wide education campaigns will encourage households to implement sustainable practices such as water conservation, mulching and soil management, extending benefits beyond direct participants.

Tenure security

- The project will support households and CPAs in clarifying and documenting land-use rights through locally recognized agreements, building on existing statutory and customary systems.
- Early tenure support gives participants the confidence to involve themselves in tree planting and agroforestry systems, knowing that their rights to trees and associated benefits are safeguarded.
- Strengthened tenure security is expected to increase household and community agency, enabling more equitable participation in decision-making and benefit-sharing processes.
- Support will be provided to participants seeking tenure security through collaboration with traditional authorities and municipal structures, including facilitation of PTO certificates and lease agreements.

Long-Term Benefits (Beyond Year 5)

Sustainable agroforestry and land use

- As trees enter productive stages, households will harvest fruit, nuts and other non-timber forest products, which is expected to increase food security and create new income streams.
- The newly planted trees are likely to improve soil fertility and water infiltration – through nitrogen fixation, litter fall and root system expansion – strengthening resilience to drought and supporting sustainable farming practices (see Section 3).
- Agroforestry activities are expected to increase water infiltration, contributing to more resilient farming systems during droughts.
- Expanding agroforestry landscapes is expected to restore habitat connectivity and ecosystem health, which in turn strengthens pollination services, water regulation and the availability of useful plants – providing direct benefits to farming households and sustaining local cultural practices.

Food security

- Harvests of fruit, nuts and improved staple crops is expected to strengthen year-round household food availability, while also improving diet diversity and nutritional quality.
- Diversified production reduces vulnerability to seasonal shortages and provides both a nutritional buffer and surplus produce that can be sold or exchanged during climate-related shocks, such as droughts or floods.

Employment and livelihoods

- Over the long term, entrepreneurship is expected to increase, creating opportunities in processing facilities, cooperatives, agroforestry enterprises and related value chains, with potential for additional diversification, such as ecotourism.

Training and capacity-building

- Communities will consolidate skills in agroforestry and climate-smart agriculture and apply them more broadly across landscapes, strengthening sustainable land management practices and improving the conditions for resilient farming systems.
- Vocational training and enterprise support will equip women, youth and other participants with skills and opportunities that will facilitate sustainable businesses and create employment opportunities, supported by mentoring and cooperative structures.
- Intergenerational knowledge transfer, combined with continuous environmental education, will support restoration and climate-smart farming practices in the daily activities of project participants. This ensures that skills are retained across generations, households become less dependent on external support and resilience benefits are sustained over the long term.

Number of Expected Beneficiaries

Beneficiary calculations in the table below are based on the project targeting ~30,000 hectares (ha) of residential areas and ~10,000 ha of croplands, informed by municipal data for Bushbuckridge Local Municipality. However, because croplands are expected to be owned and managed by people living within residential areas, the population size for croplands is conservatively assumed to be zero and calculations are focused on residential land use only.

Within the residential areas, typical homestead plots are ~50 m², indicating a total of 4 households/ha and ~120,000 eligible households within the project area. Municipal data show that there are ~4 people per household with a 55% of residents being female⁴⁷⁰. Within a typical household, it is assumed that 50% are working-age adults, who will be the primary beneficiaries targeted for project activities. As a result, training and improved livelihoods are calculated for working-age adults only, whereas education and improved well-being benefits are expected to extend to all household members due to improved quality-of-life outcomes such as increased household income and food security.

The number of employees is based on projected labor requirements for implementing project activities across nurseries, planting operations, monitoring and management functions. Between 2026 and 2030, staffing levels are expected to be greatest during the planting and establishment phases. From 2031 onwards, employment requirements are projected to decline as activities focus on maintenance, monitoring and long-term project operations. Approximately half of the workforce is expected to be women throughout the project duration.

These preliminary beneficiary calculations, summarized in the table below, will be refined during project implementation, when onboarding processes and household surveys will be used to determine the number of participants, demographics and average household size.

Category	Total	Female
Training	~240,000	~132,000
Improved Livelihoods	~240,000	~132,000
Education	~480,000	~264,000
Improved Well-being	~480,000	~264,000
Employment	Between 2026 and 2030 the project is expected to employ ~200–460 people. After 2030 the project is expected to employ 10–30 people.	Approximately half of the workers employed are expected to be women. As a result, the project is expected to employ ~100–230 women between 2026 and 2030. After 2030, the project is expected to employ 5–15 women.

⁴⁷⁰ Republic of South Africa National Treasury. 2021. Municipal Socio-Economic Profiles. Retrieved from: https://lg.treasury.gov.za/ibi_apps/rs/ibfs/WFC/Repository/Public/Municipal_Socio-Economic_Profiles/Profiles/Municipal_Profiles/Mpumalanga/Bushbuckridge.pdf.

4.5.3 Community Participation Risks (CCB, GL2.3)

Stakeholder consultations undertaken during the Stakeholder Engagement and FPIC process identified risks that may limit community participation in tree planting and other activities. These risks and their mitigation strategies are outlined below.

Land tenure uncertainty

The project area contains several land tenure arrangements, including CPAs⁴⁷¹, traditional authorities⁴⁷² and private occupancy⁴⁷³. During consultations, the project team explained that participation is contingent on households or groups having recognized or locally accepted access rights. Planting will only proceed in areas where access rights are formally recognized or locally validated to reduce the risk of working in areas with disputes. Where participants hold permission-to-occupy (PTO) certificates issued by traditional leaders but not validated by the municipality, the project will direct them to the relevant administrative channels for assistance with registration and formal recognition. Furthermore, during the second phase of the FPIC process, the project team will work with community representatives, land authorities and traditional leaders to verify participants' claims and co-develop land-use agreements for eligible sites. These activities will be validated using the Rapid Land Tenure Assessment⁴⁷⁴ methodology to confirm the validity of tenure agreements and ensure that project implementation occurs only in areas with clear, uncontested access rights. The project will also continue to monitor the national land-claims register to identify any new claims overlapping with the project area, thereby supporting equitable participation

Community expectations

Substantial unemployment creates a risk that community members could expect immediate employment or cash payments from project activities. If these expectations are not met, disengagement and dissatisfaction could arise. Phase One Stakeholder Engagement and FPIC processes clarified that while the project is not designed as a short-term cash-transfer scheme, it does generate tangible near-term benefits such as seasonal employment in nurseries and planting, wages that provide immediate household relief and training in climate-smart agriculture such as permaculture. Over time, these will be combined with longer-term outcomes, including gains in soil fertility, sustained harvests of fruit and nuts, processing and market opportunities and diversified livelihood pathways. To manage expectations, the project will provide clear communication materials that outline this sequencing of benefits, using simple timelines and examples from similar initiatives to show when and how benefits are likely to be realized.

Labor and food security trade-offs

During the Stakeholder Engagement and FPIC consultations, community elders and farmers highlighted that tree planting requires household labor, which could compete with subsistence farming and that some species – such as marula – take several years before producing substantial yields. This raised concerns that participation could create short-term labor burdens with delayed returns, potentially discouraging households or affecting food security. The project design directly mitigates these trade-offs by providing short-term benefits that support livelihoods, such as training in climate-smart permaculture to establish home gardens. These interventions are expected to facilitate immediate nutrition and small income opportunities while tree crops are still developing. Additional training in labor-saving agroforestry practices – such as intercropping, mulching and water-efficient management – ensures that tree cultivation integrates with existing farming systems rather than replacing them. Over the longer term, as fruit and nut trees begin bearing produce, households will gain sustained harvests, diversified diets and surplus products for sale. Together, these short- and long-term benefits ensure that households are not

⁴⁷¹ Republic of South Africa. 1996. Communal Property Associations Act (No. 28 of 1996). Retrieved from: https://www.gov.za/sites/default/files/gcis_document/201409/act28of1996.pdf.

⁴⁷² Republic of South Africa. 2019. Traditional and Khoi-San Leadership Act (No. 3 of 2019). Retrieved from: https://www.gov.za/sites/default/files/gcis_document/201911/4286528-11act3of2019tradkhoisanleadership.pdf.

⁴⁷³ Republic of South Africa. 1937. Deeds Registries Act (No. 47 of 1937). Government Gazette Extraordinary.

⁴⁷⁴ Galudra G. 2010. RaTA: A Rapid Land Tenure Assessment manual for identifying the nature of land tenure conflicts. World Agroforestry Centre.

disadvantaged during the establishment phase and that tree planting enhances rather than competes with food security.

Livestock damage to saplings

Free-roaming cattle and goats in communal grazing areas pose a risk to young saplings. Consultations confirmed that browsing and trampling are likely to reduce survival rates if unmanaged. Mitigation will include training in low-cost fencing techniques using local materials and collaboration with traditional leaders on communal grazing management. Community grazing committees will be supported where feasible and monitoring of sapling survival and fence maintenance will guide supplementary assistance if livestock pressures persist.

Limited water access

Community members expressed concern that limited water availability and droughts could threaten tree survival. Infrastructure for irrigation – such as boreholes and piping – is also limited. To address this, the project will prioritize drought-tolerant native species and promote water-efficient practices such as mulching and composting. Planting sites will also be co-designed with participants to locate trees near homesteads or existing water points, where feasible.

Inclusive participation

Women, youth, the elderly and people with disabilities could be exposed to participation barriers. Targeted consultations, accessible materials in local languages and trained facilitators to manage power dynamics will be used to address these risks. Inclusion will be institutionalized through women's forums, youth engagement platforms linked to schools and collaboration with training centers such as the GWF. Logistical support will be provided to elderly and disabled participants and continuous feedback mechanisms, including community liaisons and a project WhatsApp chatbot, will ensure inclusive participation across all groups.

Continued risk management

The Project Proponent recognizes Stakeholder Engagement and FPIC as an ongoing process and not a one-off event. Consent will be reaffirmed at the household level as new activities are introduced. Grievance mechanisms will remain active throughout implementation and monitoring, and activities will integrate Traditional Ecological Knowledge into site and species selection. Additionally, regular meetings, monitoring updates and use of local radio and digital platforms will sustain open communication. These measures create an enabling environment for continuous participation and reduce risks as they emerge.

4.5.4 Marginalized and/or Vulnerable Community Groups (CCB, GL2.4)

Marginalized groups in the project area – particularly women, youth and smallholder farmers – are disproportionately affected by ecological degradation and socio-economic constraints. Reduced water availability, soil degradation and unreliable rainfall limit agricultural productivity, while elevated unemployment, especially among women⁴⁷⁵ and youth⁴⁷⁶, restricts livelihood options. Smallholder farmers often are without formalized land tenure security, technical support and market access, which further undermines resilience.

The project design responds to these constraints by engaging each group through tailored measures. Women gain access to training, leadership roles and livelihood initiatives that improve household food security and reduce economic vulnerability. Youth are engaged through vocational training, enterprise

⁴⁷⁵ Commission for Gender Equality. 2024. Women in the South African economy 2024. Johannesburg: Commission for Gender Equality. Retrieved from:

https://www.parliament.gov.za/storage/app/media/OISD/Reports/Commission_for_Gender_Equality/2024/01-08-2024/CGE_Report_Women_in_the_South_African_Economy.pdf

⁴⁷⁶ Mpumalanga Department of Economic Development and Tourism. 2025. Socio-Economic Review and Outlook (SERO) for Mpumalanga: March 2025. Retrieved from:

https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2025_final-1.pdf

development and digital platforms, facilitating future employment. Smallholder farmers benefit from secure land-use agreements, agroforestry training and access to improved inputs and markets. Across all groups, inclusion is supported through targeted consultations, mentorship and equitable participation in benefit-sharing structures. These measures ensure that marginalized and vulnerable community members achieve net positive well-being outcomes from the project.

Community Group	Women
Net positive impacts	Women will benefit directly from project livelihood initiatives and tailored capacity development. Training in agroforestry, sustainable farming and small enterprise development will equip them with practical skills, while employment in nurseries and tree-planting teams provides immediate income. These activities improve household food security and strengthen economic resilience. Over the longer term, women will gain opportunities through increased capacity and entrepreneurship. Women’s participation in leadership and decision-making bodies is actively promoted to ensure that they influence governance and benefit from project outcomes.
Benefit access	Cultural norms, insecure land rights and exclusion from traditional decision-making have historically limited women’s participation. These constraints are addressed through women-only consultation sessions and the provision of information in local languages and accessible formats. Safeguards in benefit-sharing arrangements – including gender-balanced committees, dedicated training opportunities and transparent monitoring of women’s participation – ensure equitable access to project benefits. These measures enable women to participate fully and share in project outcomes.
Negative impacts	No negative impacts are expected for women from this project.

Community Group	Youth
Net positive impacts	Youth will benefit from training and employment opportunities linked to nursery operations, tree planting and climate-smart agriculture. These activities strengthen technical skills and facilitate employment and entrepreneurship. Educational initiatives – including environmental awareness sessions in schools, youth eco-clubs and internships at nurseries – will support sustainability in learning and provide leadership opportunities. By participating in project activities and educational programs, young people will secure an income as well as develop the knowledge, values and career prospects needed for long-term resilience.
Benefit access	Barriers such as limited land ownership, exclusion from decision-making processes and inadequate access to information often restrict youth participation. These constraints are addressed by ensuring that recruitment is not dependent on land tenure, allowing all young people to apply for jobs and training. Dedicated youth consultation sessions and digital tools, such as a WhatsApp chatbot provide accessible information and ongoing engagement. Partnerships with local training and education initiatives, including FEADT-SA, the Good Work Foundation and the Ten Trees project, expand access to vocational training, digital literacy and leadership skills. These measures ensure that youth have equitable access to both livelihood and educational opportunities, positioning them as facilitators of the project’s long-term sustainability.
Negative impacts	No negative impacts are expected for the youth.

Community Group	Smallholder farmers
Net positive impacts	Smallholders and subsistence farmers will benefit directly from agroforestry activities that improve soil health, water retention and crop diversity. Planting fruit and nut trees will provide households with additional food sources and products for sale, strengthening both nutrition and income. Training and extension support in climate-smart agriculture, soil management and agroforestry techniques will allow farmers to increase productivity and resilience to droughts and other climate shocks. Over the longer term, smallholders will access new livelihood opportunities through surplus sales and increased entrepreneurship. Educational initiatives – including farmer field days, demonstration sites and community awareness programs – will facilitate peer-to-peer learning, enabling farmers to support improved practices in their daily agricultural activities.
Benefit access	Barriers to participation for smallholder farmers include insecure land tenure, limited awareness of project opportunities and inadequate access to agricultural support services. These barriers are addressed by opening participation to all farmers with recognized or locally accepted land-use rights, at no cost. Enrolment is supported by partners such as FEADT-SA and the Ten Trees project, who assist with outreach and mobilization. Traditional authorities, land offices and CPAs will work with the project team to establish clear agreements that safeguard farmers' rights to trees and associated benefits. Farmers also receive continuous technical support through training, community nurseries and liaison committees. These measures ensure that even the most resource-constrained farmers will access project benefits.
Negative impacts	No negative impacts are expected for smallholder farmers.

4.5.5 Net Impacts on Women (CCB, GL2.5)

In Mpumalanga, 43.6% of households were female-headed in 2023, with rural provinces recording the greatest prevalence⁴⁷⁷. These households are exposed to persistent barriers, including limited access to employment, restricted control over resources and reduced economic opportunities⁴⁷⁸. Women experience these constraints to a greater extent, as they are primarily responsible for household food production, water collection and caregiving, while also being disproportionately affected by elevated unemployment and limited income diversification opportunities^{479,480}.

