VILLAGE CLIMATE SOLUTIONS

Project title	Village Climate Solutions
Project ID	1325
Crediting period	21-April-2012 to 20-April-2064
Project lifetime	21-April-2012 – 20-April-2064; 52-year lifetime
(CCB) GHG accounting period	21-April-2012 – 20-April-2064; 52-year lifetime
Original date of issue	21-December-2015
Most recent date of issue	29-June-2026
Version	2.3
VCS Standard version	4.7
CCB Standards version	3.1
Project location	Tanzania – Morogoro and Lindi Regions
Project proponent(s)	Village Climate Solutions, Charles Meshack, meshack@villageclimatesolutions.co.tz, +255 754 380 607
Validation/verification body	AENOR, José Luis FUENTES PÉREZ, jfuentes@aenor.com, (+34) 914 326 000
History of CCB status	First validation - 21-December-2015

Gold Level criteria	**Climate change adaptation** – The project spans a 50-year crediting period, providing communities with REDD income previously unattainable and unavailable through any other forest enterprise. According to the opportunity cost survey, the project will offer more reliable income than farming, which is increasingly affected by changing climate conditions. Providing agricultural extension services aimed at enhancing the productivity of arable land by at least 1% annually will significantly strengthen climate resilience among local farmers. Additionally, having more forest cover in the landscape is associated with reduced temperatures and increased rainfall, which will reduce the impact of climate change on the project communities. **Exceptional community benefits** – The project will significantly boost community income and fund village development projects, enhancing social services, counting health, water, education, and formal land titling. Investment in education will deliver long-term benefits to the younger generation, motivating them to pursue livelihoods that avoid forest clearing. **Exceptional biodiversity benefits** – The project will reduce deforestation and forest degradation in the biodiversity hotspots of the coastal forests of Rondo, Noto and the Chitoa Plateau in Lindi, home to 11 species listed as vulnerable or endangered on the IUCN Red List. It also protects sub-montane forests in the Eastern Arc Mountains in Morogoro, while buffering protected areas of national and global significance, including Mikumi, Udzungwa, and Nyerere National Parks, as well as the Selous-Msanjesi-Niassa Wildlife Corridors.
Expected verification schedule	Annually from June 2024
Prepared by	Prepared by Theron Morgan-Brown from Reterra Limited and Aklei Albert from Village Climate Solutions Limited.

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1 SUMMARY OF PROJECT BENEFITS

1.1 Unique Project Benefits

Outcome or impact estimated by the end of project lifetime	Section reference
1) Improved village governance is expected to come as a biproduct of the benefit sharing system promoted by the project which treats REDD revenue as potential dividends to community members. Communities will meet annually to decide how much to cut from their dividends to spend on village development projects. This creates increased accountability over the delivery of development projects because the funding comes directly from community members rather than donors or rent.	2.1.17
2) Near universal stakeholder awareness and engagement. This is another impact of the project's benefit-sharing system. On dividend distribution days, as much as 95% of community members will appear in person to collect their dividends. This provides the project with the opportunity to directly engage with nearly all community members to increase their understanding of REDD and project activities, including the project's agricultural extension services.	2.1.17

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	N/A	
	Net estimated reductions in the project area, measured against the without-project scenario	18,426,925 t CO_2e	3.2.4
Forest[1] cover	Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario	108,283 ha	3.2.4
	Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	N/A	
Improved land management	Number of hectares of existing production forest land in which IFM[2] practices are expected to occur as a result of project activities, measured against the without-project scenario	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	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	8,738	4.2.1, 4.5.4

[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)

[2] 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)

	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	4,218	4.2.1, 4.5.4
Employment	Total number of people expected to be employed in project activities[3], expressed as number of full-time employees[4]	2,586	2.4.3, 2.4.4
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	523	2.4.3, 2.4.4
Livelihoods	Total number of people expected to have improved livelihoods[5] or income generated as a result of project activities	145,609	4.2.1
	Number of women expected to have improved livelihoods or income generated as a result of project activities	76,232	4.2.1
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	145,609	4.2.1
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	76,232	4.2.1
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	51,788	4.5.4
	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	27,113	4.5.4

[3] 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.

[4] 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])

[5] 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.