The project is designed to address these constraints and generate net positive impacts on women's well-being by supporting equity measures in all aspects of project implementation. Specific provisions are outlined below.

⁴⁷⁷ Statistics South Africa. 2023. General household survey 2023: Presentation. Retrieved from: <https://www.statssa.gov.za/publications/P0318/GHS%202023%20Presentation.pdf>

⁴⁷⁸ Mpumalanga Department of Economic Development and Tourism. 2025. Socio-Economic Review and Outlook (SERO) for Mpumalanga: March 2025. Economic Analysis Unit, Mbombela. Retrieved from: https://dedtkm.mpg.gov.za/images/km/economic_profiles/SERO_Mar_2025_final-1.pdf

⁴⁷⁹ Murugani VG & Thamaga-Chitja JM. 2019. How does women's empowerment in agriculture affect household food security and dietary diversity? The case of rural irrigation schemes in Limpopo Province, South Africa.

⁴⁸⁰ Hlatshwayo AT. 2023. The role of local economic development in empowering women in rural areas in the City of Mbombela Municipality in South Africa. Master's dissertation. University of Mpumalanga, Faculty of Economics, Development and Business Sciences, School of Development Studies. Retrieved from: <https://openscholar.ump.ac.za/bitstream/20.500.12714/793/1/Hlatshwayo-Andile-Titus-220160740.pdf>

- **Decent work and equal pay:** Women will have equal access to employment opportunities across nurseries, tree-planting teams and other project activities. Wage parity will be monitored to ensure women and men receive equal pay for equivalent roles. Safe and dignified working conditions are guaranteed, enabling women to participate fully in all field-based and administrative tasks without discrimination or risk.
- **Leadership and decision-making:** Women will be actively included in project committees, appointed as liaisons and supported to take on leadership roles. Women-only consultation forums provide opportunities for women to express priorities and concerns, with feedback directly integrated into project design and benefit-sharing arrangements. This ensures that women’s perspectives inform decision-making and are not contingent on participation numbers only.
- **Skills and enterprise development:** Women will have equal access to training in nursery management, climate-smart agriculture, financial literacy and small business development, with measures in place to ensure that caregiving responsibilities and other barriers do not limit participation. Gender-sensitive procurement will prioritize women-led small, medium and micro-enterprises in the supply chain, creating opportunities for women to participate as both employees and entrepreneurs.
- **Reducing unpaid labor burdens:** Water-smart planting techniques, low-cost fencing and agroforestry systems that improve household food security will reduce the time women spend on resource collection, freeing time for income-generating and leadership activities.
- **Empowerment and long-term resilience:** Mentorship and leadership training will strengthen women’s influence in grievance redress and monitoring committees, supporting equitable representation in governance structures. Intergenerational knowledge-sharing and environmental education further ensure that women’s skills and opinions remain central to sustaining resilience across the project life cycle.

4.5.6 Benefit Sharing Mechanisms (CCB, GL2.6)

The Benefit-Sharing Mechanism is structured to meet Gold Level Community Benefits by combining direct incentives, participatory engagement and sustained capacity building. Tree custodians receive performance-related payments, training and agroforestry products such as fruits and nuts, supporting immediate livelihood improvements while promoting long-term stewardship and improved land management practices. In parallel, employment is provided through nurseries and planting operations with measures to include women, youth and vulnerable groups. Furthermore, oversight by a representative Benefit Sharing Committee ensures accountability, the equitable distribution of benefits and transparent conflict resolution. Collectively, these mechanisms generate measurable outcomes in food security, income, skills and community services which are expected to reach vulnerable groups while strengthening resilience and institutional capacity over the project duration.

Please refer to Section 2.5.8 for further information on the project’s Benefit Sharing Mechanism.

4.5.7 Benefits, Costs, and Risks Communication (VCS, 3.18; CCB, GL2.7)

The Project Proponent will provide community members with clear information on predicted and actual benefits, costs and risks during Phase Two of the Stakeholder Engagement and FPIC process, scheduled for December 2025 and early 2026. During this process, the benefit-sharing framework will be presented to stakeholders, defining the processes for allocating carbon revenues, non-carbon benefits and community development investments. Additionally, the benefit-sharing plan will outline the associated costs – such as management requirements and opportunity costs – and the potential risks assumed by stakeholders, such as environmental and livelihood risks. The plan will be presented in participatory workshops where allocations will be discussed with all communities, as well as through focus-group engagement with women, youth and vulnerable groups. Refinements to the benefit-sharing plan will be made through participatory approaches to ensure benefits, costs and risks are informed by local conditions and opinions.

Information will be communicated through in-person meetings facilitated by community liaisons as well as digital platforms, including the project's WhatsApp chatbot and project website. All content will be translated and prepared in accessible formats to allow communities to assess project implications before making decisions. Evidence of understanding will be recorded through signed memoranda of understanding, acknowledgement forms and land use agreements. Meeting minutes, attendance registers and photographs will provide additional proof of consent and comprehension. Feedback mechanisms – such as grievance redress procedures, question-and-answer sessions and digital feedback channels – will allow communities to confirm understanding, raise concerns and request clarification.

4.5.8 Governance and Implementation Structures (CCB, GL2.8)

The governance and implementation arrangements for the project are set out in Section 2.3.13 and Section 2.4.1 of this document.

4.5.9 Smallholders/Community Members Capacity Development (CCB, GL2.9)

The project will improve the capacity of smallholders, community members and local institutions to participate in all stages of project development – from design and implementation to governance, monitoring and benefit-sharing. Capacity building is integrated into the project design and will be delivered through training programs, technical support and participatory governance structures.

- **Community nurseries and agroforestry training:** Decentralized nurseries will be established, offering: i) hands-on training in seedling propagation; ii) tree management; and iii) climate-smart agriculture. Community groups will oversee the nurseries, creating opportunities for employment, strengthening skills development and knowledge exchange.
- **Technical workshops and mentoring:** Regular workshops will increase knowledge in tree-care, water conservation and soil management practices, complementing traditional land-use knowledge. Mentorship from project implementation staff and partners will strengthen the capacity to manage project activities and sustain long-term benefits.
- **Leadership and governance roles:** Women and youth will be supported to participate in project committees, act as liaisons and lead community consultations. This develops decision-making skills, ensures inclusive governance and strengthens accountability mechanisms at the community level.
- **Institutional strengthening:** Traditional authorities, CPAs and local organizations will receive support to participate in land-use planning, benefit-sharing frameworks and grievance redress mechanisms. This enables local institutions to represent community interests transparently and equitably.
- **Market access and enterprise support:** Training in post-harvest handling, cooperative frameworks and value-chain development for agroforestry products will develop entrepreneurial capacity.

Together, these initiatives will equip communities with the skills, institutions and governance structures needed to sustain project outcomes over the long term. By supporting knowledge and leadership capacity at the household, community and institutional levels, the project facilitates local ownership and supports resilience and sustainable land management beyond the project's duration.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (VCS, 3.19; CCB, B1.1)

The ~630,000 hectares (ha) within the project zone includes three major biomes – savanna, grassland and forest (Figure 8; Section 2.1.14) – which have been classified by the South African National

Biodiversity Institute National Vegetation Map into thirteen distinct vegetation types⁴⁸¹. Eastern portions of the project zone, extending toward the Mozambique border, are predominantly covered by savanna vegetation typical of the Lowveld bushveld. In contrast, the grassland and forest biomes are primarily situated on the plateaus and slopes of the Great Escarpment in the western parts of the project zone. Project activities will only take place in the savanna biome, which covers most of the area (~90%), while grassland and forest biomes account for ~8% and ~2%, respectively.

Vegetation and flora

The savanna component in the project zone includes seven vegetation types: i) Delagoa Lowveld; ii) Gabbro Grassy Bushveld; iii) Granite Lowveld; iv) Legogote Sour Bushveld; v) Northern Lebombo Bushveld; vi) Pretoriuskop Sour Bushveld; and vii) Tshokwane-Hlane Basalt Lowveld. Grassland types comprise Long Tom Pass Montane Grassland, Northern Escarpment Afromontane Fynbos, Northern Escarpment Dolomite Grassland and Northern Escarpment Quartzite Sourveld. The grassland units are concentrated in the nutrient-poor, quartzitic geology of the northwestern escarpment region at elevations between 1,000 and 2,000 m. Forest units of Northern Mistbelt Forest and Scarp Forest, occur in fire-refugia and scarps on the east-facing slopes of the great escarpment. The forests are tall (15–25 m), multi-layered, species-rich, with a suite of endemic species⁴⁸².

The largest component of the savanna biome is Granite Lowveld, covering ~335,000 ha within the project zone. This vegetation type is characterized by a diverse mosaic of woody plants interspersed with a well-developed grass layer. Characteristic tree species include silver cluster-leaf (*Terminalia sericea*), marula (*Sclerocarya birrea*), apple leaf (*Philenoptera violaceae*), Jackalberry (*Diospyros mespiliiformis*), tamboti (*Spirostachys africana*), false marula (*Lannea discolor*), bushwillows (*Combretum* spp.), knobthorn (*Senegalia nigrescens*) and umbrella tree (*Vachellia tortilis*). The endangered Pepperbark tree (*Warburgia salutaris*) also occurs in the project zone. Riparian corridors are distinguished by greater tree density and the presence of species such as sycamore fig (*Ficus sycomorus*), natal mahogany (*Trichilia emetica*) and matumi (*Breonadia salicina*).

Shrub cover in the savanna biome is widespread, with common species including magic guarrie (*Euclea divinorum*), sicklebush (*Dichrostachys cinerea*) and spikethorn (*Gymnosporia senegalensis*). These species are particularly abundant along the margins of agricultural and residential areas, where they often persist despite habitat disturbance. The herbaceous layer is dominated by grasses, notably *Themeda triandra*, *Eragrostis* spp., *Chloris* spp., *Aristida* spp. and *Panicum* spp. Several species of conservation concern occur within the savanna biome of the project zone. These include the red-listed forest elephant's foot (*Dioscorea sylvatica*), natal ginger (*Siphonochilus aethiopicus*) and impala lily (*Adenium swazicum*), highlighting the ecological importance of this landscape for supporting regionally threatened flora.

Land use change represents the predominant threat to the flora and vegetation within the project zone. Approximately 36% of the Sabie and Sand River catchments underwent land transformation between 1993 and 2006, primarily caused by the expansion of urban development, agricultural cultivation and plantation forestry. Historically, large areas along the western escarpment were converted to commercial plantations, which are composed mostly of pine and eucalyptus species. In the surrounding lowland regions, agricultural expansion has become increasingly dominant, with croplands and pastures replacing much of the natural vegetation. This shift has intensified land-use pressures, reducing habitat availability and altering ecosystem processes across the landscape⁴⁸³.

Faunal species in the project zone

⁴⁸¹ Mucina L, Rutherford MC & Powrie LW. 2006–2024. The Vegetation Map of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute (Editors). Version 2024. Available at: <https://bgis.sanbi.org/Projects/Detail/2258>. Accessed on 26 September 2025.

⁴⁸² Mucina L, Geldenhuys CJ, Rutherford MC, Powrie LW, Lötter MC & Von Maltitz GP. 2006. Afrotemperate, subtropical and azonal forests. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia*, 19, 584–614.

⁴⁸³ Coetzer KL, Erasmus BF, Witkowski ETF & Bachoo AK. 2010. Land-cover change in the Kruger to Canyons Biosphere Reserve (1993-2006): A first step towards creating a conservation plan for the subregion. *South African Journal of Science*, 106, 7, 1–10.

The Sabie and Sand River catchments support substantial faunal biodiversity and several protected areas are located within or adjacent to the catchments, including portions of the Kruger National Park (KNP). These areas support a wide range of fauna typical of the African savanna. Large mammal populations include the ‘Big Five’ – lion (*Panthera leo*), leopard (*Panthera pardus*), elephant (*Loxodonta africana*), rhino (*Diceros bicornis* and *Ceratotherium simum*) and buffalo (*Syncerus caffer*) – alongside species such as giraffe (*Giraffa giraffa*), zebra (*Equus quagga*), wildebeest (*Connochaetes* spp.), hippopotamus (*Hippopotamus amphibius*) and numerous antelope⁴⁸⁴. Smaller carnivores such as hyena (*Crocuta Crocuta* and *Hyaena brunnea*), jackal (*Canis* spp.) and serval (*Leptailurus serval*) are also found in the area. While the larger mammals are confined to the protected areas, smaller mammals roam in the croplands and residential areas occasionally.

Avian diversity within the Sabie and Sand River catchments is also considerable, with over 500 bird species recorded, including raptors such as the martial eagle (*Polemaetus bellicosus*), scavengers such as vultures and waterbirds such as herons and storks⁴⁸⁵. Several amphibians and reptiles are found in the area, with species such as Nile crocodile (*Crocodylus niloticus*), monitor lizards (*Varanus* spp.) and diverse frog species occupying riparian and wetland habitats. Birds and smaller reptiles and amphibians are likely to be found outside protected areas and in the project area, although many of the raptor and larger bird species prefer a less built environment and tend to stay away from more inhabited areas⁴⁸⁶.

Of these faunal species, several are rare, threatened or endangered (RTE) (Appendix 1: Stakeholder Description Table); however, these are restricted to protected areas and remnant patches of natural vegetation outside the protected area network, and do not occur within the residential and agricultural areas where project activities will take place. The plant species listed in the table below are those with an increased chance of occurring in the natural corridors adjacent to the project area.

Species and habitat	<i>Siphonochilus aethiopicus</i> “Natal Ginger”. Critically endangered geophyte that is considered to be one of the most sought-after medicinal species in the South African Bushveld
Areas needed for habitat connectivity	Bushveld in ecological corridors surrounding urban environments
Species and habitat	<i>Dioscorea sylvatica</i> “Forests Elephant foot”. Commonly harvested for medicinal purposes ⁴⁸⁷ . Forests and Bushveld of ecological corridors adjacent to project areas.
Areas needed for habitat connectivity	Wooded ecological corridors surrounding urban environments.
Species and habitat	<i>Adenium swazicum</i>

⁴⁸⁴ SANParks. n.d. Kruger National Park, Mammal Checklist. Available at: <https://www.sanparks.org/parks/kruger/explore/fauna-flora/mammals/checklist>. Accessed on 26 September 2025.

⁴⁸⁵ SANParks. n.d. Kruger National Park, Birds Checklist. Available at: <https://www.sanparks.org/parks/kruger/explore/fauna-flora/birds/checklist>. Accessed on 26 September 2025.

⁴⁸⁶ O'Bryan CJ. 2022. Human impacts on the world's raptors. *Frontiers in Ecology and Evolution*, 10.

⁴⁸⁷ Von Ahlefeldt, D., Crouch, N.R., Nichols, G., Symmonds, R., McKean, S., Sibiyi, H. and Cele, M.P. 2003. Medicinal plants traded on South Africa's eastern seaboard. Porcupine Press, Durban.

	“Summer Impala Lily”. Occurs in Bushveld around the KNP westwards towards the Lebombo mountains. Declining populations due to habitat loss, but also illegal collecting for the horticultural industry ⁴⁸⁸ .
Areas needed for habitat connectivity	Bushveld in ecological corridors surrounding urban environments

5.1.2 High Conservation Values (CCB, B1.2)

High Conservation Values (HCVs) 1, 2 and 3 are found within the project zone. HCV 1 refers to areas that support concentrations of biological diversity, including endemic species as well as RTE species. HCV 2 includes large-scale ecosystems and landscape mosaics, as well as Intact Forest Landscapes, while HCV 3 refers to RTE ecosystems and habitats.