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	145,609	4.2.1
	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	76,232	4.2.1
Well-being	Total number of community members whose well-being[6] is expected to improve as a result of project activities	145,609	4.2.1
	Number of women whose well-being is expected to improve as a result of project activities	76,232	4.2.1
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation[7], measured against the without-project scenario	327,234	1.1.2 of methodological annex
	Expected number of globally Critically Endangered or Endangered species[8] benefiting from reduced threats as a result of project activities[9], measured against the without-project scenario	8	5.5.1

[6] 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.

[7] 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

[8] Per IUCN's Red List of Threatened Species

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

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 Village Climate Solutions REDD+ project is a grouped project covering 327,234 hectares of primarily village-owned forest in Eastern Tanzania, spanning 60 rural communities in seven local authorities in three regions in Tanzania. It aims to promote sustainable development and biodiversity conservation while delivering net positive economic benefits to over 150,000 beneficiaries.

Without the project, 59% of the forest area would be lost over the next 40 years, primarily to low-productivity smallholder agriculture driven by population growth and limited livelihood alternatives. To counter this, the project supports community-based forest management, technical support for forest protection using remote sensing and mobile mapping, performance-based payments to incentivize forest conservation, and agricultural extension services to improve crop yields and mitigate leakage.

A standout feature of the project is the benefit sharing system which puts all community members in control over spending priorities. Communities vote annually to decide how much to spend on development projects and how much to pay out to themselves as dividends. This strengthens the sense of communal ownership over the forest and the development projects and incentivizes local leaders to deliver on community priorities. One of the key priorities that the project encourages communities to focus on is increasing secondary school access, offering future generations better livelihood opportunities.

For the 2022-2028 baseline period, after deducting for non-permanence risk, the project expects to reduce emissions from land-use change by 354,364 t CO_2e annually. Between 2012 and 2064, the project expects to generate at least 14,806,806 t CO_2e in sellable reductions.

The climate, community, and biodiversity objectives include:

• Help communities adapt to climate change by promoting climate-smart agriculture, maintaining forest cover to protect water sources, and mitigating impacts on local rainfall and temperature.

• Ensure communities receive REDD compensation exceeding opportunity costs and support democratic benefit-sharing systems that leverage earnings for greater economic impacts.

• Protect critical habitats for endangered mammal species like the African Savanna Elephant, Rondo Dwarf Galago, African Wild Dog, and Abbot's Duiker, as well as 14 other plant and animal species listed as endangered or vulnerable in the IUCN Red List.

The project is not located in a jurisdictional REDD+ program.

2.1.2 Audit History (VCS, 4.1)

Audit type	Period	Program	Validation/verification body name	Number of years
Validation/ verification	(21-April-2012--20-April-2013)	VCS, CCB	SCS Global Services	1
Verification	(21-April-2013--20-April-2022)	VCS	TÜV Rheinland Energy & Environment GmbH	9
Revalidation / verification	(21-April-2022--30-June-2024)	VCS, CCB	AENOR	2.1

2.1.3 Sectoral Scope and Project Type (VCS, 3.2)

Sectoral scope	14: Agriculture, forestry, and other land use
AFOLU project category [10]	Reduced Emissions from Deforestation and Degradation (REDD)
Project activity type	Avoiding Unplanned Deforestation and/or Degradation (AUDD)

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)

The project meets all applicable rules and requirements set out under the VCS Program.

The applied methodology is VM0015 v1.2, issued on 18-December-2023, which is a methodology applicable to unplanned deforestation. It is the most recent version of the methodology and is adopted in place of the previous version since this project document covers a new baseline validity period. According to Verra guidance regarding transitioning to VM0048, it may be used so long as validation and/or verification is initiated within 6 months of jurisdictional activity data becoming available for the respective region and then completed within 1 year of the start of the public comment period. At the time of submission of this project document for public comment, no jurisdictional activity data was available for Tanzania. In support of application of VM0015 v1.2, the project has also used VT0001 v3.0, to demonstrate additionality, and AFOLU Non-

[10] See Appendix 1 of the VCS Standard

Permanence Risk Tool v4.3, to evaluate non-permanence risk, which are the most recent versions of these tools.

The project follows applicable laws as described in section 2.5 of this project description.

The project baselines for the original 2012-2022 baseline validity period and the revised 2022-2028 baseline validity period are based on green-house gas emissions from unplanned deforestation in the project area and the project activities are designed to reduce deforestation in the project area. Thus, the project is eligible under scope 14 which deals with emission from agriculture, forestry and other land-uses.

The project has gone through extensive stakeholder engagement and consultation meeting the VCS and CCB requirements as described in section 2.3.

This project was originally registered as grouped project allowing for the inclusion of new project instances over time. All current and future project instances shall meet the eligibility requirements specified in section 2.1.6.1. In terms of general AFOLU requirements, the project area in each project instance has been forest for at least 10 years before the project instance start date. This was determined by forest mapping presented in section 3.4 of the methodological annex. No part of the project area is covered by a jurisdictional REDD+ program nor occur on wetlands. All implementation partners (forest managing authorities) and their roles and responsibilities are listed in section 2.1.8.

The project was originally registered in 2015 and underwent a public comment period starting after May 16th in 2014 prior to validation/verification body site visit from 19-Aug-2014 to 23-Aug-2014. The CCB and VCS validation reports and representations were issued on 6-May-2015, less than one year after the start of the public comment period and less than 5 years after the project start date. The project was submitted for VCS pipeline listing on 16-May-2014, less than 3 years after the project start date.

The project completed its first CCB verification on 22-May-2015. However, the project did not complete a subsequent CCB verification and thus the status was changed to verification expired. Thus, the project must undergo CCB validation again. This updated project description was submitted for a new public comment period starting on 21-November-2024. The public comment period closed on the 20-December-2024. The site visit for the re-validation of the PD was conducted between 17-March-2025 and 27-March-2025 with an opening meeting on 17-March-2025. The project has until 20-November-2025 to submit the validation statement for CCB re-validation before the expiration of the public comment period started on 21-November-2024.

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

This is not a transfer project.

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

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

This project was original registered as a grouped project under an earlier version of the VCS standard. This section has been updated to comply with the requirements of v4.7 of the VCS standard and v3.1 of the CCB standard.

The two current project instances are depicted in Figure 1 and corresponding geodetic polygons have been provided to the VVB.

The following table specifies the eligibility criteria for project instances and demonstrates how the two current project instances meet the criteria. New instances must meet all eligibility requirements to be included.

Table 1 Project instance eligibility requirements

Criteria	Project instance 1	Project instance 2
Primary activity of the project instance is avoided unplanned deforestation.	Yes	Yes
Baseline scenario is primarily unplanned conversation to small holder agriculture driven by rural population growth and baseline estimates of emissions have been extended to cover the project instance following the procedures described in section 3.2.1 and this has been adequately described in the monitoring report where the instance is added.	Yes	Yes
If applied to the instance, the results of VT0001 would be	Yes	Yes

the same as described in section 3.1.5.		
Have important community and biodiversity values which will be negatively impacted in the without project scenario.	The instance forests include water sources for rural communities and protect habit for species listed as endangered and vulnerable in the IUCN redlist	The instance forests include water sources for rural communities and protect habit for species listed as endangered and vulnerable in the IUCN redlist
Forest management responsibility and REDD earnings will primarily be given to people living adjacent to the project instance or in the communities that own the project instance.	Instance was originally entirely village forests managed by village governments, but due to municipalization of two project villages, now also includes areas belonging to the Lindi municipality and University of Dar Es Salaam. The areas no longer under village ownership will be managed by community-based organizations who have joint forest management agreements with the forest owners and consist of people who previously farmed within 350 meters of the forest.	Consists mostly of village forest reserves except for some forests in the former Ihombwe and Msimba villages which are now owned by the district council and one local authority reserve in Lindi Municipality. Community-based organizations have been formed to take over responsibility for managing the forests not in village forest reserves and they will receive most of the REDD revenue from those forests.
Stakeholder engagement meeting the requirements of the VCS and the CCB standard has been conducted and documented prior to the submission of the monitoring report where the project instance is added.	Yes, See section 2.3	Yes, See section 2.3
The project proponent as secured ownership over the project instance in a manner satisfying the requirements of the VCS and CCB standards	Yes, see section 2.1.9	Yes, see section 2.1.9