HCV	High Conservation Value 1: Species diversity
Qualifying attribute	Due to the size and ecological diversity of the Sabie and Sand River catchments, a substantial number of RTE floral and faunal species are present, which are regarded as part of HCV 1. At least 111 RTE taxa occur within the project zone, including 10 critically endangered, 35 endangered, 5 rare and 61 vulnerable species. This includes 65 plant ⁴⁸⁹ , 32 bird ⁴⁹⁰ and 12 mammal ⁴⁹¹ species. In addition to these, the project zone contains numerous endemic species associated with its diverse vegetation types. At least 30 plant species are endemic to Northern Escarpment Quartzite Sourveld, with 8 and 1 endemic species in Northern Escarpment Dolomite Grassland and Legogote Sour Bushveld, respectively (see Appendix 1: Stakeholder Description Table for species list).
Focal area	The Bushbuckridge Nature Reserve and natural corridors surrounding the residential and agricultural areas of the project zone.

HCV	High Conservation Value 2: Landscape-level ecosystems, ecosystem mosaics and intact forest landscapes – Maputoland-Pondoland-Albany Global Biodiversity Hotspot
Qualifying attribute	The project zone is situated within the Maputoland-Pondoland-Albany (MPA) global biodiversity hotspot, which extends from the Eastern Cape along South Africa’s eastern seaboard into southern Mozambique ⁴⁹² . Within this hotspot, the project zone encompasses four Key Biodiversity Areas (KBAs): i) the Blyde River Canyon; ii) Kruger National Park; iii) Legogote; and iv) Long Tom Grasslands. A substantial portion of the KNP KBA, which includes the Hazyview subsection, is located within the project zone. The Hazyview subsection of the MPA, located in the northern extent of the MPA hotspot, spans ~220,000 ha and supports considerable biodiversity, including 11 Critically Endangered, 9 Endangered and 43 Vulnerable

⁴⁸⁸ Van der Walt, K. 2010. In: The ecology and population biology of the Critically Endangered succulent - *Adenium swazicum* (pp. 1-3). Paper presented at the 4th Global Botanic Gardens Congress Proceedings, Botanic Gardens Conservation International.

⁴⁸⁹ Raimondo D. et al. 2009. Red List of South African Plants. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

⁴⁹⁰ The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. 2025. Taylor MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

⁴⁹¹ Child MF. et al. 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

⁴⁹² Conservation International Southern African Hotspots Programme & South African National Biodiversity Institute. 2010. Ecosystem Profile: Maputoland-Pondoland-Albany Biodiversity Hotspot – Final Version, 23 April 2010. Critical Ecosystem Partnership Fund.

	species ⁴⁹³ (see Appendix 1). The project zone also contains several protected areas, such as sections of KNP, Sabi Sands Private Nature Reserve, Manyeleti Game Reserve and Timbavati Private Nature Reserve (see Figure 13 in Section 2.1.15).
Focal area	The focal area will be natural patches of vegetation adjacent to urban and agricultural areas, particularly river and ridge line areas, which act as ecological networks between protected areas.

HCV	High Conservation Value 3: Ecosystems and habitats
Qualifying attribute	<p>Five of the thirteen vegetation types mapped in the project zone, totaling ~500,000 ha, are listed as RTE. These are provided below.</p> <ul style="list-style-type: none"> • Granite Lowveld (Vegetation code – SVI3): Vulnerable. Typical lowveld savanna habitat with a scattering of trees and large shrubs in a matrix of grasses. Threats to this vegetation type include development and increased settlement, with 20% of Granite Lowveld already transformed. This is the largest vegetation type in the project zone with an extent of ~335,000 ha. • Legogote Sour Bushveld (SVI9): Endangered. Dense woodland dominated by <i>Parinari curatellifolia</i> and <i>Bauhinia galpinii</i> with graminoids such as <i>Hyperthelia dissoluta</i> and <i>Panicum maximum</i> in the undergrowth. Half of this vegetation type has been transformed due to plantations, cultivation and urban development. This vegetation type covers ~115,000 ha in the western section of the project zone. • Northern Escarpment Dolomite Grassland (GM22): Endangered. Species-rich grasslands with numerous endemic taxa. More than half of this vegetation type has been transformed, mainly by plantations. This unit covers 16,000 ha near the foothills of the mountains towards the west of the project zone. • Northern Escarpment Quartzite Sourveld (GM23): Vulnerable. Endemic-rich grassland on rugged, nutrient-poor quartzitic geology. The vegetation type is mostly closed grassland with a shrub element of taxa mostly associated with Fynbos (genera such as <i>Protea</i>, <i>Helichrysum</i>, <i>Clutia</i>, <i>Crotalaria</i>) and ~22,000 ha of the project zone is made up of this vegetation type. The major threat to this unit is the development of plantations, transforming 38% of the area of this vegetation type. • Delagoa Lowveld (SVI4): Vulnerable. Dense woodland covering ~10,000 ha towards the eastern section of the project zone. A third of this unit has been transformed, mostly due to cultivation.
Focal area	The focal area will be natural patches of Granite Lowveld and Legogote Sour Bushveld adjacent to urban and agricultural areas.

5.1.3 Without-project Scenario: Biodiversity (CCB, B1.3)

The without project scenario presented here is informed by GIS analysis and secondary sources such as scientific articles and global datasets. Baseline assessments will be conducted before project commencement to confirm the current biodiversity conditions. One of the major consequences of land-use change is the fragmentation of habitat connectivity. Urban and agricultural development increasingly reduces the ecological linkages that facilitate the movement of species and the flow of ecological functions between intact natural areas⁴⁹⁴. Ecological connectivity is necessary for maintaining viable

⁴⁹³ Conservation International Southern African Hotspots Programme & South African National Biodiversity Institute. 2010. Ecosystem Profile: Maputaland-Pondoland-Albany Biodiversity Hotspot – Final Version, 23 April 2010. Critical Ecosystem Partnership Fund.

⁴⁹⁴ Linden E, Rittenhouse CD, Peel MJ, Ortega IM & Smit IP. 2023. Vegetation changes following large-scale fence removal across a protected area network within the Kruger to Canyons Biosphere Reserve, South Africa. *Ecosystems*, 26, 4, 768–783.

metapopulations, enabling species migration and dispersal⁴⁹⁵ and ensuring the continuity of ecosystem services⁴⁹⁶. Consequently, the enhancement of connectivity between protected areas has become a priority in contemporary conservation planning, particularly within biodiversity hotspots and where natural habitats are interspersed with human-modified landscapes.

Although the project zone contains several formally protected areas, including parts of the KNP and other nature reserves, the surrounding matrix has become fragmented due to cultivation and the expansion of the urban environment. The current baseline scenario is characterized by reduced levels of connectivity across the project zone and a near-complete absence of native tree cover in urban and agricultural areas. In the without-project scenario, this fragmented landscape condition is expected to persist and even worsen as continued urban and agricultural development, as well as harvesting pressures, degrade remnant habitat patches.

Between 2000 and 2020, the cropland and built-up area in the project zone increased by ~58,000 ha⁴⁹⁷. At present, ~50,000 ha of the project zone is classified as urban/peri-urban and ~18,000 ha as agricultural, totaling 68,000 ha and making up 11% of the project zone (see Figure 12 in Section 2.1.15). When areas affected by plantations in the western portion are included (~105,000 ha) and the area of formally protected areas removed (~295,000 ha), this figure rises to 32% of the project zone. In the ten years from 2000 to 2010, Coetzee *et al.* (2010)⁴⁹⁸ reported a 39.7% increase in urban areas and a 51.9% increase in cropland in Mpumalanga. Using the current baseline of 50,000 ha urban and 18,000 ha agricultural area and assuming these trends continue linearly, this would result in a combined increase of ~116,000 ha of anthropogenic land cover over 40 years, representing a substantial proportion of the landscape. When plantations in the western portion are included and protected reserves are excluded, this could amount to over 60% of the project zone being converted from natural habitat to human-modified land uses. Although this rate of rapid expansion is unlikely to be sustained indefinitely due to spatial constraints, the extent of anthropogenic land cover is nevertheless expected to continue increasing over time.

A culture of residential tree planting exists within the project zone and is likely to continue even under rapid development; however, preliminary field observations indicate that ~90% of trees planted in residential environments are non-native fruit species. In the absence of the project interventions, this pattern will persist and with ongoing urban expansion, the representation of native trees in the landscape will diminish substantially. As a result, opportunities to enhance local biodiversity, support ecological connectivity and restore ecosystem functions will decrease.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (VCS, 3.19; CCB, B2.1)

The project area consists of urban and agricultural zones – land uses which have been consistent in the region for the last ten years – and does not contain natural ecosystems.

Biodiversity element	Ecological connectivity
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⁴⁹⁵ McRae BH, Hall SA, Beier P & Theobald DM. 2012. Where to restore ecological connectivity? Detecting barriers and quantifying restoration benefits. *PloS one*, 7, 12, e52604.

⁴⁹⁶ Mitchell MG, Bennett EM & Gonzalez A. 2013. Linking landscape connectivity and ecosystem service provision: current knowledge and research gaps. *Ecosystems*, 16, 5, 894-908.

⁴⁹⁷ Potapov, P., Hansen, M. C., Kommareddy, I., Kommareddy, A., Turbanova, S., Pickens, A., Ying, Q. (2022). Global Land Cover and Land Use Change 2000–2020 (GLCLUC2020). Global Land Analysis & Discovery Lab (GLAD), University of Maryland. Retrieved [29/08/2025], from Earth Map: glad.earthengine.app/view/glcluc-2000-2020

⁴⁹⁸ Coetzer KL, Erasmus BF, Witkowski ETF & Bachoo AK. 2010. Land-cover change in the Kruger to Canyons Biosphere Reserve (1993-2006): A first step towards creating a conservation plan for the subregion. *South African Journal of Science*, 106, 7, 1–10.

Estimated change	Increase in ecological connectivity
Justification of change	<p>Green spaces in residential and agricultural areas are recognized as corridors that support species movement and habitat use⁴⁹⁹. Patches of vegetation function as movement corridors, while also providing nesting sites and foraging opportunities for native fauna⁵⁰⁰. Project activities will include planting both ecologically beneficial native species and non-native fruit-bearing species with economic value. This will increase tree canopy cover over the project lifetime, creating additional habitat and improving connectivity between natural areas in the project zone.</p> <p>Increasing canopy cover will create microhabitats within residential areas and croplands. This increases habitat heterogeneity, supporting species that rely on varied ecological niches. Additionally, establishing native tree species supports connectivity for fauna. Several bird, insect and small mammal species rely on native trees for nectar, pollen, fruits and nesting substrates. Reintroducing these trees into human-modified landscapes will support the restoration of local food web linkages and facilitate species movement between remnant natural patches and protected areas.</p> <p>Riparian areas and ridgelines within the project zone will benefit from increased canopy cover. These features often function as ecological corridors within human-modified landscapes and tree planting in nearby urban areas is expected to strengthen existing linkages across the landscape⁵⁰¹. Such interventions will support biodiversity and contribute to ecosystem services at the catchment scale, including erosion control and water regulation.</p> <p>An additional outcome of increased canopy cover is the moderation of climate extremes. Tree shade reduces the heat-island effect in residential areas, lowers surface evaporation rates and improves water infiltration. These changes will stabilize habitats and improve conditions for species sensitive to temperature and moisture fluctuations, thereby enhancing ecosystem resilience to climate change.</p>

Biodiversity element	Native flora
Estimated change	Increase in the number of native tree species
Justification of change	<p>The project is expected to contribute to addressing biodiversity loss in the project zone by restoring native tree cover that has been reduced as a result of land-use change. Although there is a tradition of tree planting in the area⁵⁰², the species currently planted are predominantly non-native fruit trees. Project activities are designed to introduce a range of native tree species selected for their natural distribution in the region and their cultural, medicinal and food value. This approach ensures that planted species are ecologically appropriate,</p>

⁴⁹⁹ Von Thaden J. et al. 2021. Contributions of green spaces and isolated trees to landscape connectivity in an urban landscape. *Urban Forestry & Urban Greening*, 64, 127277.
⁵⁰⁰ Kodym A, Lapin K & Sanyal D. 2025. Ecological Connectivity in Urban and Semi-Urban Forests. In *Ecological Connectivity of Forest Ecosystems*, 365–381. Cham: Springer Nature Switzerland.
⁵⁰¹ Aronson MF, Patel MV, O'Neill KM & Ehrenfeld JG. 2017. Urban riparian systems function as corridors for both native and invasive plant species. *Biological Invasions*, 19, 12, 3645–3657.
⁵⁰² As per field observation, August 2025.



locally adapted and able to support biodiversity conservation and community use.

By re-establishing native vegetation cover, project activities will support the restoration of habitat structure and ecological functions absent under the without-project scenario (Section 5.1.3). Native trees provide resources for pollinators, birds and small mammals, support natural regeneration processes and enhance connectivity between fragmented habitat patches and protected areas.

5.2.2 Mitigation Measures (VCS, 3.19; CCB, B2.3)

Although project activities will introduce non-native tree species, these will be limited to fruit and nut trees – such as avocado (*Persea americana*), mango (*Mangifera indica*) citrus (*Citrus* spp.) and macadamia (*Macadamia integrifolia* or *M. tetraphylla*) – that are non-invasive and commonly cultivated in Mpumalanga. There is no evidence of these species self-propagating outside cultivation areas within the project zone. The fruit and nuts will be harvested, which reduces the likelihood of seed dispersal and unintended establishment. Restricting non-native species to croplands and residential areas, alongside extensive planting of native trees, supports the maintenance of biodiversity in the project zone.

5.2.3 Net Positive Biodiversity Impacts (CCB, B2.2, GL1.4)

Project activities are expected to result in positive impacts on biodiversity in the project area when compared to the without-project scenario. In the absence of the project, urbanization and agricultural expansion are projected to continue, resulting in increased human-modified land cover, further habitat fragmentation and the predominance of non-native fruit trees in residential areas (see Section 5.1.3). By contrast, project activities will counteract these trends through the introduction of native tree species into croplands and residential areas, which are expected to:

- **improve ecological connectivity** by reducing the isolation of native tree patches, creating corridors and ‘stepping-stone’ habitats that link remnant and protected areas;
- **increase habitat availability and diversity** by introducing native species that provide foraging, nesting and shelter opportunities for birds, insects and small mammals; and
- **enhance ecosystem resilience** by restoring ecological processes, including pollination, seed dispersal and soil stabilization, which are reduced in modified landscapes.

Through these measures, the project is expected to achieve positive impacts on biodiversity compared to the without-project scenario. These outcomes will support ecosystem and species resilience to the anticipated impacts of climate change.

5.2.4 High Conservation Values Protected (CCB, B2.4)

As described in Section 5.1.2, HCVs related to biodiversity occur in the project zone. Project activities primarily take place in croplands and residential areas that have already been converted to anthropogenic land use, and no clearing or disturbance of natural habitats associated with HCV areas will take place. As such, no HCVs related to biodiversity are negatively affected. The reintroduction of native species contributes to the enhancement of biodiversity values by restoring habitat structure, providing food and nesting resources for fauna and reinforcing ecological processes such as pollination and seed dispersal. In addition, specific restoration activities may be implemented in riparian areas and other priority sites identified through site-specific assessments. In these cases, interventions will be designed to enhance ecosystem function while maintaining or improving existing HCV attributes. Appropriate safeguards, including the use of native species, avoidance of disturbance to intact habitats and adherence to buffer zones, will ensure that HCVs are protected and strengthened through these restoration efforts.

The inclusion of selected non-native fruit and nut trees in residential areas and croplands further increases canopy cover and livelihood benefits, which reduces pressure on natural ecosystems. Together, these interventions strengthen ecological connectivity between fragmented habitats and HCV areas, thereby supporting the conservation objectives associated with HCV 2 and HCV 3. This includes planting of several nationally protected tree species, such as pepper bark (*Warburgia salutaris*), jackal-berry (*Diospyros mespiliformis*), leadwood (*Combretum imberbe*), marula (*Sclerocarya birrea*), red ivory (*Phyllogeiton discolor*), and wild teak (*Pterocarpus angolensis*).

5.2.5 Species Used (VCS, 3.19; CCB, B2.5, B2.6)

The species listed in the table below represent options that could be used in the project, with the understanding that each project activity instance and participating land user is likely to differ and will be able to select from among these species – with guidance from the Project Proponent – for suitability to local context and needs. All native species listed below occurred historically within the project zone and many have additional benefits, such as fruit production or medicinal uses. All non-native species have been carefully selected to be well adapted to the climate of the project zone, as evidenced by either commercial or subsistence cultivation, or both, within the project zone.

Prior to implementation, site-species matching will be guided by factors such as soil characteristics, moisture availability and elevation, and species combinations will be selected to enhance ecological complementarity and resilience. Seasonal planting windows will be determined in consultation with implementing partners to optimize survival. The project design maintains ~60% native species composition across planting units, while the proportion of any single species will be managed to avoid monocultures. Species selection will remain adaptive, with adjustments made based on early survival monitoring and local stakeholder feedback to ensure long-term sustainability and community alignment.

Species introduced	Classification	Justification for use	Adverse effects and mitigation
Apple-leaf (<i>Philenoptera Violaceae</i>)	Native	Historical occurrence in the project area; protected in South Africa; medicinal ⁵⁰³ .	Not applicable (N/A)
Carrot Tree (<i>Steganotaenia araliacea</i>)	Native	Historical occurrence in the project area ⁵⁰⁴ .	N/A
Common Cabbage Tree (<i>Cussonia spicata</i>)	Native	Historical occurrence in the project area; medicinal ⁵⁰⁵ .	N/A
Coral Tree (<i>Erythrina lysistemon</i>)	Native	Historical occurrence in the project area; ecological importance, providing food for many birds, animals and insects; cultural importance; medicinal ⁵⁰⁶ .	N/A

⁵⁰³ South African National Biodiversity Institute (SANBI). 2009. *Philenoptera violacea*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/philenoptera-violacea> Accessed on 23 September 2025.

⁵⁰⁴ Victor JE & Winter PJD. 2005. *Steganotaenia araliacea* Hochst. var. *araliacea*. National Assessment: Red List of South African Plants version 2024.1. Available at: <https://redlist.sanbi.org/species.php?species=2122-1>. Accessed on 23 September 2025.

⁵⁰⁵ SANBI. 2004. *Cussonia spicata*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/cussonia-spicata>. Accessed on 23 September 2025.

⁵⁰⁶ SANBI. 2002. *Erythrina lysistemon*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/erythrina-lystemon>. Accessed on 23 September 2025.

Fever (<i>Vachellia xanthophloea</i>)	Native	Historical occurrence in the project area; medicinal ⁵⁰⁷ .	N/A
Grey Cabbage Tree (<i>Cussonia transvaalensis</i>)	Native	Historical occurrence in the project area; medicinal ⁵⁰⁸ .	N/A
Jackal-berry (<i>Diospyros mespiliformis</i>)	Native; protected in South Africa	Historical occurrence in the project area; provides fruit for humans, birds and animals; provides important nesting sites for raptors, specifically vultures; medicinal ⁵⁰⁹ .	N/A
Kei Apple (<i>Dovyalis caffra</i>)	Native	Historical occurrence in the project area; fruit producing ⁵¹⁰ .	N/A
Large-fruited Bushwillow (<i>Combretum zeyheri</i>)	Native	Historical occurrence in the project area; provides fruit for birds and animals ⁵¹¹ .	N/A
Lavender Tree (<i>Heteropyxis natalensis</i>)	Native	Historical occurrence in the project area; medicinal ⁵¹² .	N/A
Leadwood (<i>Combretum imberbe</i>)	Native; protected in South Africa	Historical occurrence in the project area; medicinal ⁵¹³ .	N/A
Lowveld Chestnut (<i>Sterculia murex</i>)	Native	Historical occurrence in the project area ⁵¹⁴ .	N/A
Marula (<i>Sclerocarya birrea</i> subsp <i>caffra</i>)	Native; protected in South Africa	Historical occurrence in the project area; high-value fruit production for humans, birds and animals; cultural value; medicinal ⁵¹⁵ .	N/A
Monkey orange (<i>Strychnos spinosa</i>)	Native	Historical occurrence in the project area ⁵¹⁶ .	N/A

⁵⁰⁷ SANBI. 2002. *Vachellia xanthophloea*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/vachellia-xanthophloea>. Accessed on 23 September 2025.

⁵⁰⁸ SANBI. 2005. *Cussonia transvaalensis*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/cussonia-transvaalensis>. Accessed on 23 September 2025.

⁵⁰⁹ SANBI. 2007. *Diospyros mespiliformis*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/diospyros-mespiliformis>. Accessed on 23 September 2025.

⁵¹⁰ SANBI. 2003. *Dovyalis caffra*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/dovyalis-caffra>. Accessed on 23 September 2025.

⁵¹¹ SANBI. 2015. *Combretum zeyheri*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/combretum-zeyheri>. Accessed on 23 September 2025.

⁵¹² SANBI. 2002. *Heteropyxis natalensis*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/heteropyxis-natalensis>. Accessed on 23 September 2025.

⁵¹³ SANBI. 2006. *Combretum imberbe*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/combretum-imberbe>. Accessed on 23 September 2025.

⁵¹⁴ SANBI. 2002. *Sterculia murex*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/sterculia-murex>. Accessed on 23 September 2025.

⁵¹⁵ SANBI. 2003. *Sclerocarya birrea*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/sclerocarya-birrea>. Accessed on 23 September 2025.

⁵¹⁶ SANBI. 2005. *Strychnos spinosa*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/strychnos-spinosa>. Accessed on 23 September 2025.

Mopane (<i>Colophospermum mopane</i>)	Native	Historical occurrence in the project area ⁵¹⁷ ; nitrogen-fixing ⁵¹⁸ .	N/A
Mountain Syringa (<i>Kirkia wilmsii</i>)	Native	Historical occurrence in the project area; drought water source; weaving fiber source ⁵¹⁹ .	N/A
Natal Guarri (<i>Euclea natalensis</i>)	Native	Historical occurrence in the project area; medicinal ⁵²⁰ .	N/A
Natal Mahogany (<i>Trichilia emetica</i>)	Native	Historical occurrence in the project area ⁵²¹ ; medicinal ⁵²² .	N/A
Nyala Tree (<i>Xanthocercis zambesiaca</i>)	Native	Historical occurrence in the project area; treatment for diabetes mellitus; shade tree; timber and fuel source; edible fruit ⁵²³ .	N/A
Paperbark thorn (<i>Vachellia sieberiana</i> var. <i>woodii</i>)	Native	Historical occurrence in the project area; medicinal ⁵²⁴ .	N/A
Pepper bark (<i>Warburgia salutaris</i>)	Native; protected in South Africa	Historical occurrence in the project area; endangered species, culturally and medicinally important, supports conservation of HCV trees ⁵²⁵ .	N/A
Poison-pod Albizia (<i>Albizia versicolor</i>)	Native	Historical occurrence in the project area; medicinal uses; nitrogen fixing root nodules; leaves provide mulch; large roots reduce soil erosion ⁵²⁶ .	N/A
Quinine Tree (<i>Rauvolfia caffra</i>)	Native	Historical occurrence in the project area; medicinal uses; food source for monkeys ⁵²⁷ .	N/A

⁵¹⁷ SANBI. 2004. *Colophospermum mopane*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/colophospermum-mopane>. Accessed on 23 September 2025.

⁵¹⁸ Burbano CS, Grönemeyer JL, Hurek T & Reinhold-Hurek B. 2015. Microbial community structure and functional diversity of nitrogen-fixing bacteria associated with *Colophospermum mopane*. *FEMS Microbiology Ecology*, 91, 4.

⁵¹⁹ SANBI. 2004. *Kirkia wilmsii*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/kirkia-wilmsii>. Accessed on 23 September 2025.

⁵²⁰ SANBI. 2010. *Euclea natalensis*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/euclea-natalensis>. Accessed on 23 September 2025.

⁵²¹ TreeSA. 2025. *Trichilia emetica*. Available at: <https://treesa.org/trichilia-emetica/>. Accessed on 23 September 2025.

⁵²² SANBI. 2014. *Trichilia emetica*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/trichilia-emetica>. Accessed on 23 September 2025.

⁵²³ SANBI. 2019. *Xanthocercis zambesiaca*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/xanthocercis-zambesiaca>. Accessed on 23 September 2025.

⁵²⁴ SANBI. 2003. *Vachellia sieberiana* var. *woodii*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/vachellia-sieberiana-var-woodii>. Accessed on 23 September 2025.

⁵²⁵ SANBI. 2018. *Warburgia salutaris*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/warburgia-salutaris>. Accessed on 23 September 2025.

⁵²⁶ SANBI. 2022. *Albizia versicolor*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/albizia-versicolor>. Accessed on 23 September 2025.

⁵²⁷ SANBI. 2011. *Rauvolfia caffra*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/rauvolfia-caffra>. Accessed on 23 September 2025.

Red bushwillow (<i>Combretum apiculatum</i>)	Native	Historical occurrence in the project area; medicinal uses ⁵²⁸ .	N/A
Red Ivory (<i>Phyllogeiton discolor</i>)	Native; protected in South Africa	Historical occurrence in the project area; edible fruit ⁵²⁹ .	N/A
Red Syringa (<i>Burkea africana</i>)	Native	Historical occurrence in the project area; medicinal uses ⁵³⁰ .	N/A
River Bushwillow (<i>Combretum erythrophyllum</i>)	Native	Historical occurrence in the project area; medicinal uses ⁵³¹ .	N/A
Round-leaved Kiaat (<i>Pterocarpus rotundifolius</i>)	Native	Historical occurrence in the project area; good nectar and pollen source for bees ⁵³² .	N/A
Sausage Tree (<i>Kigelia africana</i>)	Native	Historical occurrence in the project area; edible seeds; traditional medicinal uses ⁵³³ .	N/A
Silver terminalia (<i>Terminalia sericea</i>)	Native	Historical occurrence in the project area; medicinal uses ⁵³⁴ .	N/A
Sycamore Fig (<i>Ficus sycomorus</i>)	Native	Historical occurrence in the project area; fruit producing; medicinal ⁵³⁵ .	N/A
Tamboti (<i>Spirostachys africana</i>)	Native	Historical occurrence in the project area ⁵³⁶ .	N/A
Toad Tree (<i>Tabernaemontana elegans</i>)	Native	Historical occurrence in the project area ⁵³⁷ .	N/A
Transvaal Milkplum (<i>Englerophytum magalismsontanum</i>)	Native	Historical occurrence in the project area; fruit producing ⁵³⁸ .	N/A

⁵²⁸ SANBI. 2011. *Combretum apiculatum*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/combretum-apiculatum-subsp-apiculatum>. Accessed on 23 September 2025.

⁵²⁹ TreeSA. *Phyllogeiton discolor*. Available at: <https://treesa.org/brachylaena-dicolor/>. Accessed on 23 September 2025.

⁵³⁰ SANBI. 2010. *Burkea africana*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/burkea-africana>. Accessed on 23 September 2025.

⁵³¹ SANBI. 2003. *Combretum erythrophyllum*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/combretum-erythrophyllum>. Accessed on 23 September 2025.

⁵³² SANBI. 2003. *Pterocarpus rotundifolius*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/pterocarpus-rotundifolius>. Accessed on 23 September 2025.

⁵³³ SANBI. 2003. *Kigelia africana*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/kigelia-africana>. Accessed on 23 September 2025.

⁵³⁴ SANBI. 2012. *Terminalia sericea*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/terminalia-sericea>. Accessed on 23 September 2025.

⁵³⁵ SANBI. 2019. *Ficus sycomorus* subsp. *sycomorus*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/ficus-sycomorus-subsp-sycomorus%C2%A0>. Accessed on 23 September 2025.

⁵³⁶ SANBI. 2004. *Spirostachys africana*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/spirostachys-africana>. Accessed on 23 September 2025.

⁵³⁷ SANBI. 2010. *Tabernaemontana elegans*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/tabernaemontana-elegans>. Accessed on 23 September 2025.

⁵³⁸ SANBI. 2004. *Englerophytum magalismsontanum*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/englerophytum-magalismontanum>. Accessed on 23 September 2025.

Transvaal Red Milkwood (<i>Mimusops zeyheri</i>)	Native	Historical occurrence in the project area ⁵³⁹ .	N/A
Tree Wisteria (<i>Bolusanthus speciosus</i>)	Native	Historical occurrence in the project area ⁵⁴⁰ .	N/A
Velvet Bushwillow (<i>Combretum molle</i>)	Native	Historical occurrence in the project area; medicinal ⁵⁴¹ .	N/A
Water Berry (<i>Syzygium cordatum</i>)	Native	Historical occurrence in the project area; supports pollinators; provides edible fruits for people and birds; medicinal ⁵⁴² .	N/A
Weeping Boer-bean (<i>Schotia brachypetala</i>)	Native	Historical occurrence in the project area; medicinal ⁵⁴³ .	N/A
Weeping Wattle (<i>Peltophorum africanum</i>)	Native	Historical occurrence in the project area; medicinal ⁵⁴⁴ .	N/A
White Cat's Whiskers/Tinderwood (<i>Clerodendron glabrum</i>)	Native	Historical occurrence in the project area; cultural value; medicinal ⁵⁴⁵ .	N/A
White Syringa (<i>Kirkia acuminata</i>)	Native	Historical occurrence in the project area ⁵⁴⁶ .	N/A
Wild Mango (<i>Cordyla Africana</i>)	Native	Historical occurrence in the project area ⁵⁴⁷ .	N/A
Wild Pear (<i>Dombeya rotundifolia</i>)	Native	Historical occurrence in the project area; produces a large quantity of pollen and nectar for pollinators ⁵⁴⁸ .	N/A
Wild Pride-of-India (<i>Galpinia transvaalica</i>)	Native	Historical occurrence in the project area ⁵⁴⁹ .	N/A

⁵³⁹ SANBI. 2005. *Mimusops zeyheri*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/mimusops-zeyheri>. Accessed on 23 September 2025.

⁵⁴⁰ SANBI. 2003. *Bolusanthus speciosus*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/bolusanthus-speciosus>. Accessed on 23 September 2025.

⁵⁴¹ SANBI. 2011. *Combretum molle*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/combretum-molle>. Accessed on 23 September 2025.

⁵⁴² SANBI. 2004. *Syzygium cordatum*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/syzygium-cordatum>. Accessed on 23 September 2025.

⁵⁴³ SANBI. 2014. *Schotia brachypetala*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/schotia-brachypetala>. Accessed on 23 September 2025.

⁵⁴⁴ SANBI. 2001. *Peltophorum africanum*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/peltophorum-africanum>. Accessed on 23 September 2025.