prior to the submission of the monitoring report where the project instance is added.		
Have a project instance start date on or after the project start date and only be eligible for crediting from the later of the start date of the instance or the monitoring period in which it was added.	Yes, this is the first instance	Yes, see sections 2.1.10 and 2.1.11.
Have similar initial forest types and final post-deforestation land-uses as those described in section 3.2 of the methodological annex and project area has been forested for at least 10 years prior to the instance start date.	Yes, this instance was included in the sampling frame for initial forest classes and post-deforestation stratum and was 100% forested at instance start.	Yes, this instance was included in the sampling frame for initial forest classes and post-deforestation stratum and was 100% forested at instance start.
If added before transition to VM0048, fall within the reference region described in section 1.1.1 of the methodological annex and depicted in Figure 1. If added after transitioning to VM0048, be anywhere in mainland Tanzania meeting the other eligibility requirements.	Yes, see Figure 1.	Yes, see Figure 1.
Monitoring of emissions, community, and biodiversity impacts as described in sections 3.3, 4.4, and 5.4 respectively has been have been appropriately extended and described in the monitoring report in each the instance is added. Required	The current monitoring plan covers this instance	The current monitoring plan covers this instance

monitoring elements should be like those used in the first two project instances.		
Subjectively, the project or partner organizations have sufficient capacity to extend technical services regarding forest management, agricultural extension, and benefit sharing at least the same level as exists at this validation.	The Tanzania Forest Conservation Group is supporting the project instance with 1 extension agent based in the area to serve 17 different communities including 10 in this instance.	The Tanzania Forest Conservation Group is supporting the project instance with 3 extension agents based in the vicinity of the instance communities. This is approximately 1 extension agent for every 15 communities.

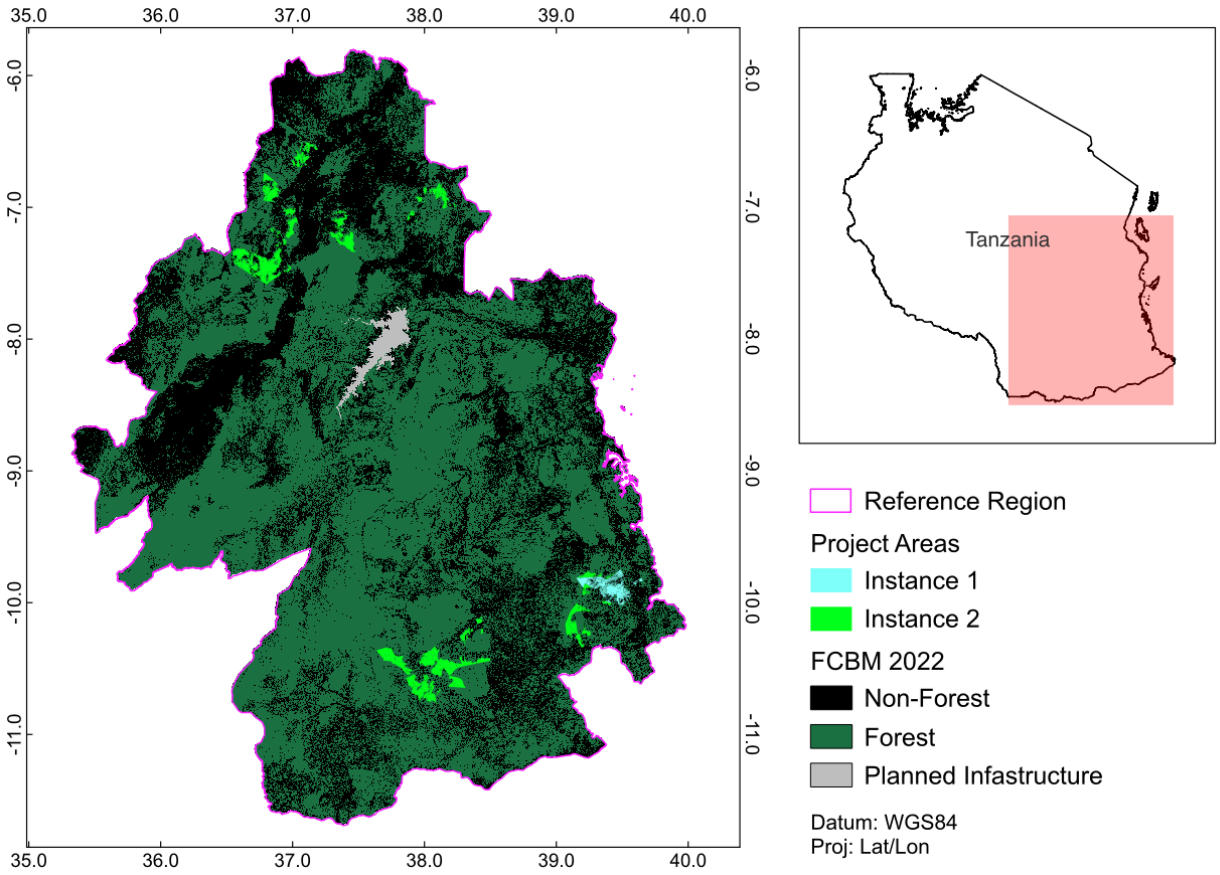


Figure 1 Location of Project Activity Instances as of 2023

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

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2.1.8 Other Entities Involved in the Project