⁵⁴⁵ SANBI. 2012. *Clerodendron glabrum*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/clerodendron-glabrum>. Accessed on 23 September 2025.

⁵⁴⁶ SANBI. 2004. *Kirkia acuminata*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/kirkia-acuminata>. Accessed on 23 September 2025.

⁵⁴⁷ SANBI. 2006. *Cordyla africana*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/cordyla-africana>. Accessed on 23 September 2025.

⁵⁴⁸ SANBI. 2001. *Dombeya rotundifolia*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/dombeya-rotundifolia>. Accessed on 23 September 2025.

⁵⁴⁹ SANBI. 2004. *Galpinia transvaalica*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/galpinia-transvaalica>. Accessed on 23 September 2025.

Wild teak (<i>Pterocarpus angolensis</i>)	Native; protected in South Africa	Historical occurrence in the project area; medicinal ⁵⁵⁰ .	N/A
Zebrawood (<i>Dalbergia melanoxylon</i>)	Native	Historical occurrence in the project area; nitrogen fixing; medicinal ⁵⁵¹ .	N/A
Avocado pear (<i>Persea americana</i>)	Non-native	High-value fruit production; well adapted to the region ⁵⁵²	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation
Guava (<i>Psidium guajava</i>)	Non-native	High-value fruit production; well adapted to the region ⁵⁵³	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation
Lemon (<i>Citrus limon</i>)	Non-native	High-value fruit production; well adapted to the region ^{554, 555}	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation
Litchi (<i>Litchi chinensis</i> subsp. <i>chinensis</i>)	Non-native	High-value fruit production; well adapted to the region ⁵⁵⁶	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation
Macadamia nut (<i>Macadamia integrifolia</i>)	Non-native	High-value nut production; well adapted to the region ⁵⁵⁷	Potential to self-propagate outside the project area; harvesting of nuts to minimize chance of self-propagation
Mango (<i>Mangifera indica</i>)	Non-native	High-value fruit production; well adapted to the region ⁵⁵⁸	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation

⁵⁵⁰ SANBI. 2003. *Pterocarpus angolensis*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/pterocarpus-angolensis>. Accessed on 23 September 2025.

⁵⁵¹ SANBI. 2019. *Dalbergia melanoxylon*. PlantZAfrica.com. Available at: <https://pza.sanbi.org/dalbergia-melanoxylon>. Accessed on 23 September 2025.

⁵⁵² Coleman A. 2025. South African avocado production: a success story. Farmer's Weekly. Available at: <https://www.farmersweekly.co.za/crops/fruit-and-nuts/south-african-avocado-production-a-success-story/>. Accessed on 13 August 2025.

⁵⁵³ Brodie L. n.d. Guava Production Fruit Farming in South Africa. Available at: <https://southafrica.co.za/guava-production.html>. Accessed on 15 September 2025.

⁵⁵⁴ Caxton Magazines. 2012. Understanding citrus – 1. The climatic, soil and water requirements of citrus trees. Farmer's Weekly. Available at: <https://www.farmersweekly.co.za/crops/field-crops/understanding-citrus-1/>. Accessed on 13 August 2025.

⁵⁵⁵ PlusNet. n.d. Key aspects of citrus fruit farming in South Africa. Available at: <https://www.plusnetgeotex.co.za/key-aspects-of-citrus-fruit-farming-in-south-africa/>. Accessed on 13 August 2025.

⁵⁵⁶ Agricultural Research Council. 2014. The Cultivation of Litchi. Available at: <https://www.arc.agric.za/arc-itsc/Pages/Litchi.aspx>. Accessed on 12 September 2025.

⁵⁵⁷ Global Africa Network. 2019. Macadamia nut production in Mpumalanga is expanding every year. Available at: <https://www.globalafricanetwork.com/company-news/macadamia-nut-production-in-mpumalanga-is-expanding-every-year/>. Accessed on 12 September 2025.

⁵⁵⁸ Van Rooyen L. 2013. Proven Mango success. Farmer's Weekly. Available at: <https://www.farmersweekly.co.za/crops/field-crops/proven-mango-success/>. Accessed on 13 August 2025.

Mulberry (<i>Morus spp.</i>)	Non-native	High-value fruit production; well adapted to the region ^{559,560}	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation
Orange (<i>Citrus sinensis</i>)	Non-native	High-value fruit production; well adapted to the region ⁵⁶¹	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation
Papaya (<i>Carica papaya</i>)	Non-native	High-value fruit production; well adapted to the region ⁵⁶²	Potential to self-propagate outside the project area; harvesting of fruit to minimize chance of self-propagation

5.2.6 Invasive Species (VCS, 3.19; CCB, B2.5)

No invasive species are included in the project tree planting activities. Selected species are either native or non-invasive fruit and nut trees that are already widely cultivated in the region and do not pose a risk of uncontrolled spread. A small number of invasive species occur within the project area as isolated individuals or minor populations. While the project does not implement a dedicated eradication program, measures are in place to prevent the spread of invasive species within areas where project activities are implemented. Governmental programs such as Working for Water⁵⁶³ and Working on Fire⁵⁶⁴ are active in the region and focus on invasive species control. The table below lists invasive species recorded in the project area and describes the measures applied to prevent their spread or continued presence.

Existing invasive species	Mitigation measures to prevent the spread or continued existence of invasive species
<i>Acacia mearnsii</i>	The spread of these species within the project area will be prevented by the removal of any seedlings sprouting where project activities have been implemented.
<i>Datura stramonium</i>	
<i>Eucalyptus spp.</i>	
<i>Eupatorium macrocephalum</i>	
<i>Pinus spp.</i>	

5.2.7 GMO Exclusion (CCB, B2.7)

Genetically modified organisms (GMOs) will not be used for any activities that contribute to greenhouse gas emission reductions or carbon dioxide removals.

⁵⁵⁹ Field observations in 2025.

⁵⁶⁰ Kriel G. n.d. Mulberries Fruit Farming in South Africa. Available at: <https://southafrica.co.za/mulberries.html>. Accessed on 15 September 2025.

⁵⁶¹ United States Department of Agriculture. 2023. Citrus Annual. South Africa – Republic of. Retrieved from: https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Citrus%20Annual_Pretoria_South%20Africa%20-%20Republic%20of_SF2023-0047.pdf

⁵⁶² Botha L. 2021. Growing papayas: Easy to produce, tricky to market. Farmer’s Weekly. Available at: <https://www.farmersweekly.co.za/crops/fruit-and-nuts/growing-papayas-easy-to-produce-tricky-to-market/>. Accessed on 15 September 2025.

⁵⁶³ Working for Water. n.d. Available at: <https://www.dffe.gov.za/working-water-wfw-programme>. Accessed on 15 September 2025.

⁵⁶⁴ Working on Fire. n.d. Available at: <https://workingonfire.org/>. Accessed on 15 September 2025.

5.2.8 Inputs Justification (VCS, 3.19; CCB, B2.8)

No pesticides or biological control agents will be applied as part of project activities. Fertilizer use is limited to small amounts of nitrogen fertilizer during seedling propagation, which is considered negligible. Any fertilizer or pesticide applied independently by surrounding communities will be monitored in accordance with the project’s safeguards, with fertilizer emissions assessed in accordance with Appendix 2 of VM0047 v1.1⁵⁶⁵, where deemed substantial.

Name	Nitrogen fertilizer
Justification of use	Nitrogen fertilizer is applied in small amounts during seedling propagation to ensure healthy establishment.
Potential adverse effect	Potential adverse effects are minimal. The inputs are negligible and limited to the nursery stage and are not expected to affect the environment or communities.

5.2.9 Waste Products (VCS, 3.19; CCB, B2.9)

Waste products arising from project activities will be identified and classified at the point of generation in nurseries, during site preparation and through maintenance. Waste will be broadly categorized into organic and inorganic material. Organic material will, wherever possible, be retained on site and used beneficially, for example as mulch, compost or ground cover. Measures will be taken to minimize inorganic waste across all project activities. Where such waste is generated, it will be collected and either reused in subsequent project cycles or recycled through appropriate channels. All waste handling forms part of the Adaptive Management Plan (Annex 2) and will be periodically reviewed and adjusted to ensure that classification and management practices remain appropriate and are updated as improved options become available.

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (CCB, B3.1) and Mitigation Measures (CCB, B3.2)

The project activities – which involve tree planting in residential areas and on croplands using non-GMO, non-invasive species – are not expected to result in negative offsite biodiversity impacts. In the unlikely event that offsite impacts are reported or observed, relevant adaptive management measures (see Annex 2, Adaptive Management Plan impacts) will be implemented to mitigate such impacts effectively.

Negative offsite impact	Mitigation measure(s)
No offsite biodiversity impacts have been identified	Not applicable

5.3.2 Net Offsite Biodiversity Benefits (VCS, 3.19; CCB, B3.3)

As stated in Section 5.3.1, no negative offsite biodiversity impacts are anticipated in response to the project activities and no unmitigated impacts outside the project zone are likely to occur. Within the

⁵⁶⁵ Verra. 2025. VCS Methodology. VM0047 Version 1.1. Retrieved from: https://verra.org/wp-content/uploads/2025/05/VM0047-v1.1_Final.pdf

project zone, the project activities are expected to deliver positive biodiversity outcomes, including improved ecological connectivity, restoration of native flora and strengthened ecosystem resilience (see Section 5.2). In addition, it is possible that some of these benefits will extend beyond the project boundary, for example, through increased tree cover and the reintroduction of native species that support pollinators, birds and small mammals. When considered together, the absence of anticipated offsite impacts and the presence of onsite biodiversity gains demonstrate that the overall net effect of the project activities on biodiversity is positive.

5.4 Biodiversity Impact Monitoring

5.4.1 Biodiversity Monitoring Plan (CCB, B4.1, B4.2, GL1.4, GL3.4)

The biodiversity monitoring plan defines the methods for collecting, analyzing and interpreting data to assess the project's contributions to biodiversity. The parameters measured are aligned with the biodiversity objectives defined in Section 5.2: i) enhancing ecological connectivity; and ii) increasing the presence of native flora within the project zone. Baseline assessments, using the following protocols, will be conducted before the start of the project and monitored throughout the project lifetime.

Ecological Connectivity

The project is designed to increase tree canopy cover — by planting native trees as well as non-native fruit and nut trees — and to reduce the spatial separation between tree canopies, thereby creating opportunities for improved habitat continuity. Tree canopy area (m²) will be measured for all planted individuals, in alignment with the census-based monitoring approach. For each tree, two perpendicular crown diameters will be measured in the field, the mean of which will be used as the effective crown radius⁵⁶⁶. Canopy area will then be estimated using the circle area formula ($A = \pi r^2$), providing a standardized approximation of canopy size. A Geographic Information System (GIS)-based program — such as QGIS⁵⁶⁷ — will be used to calculate canopy cover (%) through the digitization of tree canopy polygons. The total canopy area will be expressed as a percentage of the total project area, using high-resolution imagery validated through ground-truthing. Connectivity will be assessed from digitized canopy polygons, with metrics including: i) Expected Mean Distance (average distance between tree canopies); ii) Nearest Neighbor Index (NNI) (degree of clustering versus dispersion); and iii) Z-score of the NNI (statistical significance of spatial distribution). Together, these metrics provide a proxy for ecological connectivity by indicating whether planted trees form clusters that reduce fragmentation and improve ecological linkages.

Native Flora

Project activities are expected to increase native tree species within the landscape. The number of native species planted will be monitored through the project's planting register, which records species, planting date and location. Canopy cover of native species (%) will be monitored through field-based canopy measurements of tagged native individuals. Remote sensing (RS) methods cannot reliably distinguish between native and non-native species at this scale; therefore, field data are necessary⁵⁶⁸. The canopy area of native species will be expressed as a proportion of total project canopy cover.

Exemplar

Figure 20 illustrates how canopy-based indicators will be monitored across the project lifetime using satellite imagery. The figure compares two suburban areas within the project zone: Panel A represents baseline conditions with low tree cover, while Panel B represents a potential future scenario with greater canopy cover resulting from project activities. Tree canopies are delineated as green polygons. In Panel A,

⁵⁶⁶ Conti G, Enrico L, Casanoves F & Díaz S. 2013. Shrub biomass estimation in the semiarid Chaco forest: a contribution to the quantification of an underrated carbon stock. *Annals of Forest Science*. 70:515–524.

⁵⁶⁷ QGIS Development Team. 2024. QGIS Geographic Information System. Open Source Geospatial Foundation Project. <http://qgis.org>.

⁵⁶⁸ Asner GP, Jones MO, Martin RE, Knapp DE and Hughes RF. 2008. Remote sensing of native and invasive species in Hawaiian forests. *Remote Sensing of Environment*, 112, 5, 1912–1926.

canopy cover is 0.3 ha (6% of the area), whereas Panel B shows 1.2 ha (26% of the area). The Expected Mean Distance between tree canopies is 17.2 m in Panel A and 20.7 m in Panel B – indicating that the baseline condition is characterized by smaller, more isolated patches, while the potential future scenario is characterized by larger, more continuous canopy cover. The NNI decreases from 1.39 (A) to 1.08 (B) and the corresponding NNI Z-scores increases from 0.8 to 4.6, suggesting that tree distribution in the future scenario will likely be more spatially clustered and less fragmented. These metrics demonstrate how project activities are expected to shift canopy structure from sparse and patchy towards more connected and evenly distributed tree cover.

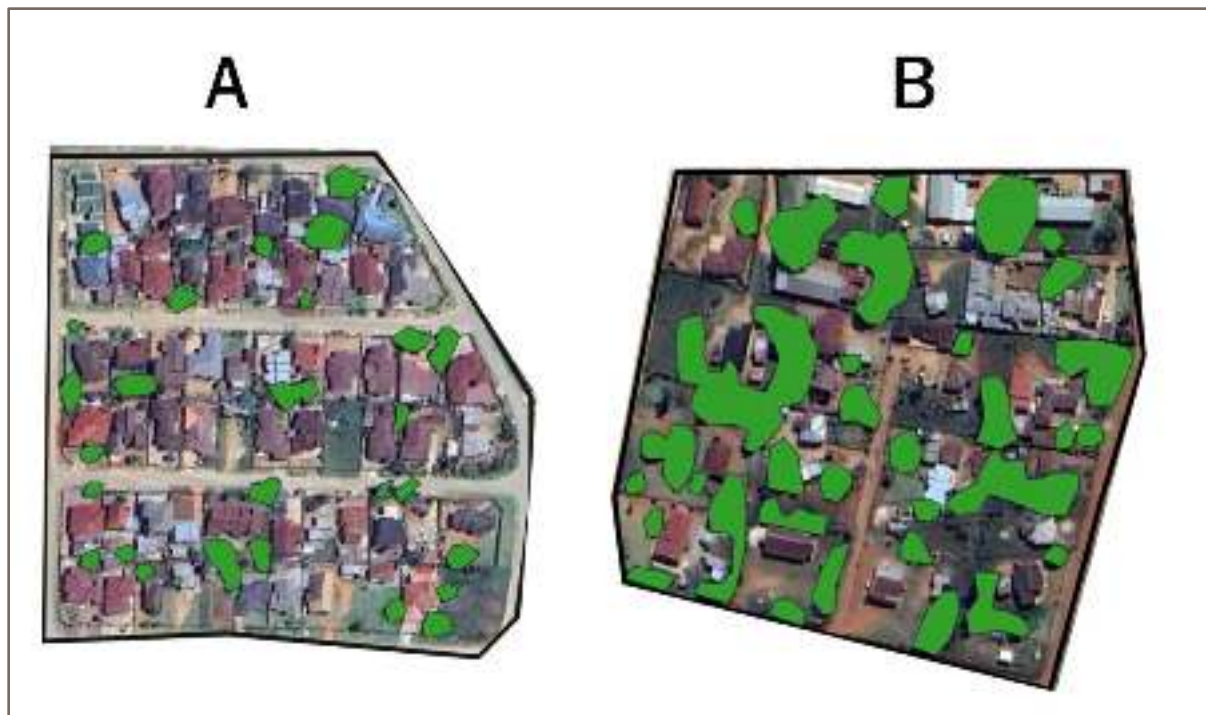


Figure 20. Comparison of baseline and anticipated future canopy cover in the project area. “A” represents the baseline conditions while “B” represents the desired future scenario conditions.

The table below sets out the indicators that will be monitored to track progress towards the project’s biodiversity objectives. The indicators are grouped by category and linked to specific outcomes, with associated data collection methods and monitoring frequencies.

Category	Outcome	Indicator	Data collection method	Frequency
Ecological Connectivity	Increased tree canopy cover	<ul style="list-style-type: none"> Tree canopy area (m²) Tree canopy area (%) 	<ul style="list-style-type: none"> Field measurements Remote-sensing methods 	Baseline and then every five years
	Decreased distance between patches	<ul style="list-style-type: none"> Expected mean distance (m) Nearest Neighbor index Z-score 	<ul style="list-style-type: none"> Remote-sensing methods using QGIS Landscape Ecology Statistics (LEcoS) package 	Baseline and then every five years
Native Flora		<ul style="list-style-type: none"> Number of native species planted 	<ul style="list-style-type: none"> Project register 	Annually

Increased presence of native flora	<ul style="list-style-type: none"> Increased canopy proportion of native species (%) 	<ul style="list-style-type: none"> Field measurements Remote-sensing methods 	Baseline and then every five years
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High Conservation Values (HCV) Monitoring

The HCV areas within the project zone are located in natural ecosystems adjacent to built-up environments, but outside formally protected areas (see Section 5.1.2). These include areas of Granite Lowveld and Legogote Sour Bushveld – which correspond to HCV 2 and 3 – that support populations of RTE species (HCV 1). At the outset of the project, the extent of these natural corridors will be quantified using remote sensing. RTE floral species – due to their relative ease of monitoring compared to faunal species – will be identified by project botanists, geo-referenced and mapped within these corridors. The persistence of these species will be assessed annually throughout the project lifetime. The spatial extent of the natural corridors and the persistence of RTE species will be monitored regularly. Any disturbances or pressures on these areas, such as fires, land clearing or other anthropogenic impacts, will be recorded and monitored to assess trends and inform adaptive management actions. Disturbances to HCV corridors will be recorded by community members associated with the project, with the nature of the disturbance recorded and photographs of vegetation loss taken.

Parameter or indicator	Frequency of monitoring	Method or source	Quality assurance and control (QA/QC)
Tree canopy area (m ² per individual)	Baseline and every 5 years	Field measurement of crown diameters; canopy area estimated using formula ($A = \pi r^2$)	Independent re-measurement of subset of plots; calibration of instruments; internal technical review
Tree canopy area (% of project zone)	Baseline and every 5 years	GIS digitization of canopy polygons; RS with ground-truthing	Consistent RS parameters across periods; internal verification of spatial outputs
Expected Mean Distance (m between canopies)	Baseline and every 5 years	GIS connectivity metrics (LEcoS package)	Methodological consistency check; subset recalculation by an independent analyst
Nearest Neighbor Index	Baseline and every 5 years	GIS connectivity metrics	Same as above
Z-score (spatial significance)	Baseline and every 5 years	GIS connectivity metrics	Same as above
Number of native species planted	Annually	Project planting register (species, date, location)	Internal data entry checks; cross-validation with field audit
Canopy proportion of native species (%)	Baseline and every 5 years	Field measurement of tagged native trees; canopy area	Subset re-measurement; consistent RS interpretation parameters

		calculations; RS where applicable	
Extent of natural corridors (Granite Lowveld, Legogote Sour Bushveld)	Annually	RS analysis; GIS mapping, annual ground truthing	Cross-comparison with historical baseline; internal review
Presence/persistence of RTE floral species	Annually	Field mapping; geo-referencing and database records	Independent verification of the subset; internal consistency checks
Disturbances/pressures (fire, land clearing, anthropogenic impacts)	Annually	Field observation logs; RS detection of fire scars or land clearing	Cross-check with Moderate Resolution Imaging Spectroradiometer/other RS datasets; field validation
Proportion of data independently re-measured (field and RS)	Each monitoring cycle	QA/QC protocol implementation	QA/QC team to check the consistency of results
Instrument calibration records	Each monitoring cycle	Calibration logs	Verification against standard protocols
Independent verification checks completed	Each monitoring cycle	External or internal reviewer	QA/QC review forms
Internal technical review of datasets	Each monitoring cycle	Specialist review prior to reporting	Documented sign-off procedure

QA/QC Procedures

The biodiversity QA/QC framework aligns with the climate and community monitoring QA/QC system (see Section 3.3.2). These QA/QC systems use independent re-measurement of data subsets, regular instrument calibration and internal technical reviews to ensure accuracy and comparability across monitoring periods. The climate QA/QC system applies these procedures to biomass, soil, crop and climate indicators, while the biodiversity plan adapts them to canopy metrics, remote-sensing analyses, RTE species mapping and disturbance monitoring. Data from monitoring systems are stored in the same secure project database with complete metadata, undergo annual internal audits for integrity and anomaly detection, and are subject to the project-wide non-conformance register, ensuring integrated QA/QC across all parameters.

The biodiversity monitoring plan follows standardized QA/QC protocols to ensure data integrity, consistency and reliability. All activities — from data collection to analysis and reporting — include independent re-measurement of field and remote-sensing data subsets and regular instrument calibration. Remote-sensing analyses use consistent parameters across monitoring periods to ensure temporal comparability. Raw measurements and spatial data are stored in a secure project database with clear metadata records. Independent verification of data subsets occurs at each monitoring interval to check accuracy and

methodological consistency. Before reporting, all datasets undergo internal review by technical specialists to confirm correct indicator calculation and alignment with predefined monitoring objectives.

5.4.2 Biodiversity Monitoring Plan Dissemination (CCB, B4.3)

The monitoring plan is made publicly accessible through its inclusion in this Project Design Document (PDD) and any subsequent updates, which are uploaded to the Verra registry. Monitoring results are compiled in reports prepared before each verification event and are similarly uploaded to the registry in accordance with Verified Carbon Standard requirements. Summaries of the monitoring plan and monitoring reports are prepared in non-technical language, translated into the predominant local languages and disseminated through both electronic and printed formats throughout the crediting period. Community dissemination will occur during stakeholder engagement events held throughout the crediting period. At these meetings, project staff will present the monitoring plan and results and provide printed summaries to facilitate understanding and participation.

As described in Section 3.4.2, copies of these summaries will also be provided to traditional councils, local administration, non-governmental organization offices and schools, and summary information will be broadcast through local radio channels, shared via the WhatsApp chatbot platform and published on the project website. This combination of dissemination pathways ensures transparency for external audiences, via the Verra registry and project website, and broad accessibility for local communities through multiple, locally appropriate communication channels.

5.5 Optional Criterion: Exceptional Biodiversity Benefits

This section does not apply to the current version of the PDD, as the Project Proponent is not seeking validation with Biodiversity Gold Level at this time. Should this change in the future, the section will be developed and included accordingly.

Projects seeking to qualify for the Biodiversity Gold Level in the CCB Standards must demonstrate that they contribute to the conservation of a Key Biodiversity Area (KBA) through the protection or recovery of globally threatened species. This project includes the propagation and planting of *Warburgia salutaris* (pepper-bark tree), which is classified as Endangered. By cultivating this species, the project is expected to reduce harvesting pressure on remaining wild populations, thereby supporting their recovery and long-term conservation. This provides a clear pathway toward achieving the Biodiversity Gold Level criterion. However, the propagation and planting of *W. salutaris* should be aligned with existing conservation and restoration initiatives, such as those led by SANParks, to ensure genetic integrity and complement ongoing recovery efforts. In addition, native populations of the species should be monitored to evaluate the effects of project interventions on wild stands. This monitoring component is not currently included in the PDD, as the potential causal link between project-led planting and impacts on native populations requires further assessment before being formalized within the project design.

APPENDIX 1: STAKEHOLDER DESCRIPTION TABLE

Stakeholder group	Sub-group	Description	Level of interest in the Project	Level of influence over the Project
Communities	<ul style="list-style-type: none"> • Setlehare; • Moreipuso; • Mnisi; • Moletele; • Thabakolo; • Jongilanga; • Malele; • Amashangana; • Hoxani; and • Mathibela 	Local Communities within each traditional authority (listed) who rely on the project area for livelihoods, culture and well-being.	<p>High interest</p> <p>Community members will gain access to trees for food and income generation derived from fruit and nut production. Additionally, they will receive training in agroforestry, water conservation and soil restoration. Households may receive fencing, vegetable seeds and nursery inputs. Their contributions include making land available for planting, maintaining tree health and participating in monitoring and training and activities.</p>	<p>High influence</p> <p>Communities will influence project implementation through land access, labor contributions and participation in monitoring, governance and benefit-sharing.</p>
	Tree custodians	Individuals, households or community groups directly involved in project activities by planting and maintaining project trees.	<p>High interest</p> <p>Project participants are primary beneficiaries of agroforestry inputs, training and livelihood opportunities generated through the project.</p>	<p>High influence</p> <p>Participants influence project performance through tree survival, agroforestry practices and demonstration of project benefits to others.</p>
Community group	Local Traditional Authorities	Traditional leaders of Local Communities.	<p>High interest</p> <p>Recognized governance bodies established by the Traditional and Khoi-San Leadership Act⁵⁶⁹ who are expected to benefit from improved land management outcomes and community resilience. Contributions include endorsing project activities, resolving disputes and supporting inclusive community participation.</p>	<p>High influence</p> <p>Traditional leaders exert high influence as recognized governance structures. Their endorsement legitimizes activities, while their authority can resolve conflicts or constrain participation.</p>

⁵⁶⁹ Republic of South Africa. 2019. Traditional and Khoi-San Leadership Act (No. 3 of 2019). Retrieved from: [//www.gov.za/sites/default/files/gcis_document/201911/4286528-11act3of2019tradkhoisanleadership.pdf](http://www.gov.za/sites/default/files/gcis_document/201911/4286528-11act3of2019tradkhoisanleadership.pdf).

Communal Property Associations (CPAs)	Facilitate community governance and land use in certain areas.	High interest CPAs are expected to benefit from improved land management outcomes and community resilience. Contributions include endorsing project activities, resolving disputes and supporting inclusive community participation	High influence CPAs have high influence by controlling land allocation and formalizing land tenure. Their cooperation enables secure landholder agreements and equitable benefit-sharing.
Smallholder farmers	Local farmers cultivating 1–50 hectares, participating in project activities	High interest Farmers are expected to benefit through increased yields and access to agroforestry inputs. Agroforestry is also expected to improve soil fertility and water retention. Contributions include voluntary participation in planting, land preparation and knowledge sharing.	Medium influence Farmers influence agroforestry outcomes through the adoption of practices, land preparation and knowledge sharing.
Nursery owners and operators	Provide the seedlings required for tree planting and agroforestry activities.	High interest Nursery owners and operators are expected to benefit through increased demand for seedlings and steady income opportunities. Project activities provide training in propagation, pest management and record-keeping, which strengthens operations and reduces losses. Contributions include supplying quality seedlings, maintaining propagation facilities and sharing technical knowledge with community members.	High influence Contributions include supplying quality seedlings, maintaining propagation facilities and sharing technical knowledge with community members.
Women, youths and marginalized groups.	Women, youths and marginalized groups participating in project activities.	High interest These demographic subsets are expected to benefit from targeted inclusion in livelihood programs, nursery operations and training. Contributions include labor, traditional knowledge and engagement in participatory planning processes to facilitate inclusive community ownership of restoration outcomes.	Medium influence These groups influence inclusivity and long-term sustainability through labor, innovation and traditional knowledge.
Community Liaisons	Facilitate two-way communication between the Project Proponent and partners and support inclusive	High interest Community liaisons contribute by coordinating project activities with Local Communities, relaying project information and managing stakeholder feedback. Benefits include capacity-	Medium influence Liaisons influence project reach with communication, trust and responsiveness. They mediate between project staff and communities, affecting perceptions and participation

		outreach and ongoing engagement.	building opportunities and participation in grievance redress and monitoring activities.	
Other stakeholders	Farmer Empowerment, Agriculture Development & Transformation (FEADT-SA)	Forms partnerships between farmers to promote sustainable agriculture and community development.	High interest FEADT-SA, as a project partner, contributes expertise in training, farmer support and cooperative development. Benefits include impact delivery, demonstration of community outcomes and co-implementation roles.	Medium influence Influences farming systems and cooperative structures by delivering training, extension and institutional support. Its technical role affects the implementation of sustainable agricultural practices.
	Londolozi Ripple Fund	Provides seed capital and technical support for early-stage farming pilots.	High interest As a conservation partner, the project activities contribute to the Londolozi Ripple Fund's objectives by increasing innovation and skills development within restoration practices in the area. Contributions include tree propagation support, regional network and alignment with community-focused conservation.	Medium influence Influences early-stage pilots and value-chain development by providing finance and conservation alignment.
	Sabi Sand Pfunanani Trust	An association-based organization supporting sustainable development and conservation in the Sabie-Sand region.	High interest A community-based organization promoting sustainable development, biodiversity conservation and community upliftment in the Sabi Sand region. The project activities contribute to the Sabi Sand Pfunanani Trust's objectives of landscape restoration, rural empowerment and improved conservation in the area. The Trust contributes local institutional capacity, community development expertise and access to the Sabi Sand NPO Forum.	Medium influence The Trust supports the integration of smallholder farmer support, FPIC-compliant governance and conservation-compatible rural development at scale.
	Oversight Committee	Oversee the project's strategic direction, consisting of leaders in finance, conservation and development.	High interest Acts as the project's governance body, the Oversight Committee will guide implementation and accountability. Benefits include receiving carbon finance and achieving community impact objectives. Contributions include oversight of compliance, stakeholder engagement and benefit-sharing integrity.	High influence Holds high influence as the governance body ensuring accountability, compliance and alignment with strategic objectives.