Organization name	Lindi Municipal Council
Role in the project	Managing Authority, and Technical Advisor to Village Councils
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Organization name	University of Dar es Salaam
Role in the project	Managing Authority
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Organization name	Mtama District Council

Role in the project	Technical Advisor to Village Councils participating in the project
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Organization name	Nachingwea District Council
Role in the project	Technical Advisor to Village Councils participating in the project
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Organization name	Morogoro District Council
Role in the project	Technical Advisor to Village Councils participating in the project
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Organization name	Mvomero District Council

Role in the project	Technical Advisor to Village Councils participating in the project
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Organization name	Kilosa District Council
Role in the project	Technical Advisor to Village Councils participating in the project
Contact person	Michael J.Gwimile
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Organization name	Mikumi Township Council
Role in the project	Managing Authority
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Organization name	Tanzania Forest Conservation Group

Role in the project	Majority shareholder of VCSL, technical advice
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Organization name	Reterra Ltd
Role in the project	Technical Advice, GIS works and Marketing
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Organization name	Chimbendenga Village Council
Role in the project	Managing Authority
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Email	

Organization name	Kiegei A Village Council
Role in the project	Managing Authority

Contact person	Kainda C. Mtanga
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Email	

Organization name	Kiegei B Village Council
Role in the project	Managing Authority
Contact person	Abdalah Makalila
Title	Village Executive Officer
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Email	

Organization name	Kilimarondo Village Council
Role in the project	Managing Authority
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Organization name	Lionja B Village Council
Role in the project	Managing Authority
Contact person	Zabron E. Mkane

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Organization name	Lipuyu Village Council
Role in the project	Managing Authority
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Organization name	Majonanga Village Council
Role in the project	Managing Authority
Contact person	Anna Ludwick Yohakimu
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Organization name	Matekwe Village Council
Role in the project	Managing Authority
Contact person	Majid Hamisi Ngajupa
Title	Village Executive Officer

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Organization name	Mbondo Village Council
Role in the project	Managing Authority
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Email	

Organization name	Mtua Village Council
Role in the project	Managing Authority
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Organization name	Nahimba Village Council
Role in the project	Managing Authority
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Organization name	Nakalonji Village Council
Role in the project	Managing Authority
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Organization name	Namatunu Village Council
Role in the project	Managing Authority
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Email	

Organization name	Nanjihi Village Council
Role in the project	Managing Authority
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Address	P. O. Box 291 Nachingwea
Telephone	+255 733664143

Email	

Organization name	Ngunichile Village Council
Role in the project	Managing Authority
Contact person	Sadati Ally Mahundu
Title	Village Executive Officer
Address	P. O. Box 291 Nachingwea
Telephone	+255 658 462 187
Email	

Organization name	Chiwerere Village Council
Role in the project	Managing Authority
Contact person	Hamisi Mtioli
Title	Village Executive Officer
Address	P O Box 328 Mtama
Telephone	+255 0776733545
Email	

Organization name	Liganga Village Council
Role in the project	Managing Authority
Contact person	Hassani Mmuya
Title	Village Executive Officer
Address	P O Box 328 Mtama
Telephone	+255 712245934
Email	

Organization name	Mihima Village Council
Role in the project	Managing Authority
Contact person	Ismail Chipondelo
Title	Village Executive Officer
Address	P O Box 328 Mtama
Telephone	+255 657585325
Email	

Organization name	Muungano II Village Council
Role in the project	Managing Authority
Contact person	Ashura Athumani
Title	Village Executive Officer
Address	P O Box 328 Mtama
Telephone	+255 716234376
Email	

Organization name	Nndawa Village Council
Role in the project	Managing Authority
Contact person	Joseph A. Mkwala
Title	Village Executive Officer
Address	P O Box 328 Mtama
Telephone	+255 622968103
Email	