Sand Catchment Pty Ltd.	Primary implementing agent and registered Project Proponent. Manages project coordination and carbon finance to support reforestation and green economy activities.	<p>High interest</p> <p>Leads project development, project registration and implementation. Benefits include revenue from Verified Carbon Units (VCUs), strategic positioning in the carbon market and delivery of development objectives on a scale. Contributions include co-managing operational delivery, coordinating partners, securing funding and ensuring compliance with VCS and CCB standards.</p>	<p>High influence</p> <p>Sand Catchment Pty Ltd holds primary responsibility for project governance, operational delivery and coordination among implementing partners. The company manages carbon finance, ensures compliance with VCS and CCB standards and oversees monitoring and reporting systems. Its decisions guide project direction, resource allocation and stakeholder coordination. As the registered Project Proponent, Sand Catchment Pty Ltd's oversight determines technical quality, financial accountability and long-term sustainability of reforestation and green-economy activities.</p>
C4 EcoSolutions (Pty) Ltd.	Provides technical expertise on the project design, MRV system development and is an implementing partner.	<p>High interest</p> <p>C4 EcoSolutions (Pty) Ltd. act as the technical team which delivers the project design and implementation mandates. Contributions include PDD authorship, risk assessments, monitoring and technical reporting for validation.</p>	<p>High influence</p> <p>Holds high influence through technical design, risk assessment and reporting. Its expertise determines project credibility and validation.</p>
The Ten Trees Project	Implement large-scale tree planting initiatives and community-based agroforestry programs.	<p>High interest</p> <p>As an implementing partner, the Ten Trees Project strengthens project outreach by coordinating distribution networks and demonstrating scalable reforestation models across rural communities. They are expected to have a high influence on project activities through raising awareness on project activities, providing training and capacity building and supporting planting logistics.</p>	<p>High influence</p> <p>Exerts high influence through raising awareness on project activities and supporting planting logistics.</p>
Bushbuckridge Local Municipality	The local municipality where initial PAIs are located. Facilitates institutional support and provides guidance on aligning project activities with	<p>Medium interest</p> <p>The municipality benefits through improved water security, land rehabilitation and alignment with local development goals. Furthermore, the project activities will increase climate adaptation, disaster risk reduction and sustainable livelihoods within the area. The municipality contributes by endorsing project</p>	<p>High influence</p> <p>The municipality contributes by endorsing project alignment with Integrated Development Plans (IDPs) and linking the project to infrastructure and extension services.</p>

		municipal conservation and development objectives.	alignment with Integrated Development Plans (IDPs) and local conservation initiatives.	
	Ehlanzeni District Municipality	Provides regional support for integrated development.	Medium interest The district municipality will benefit from regional economic upliftment, improved water catchment conditions and support for district-wide land restoration. Contributions include facilitating strategic alignment with regional conservation goals.	High influence Its role ensures alignment with broader governance. Contributions include facilitating strategic alignment with regional goals.
	Lotus Impact Foundation	The foundation offers technical and impact funding to innovate social development solutions.	High interest The Lotus Impact Foundation provides supporting governance structures and training initiatives. Through its role, the Lotus Impact Foundation strengthens long-term community impact and the project's ability to attract capital.	Medium influence Influences project development by supplying catalytic funds and informing equity-centred governance. Through its role, the Lotus Impact Foundation strengthens long-term impact integrity and the project's ability to attract mission-aligned capital.
	Good Work Foundation (GWF)	An NGO providing support in rural education, digital literacy and capacity building.	High interest The Good Work Foundation strengthens community capacity, supports inclusive technology use and promotes long-term knowledge systems within the project. As a project partner, GWF will integrate environmental education into rural development and increase visibility for its Digital Learning Centres across the project area. It delivers project participant training, digital skills development and environmental literacy through its Hazyview campus and satellite centers in the project area.	Medium influence Influences community skills and education pathways. Additionally, GWF will facilitate training and ensure the project's capacity-building objectives are met.
	Mpumalanga Green Cluster Agency	Promotes sustainable economic initiatives in Mpumalanga.	Medium interest The Mpumalanga Green Cluster Agency promotes sustainable industrial development and innovation in the province. Through its involvement, the agency gains a model for environmental employment and landscape restoration aligned with provincial economic	Medium influence The agency will support the project activities by connecting stakeholders, identifying investment opportunities and aligning natural capital activities with broader regional development strategies.

			goals. The agency will support the project activities by connecting stakeholders, identifying investment opportunities and aligning with broader regional development strategies.	
	Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA)	Governmental partner supporting policy alignment.	<p>Medium interest</p> <p>The DARDLEA promotes inclusive agricultural sector growth and land access. The department will gain from improved land use on communal and restituted land, increased smallholder productivity and demonstration of policy-aligned models. DARDLEA will enable landholder participation, establish regional nursery hubs in accordance with its vision, support PTO and CPA recognition and integrating project activities into extension and land reform programs.</p>	<p>Medium influence</p> <p>DARDLEA will collaborate on integrating project activities within provincial land reform and extension programmes. It will provide technical support for landholder training, assist with PTO and CPA recognition and facilitate linkages between community nurseries and provincial agroforestry initiatives. Its involvement strengthens policy alignment, improves coordination across land and agriculture departments and promotes sustainability of project outcomes through institutional integration.</p>
	Department of Forestry, Fisheries and Environment (DFFE)	Leads national tree-planting and climate resilience programs.	<p>Medium interest</p> <p>The Department of Forestry, Fisheries and the Environment is responsible for coordinating South Africa’s environmental, climate and biodiversity policy. Project activities will advance DFFE priorities by delivering verified emission reductions and measurable ecosystem restoration. DFFE provides technical input, ensures policy alignment and facilitates registration and recognition in accordance with national climate and biodiversity frameworks.</p>	<p>Medium influence</p> <p>DFFE provides technical input, ensures policy alignment and facilitates registration and recognition within national climate and biodiversity frameworks.</p>
	SANParks	The national authority responsible for managing protected areas and biodiversity within its mandate, including the Kruger National Park.	<p>High interest</p> <p>The project activities contribute to SANParks’ Vision 2040 strategy, which emphasizes ecological restoration, catchment protection and community partnerships as part of its Mega Living Landscapes. SANParks provides technical expertise on monitoring and biodiversity baselines and coordinates with adjacent protected areas. Its endorsement strengthens institutional alignment and investor confidence.</p>	<p>High influence</p> <p>SANParks ‘will supply tree seedlings and technical support for restoration and agroforestry activities. It will also provide expertise on biodiversity monitoring, ecosystem restoration and coordination with adjacent protected areas. SANParks’ endorsement reinforces alignment with national conservation priorities and increases investor confidence through its established governance and environmental management systems.</p>

Kruger to Canyons Biosphere (K2C)	Implements integrated conservation and development projects.	Medium interest The Kruger to Canyons Biosphere is a regional coordination platform linking conservation and development across a UNESCO-recognized landscape. This project creates wildlife corridors within its protected areas and supports sustainable livelihoods adjacent to them. K2C contributes through stakeholder coordination, integration of ecological corridors and support for monitoring restoration and biodiversity outcomes	Medium influence K2C contributes through stakeholder coordination, integration of ecological corridors and support for monitoring restoration and biodiversity outcomes.
Project Biome	Promotes regenerative food systems and capacity building across food sectors.	Medium interest Project Biome brings ecological expertise to the design of biodiversity-friendly restoration. Its involvement with the project provides a platform to apply and validate sustainable land use models on scale. Contributions include, support for habitat restoration strategies and guidance on integrating biodiversity indicators into project monitoring.	Medium influence Contributions include baseline ecological surveys, support for habitat restoration strategies and guidance on integrating biodiversity indicators into project monitoring.
UVU Africa	Strengthens innovation systems and sustainable business capabilities in farming communities.	Medium interest UVU Africa is a development platform focused on innovation, skills and enterprise support in emerging markets. Engagement in the project allows UVU Africa to extend its digital and entrepreneurial training into a rural, restoration-focused context. The organization provides capacity-building programs, digital learning platforms and support for young agricultural entrepreneurs entering the economy.	Low influence The organization provides capacity-building programmes, digital learning platforms and support for young agricultural entrepreneurs entering the economy.
Abundant Village	Develop sustainable villages delivering essential services to build community resilience.	Medium interest Abundant Village is a regenerative development partner promoting ecologically informed livelihoods and village-based enterprise. Through the project, it contributes permaculture expertise, training in integrated land use systems and co-design of agroecological demonstration sites. Its involvement supports local income generation while strengthening	Low influence Through the project, it contributes permaculture expertise, training in integrated land use systems and co-design of agroecological demonstration sites. Its involvement supports local income generation while reinforcing cultural knowledge and long-term ecosystem stewardship.

			cultural knowledge and long-term ecosystem stewardship.	
Global Water Partnership South Africa (GWPSA)	Supports climate-resilient water resource management.	Medium interest GWPSA benefits from collaboration on water security and catchment restoration. The project activities support GWPSA's mandate to promote integrated water resources management (IWRM) by increasing water infiltration and retention, improving riparian health and ensuring climate-resilient water use across the Sabie and Sand river catchments. Contributions include expertise to align with their IWRM framework to improve land and water use to support social equity, ecosystem health and resilient livelihoods.	Low influence Contributions include training in agroecological practices, co-design of demonstration sites and facilitation of sustainable production systems that align with IWRM, a framework that coordinates land and water use to support social equity, ecosystem health and resilient livelihoods. This approach promotes long-term stewardship and cultural relevance within restoration activities.	
Root and Ground (Pty) Ltd.	Specializes in agricultural value chain consulting and technology for tree propagation.	Medium interest Root and Ground (Pty) Ltd. provides technical support across the agroforestry value chain, from seedling propagation to planting systems. Participation in the project enables the scaled deployment of propagation technology and integrated planting logistics. The company contributes nursery management, supply chain coordination and agronomic guidance tailored to restoration conditions.	Low influence The company contributes nursery management, supply chain coordination and agronomic guidance tailored to restoration conditions.	
Agricultural Research Council (ARC)	Facilitate research in agricultural innovation.	Low interest The Agricultural Research Council is South Africa's leading public agricultural research and development institution. It provides evidence-based decision-making across species selection, soil management and farmer support. ARC contributes applied research, field trials and advisory support to optimize planting systems for climate resilience and productivity.	Low influence ARC contributes applied research, field trials and advisory support to optimize planting systems for climate resilience and productivity.	
South African National Biodiversity Institute (SANBI)	Supports biodiversity management.	Low interest The South African National Biodiversity Institute leads national programs in ecosystem monitoring, biodiversity assessment and	Low influence Contributes applied research and expertise on biodiversity and monitoring.	

			<p>conservation planning. The project advances SANBI's mandate by restoring degraded landscapes, supporting species recovery and enhancing ecological connectivity in priority areas. SANBI contributes baseline biodiversity data, alignment with national and global conservation targets and technical input on incorporating biodiversity co-benefits into carbon verification and long-term reporting systems.</p>	
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APPENDIX 2: PROJECT ACTIVITIES AND THEORY OF CHANGE TABLE

Activity description	Expected climate, community, and/or biodiversity			Relevance to the project's objectives
	Outputs (short term)	Outcomes (medium term)	Impacts (long term)	
Activity 1. Agroforestry in croplands and residential areas	2.5 million trees planted and maintained across 40,000 ha of agroforestry landscapes with planting densities of 50 trees/ha in residential areas and 100 trees/ha in croplands	<ul style="list-style-type: none"> Improved vegetation cover, soil fertility and water retention Additional revenue streams for local communities 	<ul style="list-style-type: none"> Sustained carbon sequestration and storage Restoration of ecosystem functions Enhanced habitat connectivity supporting pollinators, wildlife and overall biodiversity. 	<p>Climate: Contributes directly to carbon sequestration to mitigate climate change.</p> <p>Biodiversity: Restores ecological integrity and habitat connectivity.</p> <p>Community: Provides communities with fruit and agroforestry products, supporting livelihoods and food security.</p>
Activity 2. Capacity building for climate-smart land use and community empowerment	Farmers and households trained in: i) permaculture; ii) sustainable land management; iii) agroforestry techniques; iv) biodiversity conservation; v) climate adaptation; vi) financial literacy; and vii) sustainable agricultural practices	<ul style="list-style-type: none"> Increased community knowledge and application of climate-resilient land use practices Adoption of sustainable farming techniques 	<ul style="list-style-type: none"> Skilled and knowledgeable farmer base able to sustain climate-smart practices beyond project duration Increased resilience of farming systems to climate variability Empowerment of women and youth. 	<p>Climate: Sustains carbon benefits by ensuring the continued application of climate-smart land use.</p> <p>Biodiversity: Builds community ownership, reinforcing long-term protection of restored biodiversity.</p> <p>Community: Strengthens community well-being through empowerment, knowledge transfer and capacity to adapt.</p>
Activity 3. Development of value chains and benefit-sharing for climate-resilient livelihoods	Functional community nurseries, training in value-added product development, benefit-sharing mechanisms and processing of non-timber forest products	<ul style="list-style-type: none"> Diversified livelihoods with enhanced adaptive capacity and income Increased adoption of sustainable land use 	<ul style="list-style-type: none"> Stable and diversified income sources from carbon credits, agroforestry products and value-added products. Reduced dependence on unsustainable land use 	<p>Climate: Ensures the permanence of carbon sequestration by creating economic incentives to protect planted trees.</p> <p>Biodiversity: Aligns economic well-being with conservation, contributing to biodiversity enhancement.</p>

			<ul style="list-style-type: none"> • Long-term community investment in restored landscapes 	<p>Community: Strengthens community resilience and equity through inclusive benefit-sharing mechanisms.</p>
<p>Activity 4. Integration of digital tools and technology for MRV and market access</p>	<p>Mobile apps, dashboards and SaaS platforms deployed for training, monitoring, reporting, verification and market integration</p>	<ul style="list-style-type: none"> • Transparent and efficient MRV of climate, biodiversity and socio-economic benefits • Improved market access for farmers 	<ul style="list-style-type: none"> • Long-term credibility and permanence of carbon and biodiversity benefits • Sustained revenue and conservation incentives • Data-driven adaptive management 	<p>Climate: Provides evidence of carbon sequestration and climate benefits to maintain credibility in carbon markets.</p> <p>Biodiversity: Ensures monitoring of biodiversity outcomes and ecological integrity.</p> <p>Community: Enhances participation, market connectivity and economic opportunity through digital inclusion.</p>

APPENDIX 3: PROJECT RISKS TABLE

	Identified risk(s)	Potential impact of risk on stakeholders, ecosystem health, and biodiversity	Mitigation or preventative measure(s) taken
Natural and human induced risks to stakeholders' wellbeing	<ul style="list-style-type: none"> Over irrigating leading to water scarcity for other users Potential inequality or confusion around project benefits 	<ul style="list-style-type: none"> Community dissatisfaction due to water scarcity for their use Dissatisfaction with the benefits resulting in stakeholders withdrawing from the project 	<ul style="list-style-type: none"> Use of drought-tolerant and native species Participatory design Stakeholder Engagement and FPIC to ensure informed and voluntary participation
Risks to stakeholder participation	<ul style="list-style-type: none"> Stakeholder fatigue from too many meetings Poor communication leading to misinformation about the project Low engagement from women, youth, elders and marginalized groups 	<ul style="list-style-type: none"> Stakeholder disengagement, less willingness to engage and provide input, resulting in less effective implementation Misinformation may create confusion, unrealistic expectations, or conflict between groups, undermining consent and cooperation Exclusion of marginalized groups may lead to undermined consent and perpetuated inequality 	<ul style="list-style-type: none"> Focused outreach on community groups Disaggregated tracking of community groups Use of local languages and accessible formats for information dissemination Liaison-led engagement for all stakeholder consultations
Working conditions	Occupational risks from manual labor	Manual labor may cause injury or dissatisfaction if expectations are unclear	<ul style="list-style-type: none"> Work conditions compliant with national regulations Training in ergonomics and tool safety Induction briefings on rights and roles Employment contracts with agreed terms
Safety of women and girls	Gender-based harassment	Women may be exposed to harassment or exclusion in male-dominated environments	<ul style="list-style-type: none"> Focus-group consultations with women Grievance redress mechanism with anonymity. Project and partnership codes of conduct to prohibit harassment
Safety of minority and marginalized groups, including children	No risk identified	No risk identified	<ul style="list-style-type: none"> Rigorous safety measures in place and guidance and training provided for the use of any tools used for implementation

			<ul style="list-style-type: none"> Assess the cause of any injury and adapt the implementation procedures to prevent repeated injury where possible Gender- and age-sensitive recruitment practices to ensure equitable access to job opportunities Clear grievance and reporting mechanisms for incidents of exclusion or unsafe practices Conduct regular safety audits and adapt protocols based on community feedback
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	<ul style="list-style-type: none"> Plastic waste from polytops Local pollution from nurseries or tree custodians using fertilizers Risk of pesticide application 	<ul style="list-style-type: none"> Plastic waste accumulating in the environment posing harm to animals Fertilizers contaminate water sources, reducing water quality and affecting human and livestock health Pesticides having non-target impacts on pollinators, birds and soil organisms, undermining ecosystem health 	<ul style="list-style-type: none"> Reuse and recycling of polytops The project activities will not use and synthetic agrochemicals and will educate all tree custodians on alternatives to fertilizers Pests managed manually or organically
Discrimination	Discriminatory practices in recruitment or participation	Risk of exclusion based on gender, age, disability or socio-economic status	<ul style="list-style-type: none"> Implementing partners will enforce anti-discrimination policies Inclusive recruitment and participatory planning Monitoring of equity indicators
Sexual harassment	Sexual harassment in the workplace or during consultations	Harassment could affect safety and retention of women workers or participants	<ul style="list-style-type: none"> All partners have formal anti-harassment policies and disciplinary procedures Workers receive induction on respectful conduct Grievance redress mechanism with anonymity
Equal pay for equal work	Pay inequities between men and women.	Potential for gender pay disparity or unequal terms for similar work	<ul style="list-style-type: none"> Equal pay principles will be upheld Wages benchmarked against statutory requirements Monitoring through partner employment registers
Gender equity in labor and work	Gender inequity in recruitment, training and roles	Women may be under-represented in recruitment, training or higher-level positions	<ul style="list-style-type: none"> Gender targets for employment Women-led training

			<ul style="list-style-type: none"> • Flexible scheduling during planting or nursery phases
Forced labor⁵⁷⁰	Forced or coerced participation in the project.	Individuals may be compelled to participate due to unclear consent or social pressure	<ul style="list-style-type: none"> • Participation is fully voluntary • FPIC obtained at the individual level with written land-use agreements • Grievance redress mechanisms • Work conditions will comply with national labor laws
Child labor	Child labor in planting or nursery work	Risk of youth below the age of 18 participating in fieldwork or nurseries	<ul style="list-style-type: none"> • Age verification at recruitment • Only individuals >18 years of age will be employed in operational roles
Human trafficking	No risk identified	No risk identified	<ul style="list-style-type: none"> • No risk identified during FPIC or scoping • All recruitment will follow verified processes with identification checks and contracts
Recognition of, respect of, and promotion of the rights to IPs, LCs and customary rights holders	Risk of insufficient recognition of customary governance structures, traditional ecological knowledge and preservation of HCVs.	Customary institutions may be undermined, traditional knowledge ignored, or High Conservation Values (HCVs) degraded, leading to community mistrust, loss of cultural heritage and reputational risks.	<ul style="list-style-type: none"> • FPIC with traditional leaders and households • Integration of traditional ecological knowledge into planning and monitoring • Mapping and protection of HCVs with community participation • Culturally appropriate communication and grievance redress mechanisms
Preserving and protecting cultural heritage	Disturbance of sacred or heritage sites	Activities may disturb sacred or culturally significant sites	<ul style="list-style-type: none"> • Site selection excludes culturally sensitive areas • The project consults elders and traditional leaders to validate site acceptability
Protecting and preserving property rights, customary rights, or protecting legal or customary tenure/access rights to territories, property, and resources, including	Unclear property or access rights caused by unclear land tenure systems	Unclear tenure could delay or invalidate participation, or lead to intra-community disputes	<ul style="list-style-type: none"> • FPIC consultations and due diligence confirm landholder rights • Only areas with verified consent from legally recognized landowners to included • No activity on disputed lands

⁵⁷⁰ The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

collective and/or conflicting rights			
Impacts on biodiversity and ecosystems	Risk of introducing invasive species into vulnerable ecosystems	Loss of native biodiversity, disruption of ecosystem functions, reduced habitat quality and potential spread of invasives into adjacent areas	<ul style="list-style-type: none"> • Native and non-invasive species used • Agricultural Research Council (ARC), South African National Biodiversity Institute (SANBI) and Root & Ground expertise will guide species selection • Planting avoids sensitive ecosystems
Soil degradation and soil erosion	Soil disturbance from poor planting practices	Inappropriate planting techniques could reduce soil quality or increase erosion	<ul style="list-style-type: none"> • Planting activities will be non-invasive • Mulching, pit planting and no-till methods will be used • Composting improves soil structure and fertility
Water consumption and stress	Over-abstraction of water during sapling establishment	Overuse of water during sapling establishment could affect local supply	<ul style="list-style-type: none"> • Drought-tolerant species used • Water-efficient practices such as mulching will be prioritized
Habitats (and areas needed for habitat connectivity) for rare, threatened, and endangered species	Impacts on habitats of rare, threatened or endangered species	Restoration could unintentionally affect sensitive species' habitats	<ul style="list-style-type: none"> • Ecological screening will guide site selection • ARC and SANBI will provide expertise on sensitive habitats • Areas with known biodiversity value are protected
Areas needed for habitat connectivity	No risk identified	No risk identified	<ul style="list-style-type: none"> • Planting zones align with natural corridors and the Kruger to Canyons (K2C) Biosphere strategies • Clustered restoration promotes connectivity
Invasive species	Introduction of non-native or invasive species	Risk of unintended introduction through nurseries or participant planting	<ul style="list-style-type: none"> • Native and non-invasive species will be used • Nursery and planting protocols monitored
Ecosystem conversion	Use of monocultures	Risk of monoculture or simplification of habitat structure	<ul style="list-style-type: none"> • Planting plans emphasize species choice and diversity • Participants select multiple species per site • Mixed-planting models will be implemented
Power imbalances	Power imbalances in community engagement	Dominant individuals may marginalize vulnerable groups in consultations or decision-making	<ul style="list-style-type: none"> • Separate sessions for women/youth/elders • Trained facilitators manage power dynamics • Rotating spokespersons and anonymous input channels remain active

<p>Governance</p>	<p>Parallel governance systems between traditional authorities and municipal authorities</p>	<p>Institutional conflict, delays in approvals, undermined legitimacy if one structure excluded.</p>	<ul style="list-style-type: none"> Engagement with both traditional and municipal leaders; joint meetings and workshops; letters of endorsement; no activity without informing both governance systems.
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APPENDIX 4: COMMERCIALY SENSITIVE INFORMATION

Section	Information	Justification
2.1.8	Personal details of 'Other entities involved in the project'	The personal details of individuals have not been added to this public version of the PDD in accordance with the Protection of Personal Information Act (Act 4 of 2013) ⁵⁷¹ . Such information will be made available to auditors and relevant stakeholders upon their request and once permission has been obtained from the people in question.
2.1.22	Financial model	The financial model has not been made available in this public version of the PDD. Rather, highlights have been provided. The full model will be made available to auditors and relevant stakeholders upon their request.
2.4.3	Personal details of persons on the 'Management team'	The personal details of individuals have not been added to this public version of the PDD in accordance with the Protection of Personal Information Act (Act 4 of 2013). Such information will be made available to auditors and relevant stakeholders upon their request and once permission has been obtained from the people in question.
2.4.4	Personal details of persons employed by the 'Project partners'	The personal details of individuals have not been added to this public version of the PDD in accordance with the Protection of Personal Information Act (Act 4 of 2013). Such information will be made available to auditors and relevant stakeholders upon their request and once permission has been obtained from the people in question.
2.4.5	Financial health of implementing organizations	The finances for the project are secured through the Project Proponent, which is underpinned by committed private financing that ensures funds are available for the full implementation period. The implementing partners contribute technical expertise as per partnership agreements but are not financially responsible for sustaining the project. Financial details, including the model and evidence of financing and payment arrangements, have not been made available in this public version of the PDD, as the process of securing investment is ongoing. These details will be made available to auditors and relevant stakeholders at their request.

⁵⁷¹ The Republic of South Africa. 2025. Protection of Personal Information Act 4 of 2013. The South African Government. Available at: <https://www.gov.za/documents/protection-personal-information-act>. Accessed on 29 Sep 2025.

APPENDIX 5: RARE, THREATENED OR ENDANGERED SPECIES

Species	Type	Status
<i>Falco fasciinucha</i>	Birds	Critically Endangered (CR)
<i>Gyps africanus</i>	Birds	CR
<i>Necrosyrtes monachus</i>	Birds	CR
<i>Trigonoceps occipitalis</i>	Birds	CR
<i>Aquila nipalensis</i>	Birds	EN
<i>Aquila rapax</i>	Birds	Endangered (EN)
<i>Ephippiorhynchus senegalensis</i>	Birds	EN
<i>Gyps coprotheres</i>	Birds	EN
<i>Macheiramphus alcinus</i>	Birds	EN
<i>Mycteria ibis</i>	Birds	EN
<i>Polemaetus bellicosus</i>	Birds	EN
<i>Scotopelia peli</i>	Birds	EN
<i>Terathopus ecaudatus</i>	Birds	EN
<i>Torgos tracheliotos</i>	Birds	EN
<i>Anthropoides paradiseus</i>	Birds	Vulnerable (VU)
<i>Aquila verreauxii</i>	Birds	VU
<i>Bucorvus leadbeateri</i>	Birds	VU
<i>Calherodius leuconotus</i>	Birds	VU
<i>Calidris ferruginea</i>	Birds	VU
<i>Ciconia nigra</i>	Birds	VU
<i>Falco biarmicus</i>	Birds	VU
<i>Falco concolor</i>	Birds	VU
<i>Geronticus calvus</i>	Birds	VU
<i>Hemimacronyx chloris</i>	Birds	VU
<i>Microparra capensis</i>	Birds	VU
<i>Neotis denhami</i>	Birds	VU
<i>Nettapus auritus</i>	Birds	VU
<i>Pelecanus onocrotalus</i>	Birds	VU
<i>Pelecanus rufescens</i>	Birds	VU
<i>Podica senegalensis</i>	Birds	VU
<i>Sagittarius serpentarius</i>	Birds	VU
<i>Stephanoaetus coronatus</i>	Birds	VU
<i>Chiloglanis bifurcus</i>	Fish	CR
<i>Enteromius treurensis</i>	Fish	CR
<i>Chetia brevis</i>	Fish	EN
<i>Serranochromis meridianus</i>	Fish	EN

<i>Oreochromis mossambicus</i>	Fish	VU
<i>Diplacodes pumila</i>	Insects	EN
<i>Thoracistus jambila</i>	Insects	EN
<i>Pseudagrion newtoni</i>	Insects	VU
<i>Diceros bicornis</i>	Mammals	CR
<i>Cloeotis percivali</i>	Mammals	EN
<i>Loxodonta africana</i>	Mammals	EN
<i>Lycaon pictus</i>	Mammals	EN
<i>Redunca fulvorufula</i>	Mammals	EN
<i>Acinonyx jubatus</i>	Mammals	VU
<i>Damaliscus lunatus lunatus</i>	Mammals	VU
<i>Hippopotamus amphibius</i>	Mammals	VU
<i>Hippotragus niger</i>	Mammals	VU
<i>Panthera leo</i>	Mammals	VU
<i>Panthera pardus</i>	Mammals	VU
<i>Smutsia temminckii</i>	Mammals	VU
<i>Chlamydephorus burnupi</i>	Mollusk	VU
<i>Disa staerkeriana</i>	Plants	CR
<i>Encephalartos laevifolius</i>	Plants	CR
<i>Gladiolus macneillii</i>	Plants	CR
<i>Ledebouria rupestris</i>	Plants	CR
<i>Siphonochilus aethiopicus</i>	Plants	CR
<i>Adenia wilmsii</i>	Plants	EN
<i>Alepidea cordifolia</i>	Plants	EN
<i>Aloe simii</i>	Plants	EN
<i>Argyrobium muddii</i>	Plants	EN
<i>Barleria oxyphylla</i>	Plants	EN
<i>Disa clavicornis</i>	Plants	EN
<i>Erica rivularis</i>	Plants	EN
<i>Eriosema naviculare</i>	Plants	EN
<i>Gladiolus cataractarum</i>	Plants	EN
<i>Habenaria mossii</i>	Plants	EN
<i>Helichrysum lesliei</i>	Plants	EN
<i>Helichrysum summo-montanum</i>	Plants	EN
<i>Ledebouria galpinii</i>	Plants	EN
<i>Leucospermum saxosum</i>	Plants	EN
<i>Morella microbracteata</i>	Plants	EN
<i>Pavetta zeyheri microlancea</i>	Plants	EN
<i>Protea laetans</i>	Plants	EN
<i>Streptocarpus actinoflorus</i>	Plants	EN
<i>Syncolostemon incanus</i>	Plants	EN
<i>Tulbaghia siebertii</i>	Plants	EN
<i>Warburgia salutaris</i>	Plants	EN

<i>Aloe nubigena</i>	Plants	Rare
<i>Combretum petrophilum</i>	Plants	Rare
<i>Haemanthus paucifolius</i>	Plants	Rare
<i>Pelargonium album</i>	Plants	Rare
<i>Pelargonium tongaense</i>	Plants	Rare
<i>Adenia fruticosa</i>	Plants	VU
<i>Adenium swazicum</i>	Plants	VU
<i>Aloe integra</i>	Plants	VU
<i>Aloe komatiensis</i>	Plants	VU
<i>Aspidonepsis shebae</i>	Plants	VU
<i>Bowiea volubilis</i>	Plants	VU
<i>Brachystelma minor</i>	Plants	VU
<i>Crinum moorei</i>	Plants	VU
<i>Crocsmia mathewsiana</i>	Plants	VU
<i>Dioscorea sylvatica</i>	Plants	VU
<i>Disa alticola</i>	Plants	VU
<i>Disa amoena</i>	Plants	VU
<i>Disa klugei</i>	Plants	VU
<i>Drimiopsis davidsoniae</i>	Plants	VU
<i>Encephalartos humilis</i>	Plants	VU
<i>Eucomis vandermerwei</i>	Plants	VU
<i>Gelrebia rostrata</i>	Plants	VU
<i>Indigofera hybrida</i>	Plants	VU
<i>Ledebouria mokobulanensis</i>	Plants	VU
<i>Ledebouria remifolia</i>	Plants	VU
<i>Leucospermum gerrardii</i>	Plants	VU
<i>Melanospermum italae</i>	Plants	VU
<i>Miraglossum davyi</i>	Plants	VU
<i>Monopsis kowynensis</i>	Plants	VU
<i>Olinia huillensis burttdavii</i>	Plants	VU
<i>Podranea ricasoliana</i>	Plants	VU
<i>Prunus Africana</i>	Plants	VU
<i>Schizochilus crenulatus</i>	Plants	VU
<i>Searsia batophylla</i>	Plants	VU
<i>Streptocarpus cyaneus longi-tommii</i>	Plants	VU
<i>Streptocarpus fasciatus</i>	Plants	VU
<i>Streptocarpus fenestra-dei</i>	Plants	VU
<i>Streptocarpus hilturtianus</i>	Plants	VU
<i>Vincetoxicum anomalum</i>	Plants	VU
<i>Kinixys lobatsiana</i>	Reptile	VU