Organization name	Ntene Village Council

Role in the project	Managing Authority
Contact person	Esha Mchopa
Title	Village Executive Officer
Address	P O Box 328 Mtama
Telephone	+255 657185005
Email	

Organization name	Kinyope Village Council
Role in the project	Managing Authority
Contact person	Maunde Yusufu
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 627662531
Email	

Organization name	Kiwawa Village Council
Role in the project	Managing Authority
Contact person	Twalibu B Magulu
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 672474026
Email	

Organization name	Likwaya Village Council
Role in the project	Managing Authority

Contact person	Raymond Mlaponi
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 788057969
Email	

Organization name	Makumba Village Council
Role in the project	Managing Authority
Contact person	Rashidi Mpwili
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 786062079
Email	

Organization name	Milola Magharibi Village Council
Role in the project	Managing Authority
Contact person	Mohamedi Katuli
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 784794341
Email	

Organization name	Mkombamosi Village Council
Role in the project	Managing Authority
Contact person	Issa Mbaruku

Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 783706901
Email	

Organization name	Muungano Village Council
Role in the project	Managing Authority
Contact person	Rashidi Rashidi
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 682593698
Email	

Organization name	Namkongo Village Council
Role in the project	Managing Authority
Contact person	Hamisi Mkopa
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 620435874
Email	

Organization name	Ruhoma Village Council
Role in the project	Managing Authority
Contact person	Somoe M Mwanga
Title	Village Executive Officer

Address	P O Box 1070 Lindi
Telephone	+255 621507227
Email	

Organization name	Mputwa Village Council
Role in the project	Managing Authority
Contact person	Selemani Issa Magaya
Title	Village Executive Officer
Address	P O Box 1070 Lindi
Telephone	+255 783649478
Email	

Organization name	NONA – Community Based Organization (Nandambi & Mkanga 1)
Role in the project	Forest Manager
Contact person	Hassani Saidi Patandi
Title	Secretary
Address	P O Box 1070 Lindi
Telephone	+255 715785923
Email	

Organization name	MTENA – Community Based Organization (Narunyu)
Role in the project	Forest Manager
Contact person	Issa Hamisi Namteje
Title	Secretary
Address	P O Box 1070 Lindi

Telephone	+255 789607698
Email	

Organization name	KUMIRU – Community Based Organization (Rutamba)
Role in the project	Forest Manager
Contact person	Bakari Fadhili Mponda
Title	Secretary
Address	P O Box 1070 Lindi
Telephone	+255 621127248
Email	

Organization name	Diguzi Village Council
Role in the project	Managing Authority
Contact person	Redemta Matola
Title	Village Executive Officer
Address	P. O Box 1880 Morogoro
Telephone	+255 711244921/789413656
Email	

Organization name	Lulongwe Village Council
Role in the project	Managing Authority
Contact person	Ramadhani Sekamba Mnyani
Title	Village Executive Officer
Address	P. O Box 1880 Morogoro
Telephone	+255 683001388

Email	

Organization name	Matuli Village Council
Role in the project	Managing Authority
Contact person	Kelvin Alex Mgomapayo
Title	Village Executive Officer
Address	P. O Box 1880 Morogoro
Telephone	+255 692122911
Email	

Organization name	Mlilingwa Village Council
Role in the project	Managing Authority
Contact person	Valence Franko Lukas
Title	Village Executive Officer
Address	P. O Box 1880 Morogoro
Telephone	+255 613040261
Email	

Organization name	Tununguo Village Council
Role in the project	Managing Authority
Contact person	Octavia Gereniah Kobero
Title	Village Executive Officer
Address	P. O Box 1880 Morogoro
Telephone	+255 774804675
Email	

Organization name	Kihondo Village Council
Role in the project	Managing Authority
Contact person	Wilned Yustine
Title	Village Executive Officer
Address	P. O. Box 663 Mvomero
Telephone	+255 716380662
Email	

Organization name	Maharaka Village Council
Role in the project	Managing Authority
Contact person	Eliza Mchilo
Title	Village Executive Officer
Address	P. O. Box 663 Mvomero
Telephone	+255 674122540
Email	

Organization name	Misengele Village Council
Role in the project	Managing Authority
Contact person	Choleta J Ngavumba
Title	Village Executive Officer
Address	P. O. Box 663 Mvomero
Telephone	+255 713090605
Email	

Organization name	Msongozi Village Council

Role in the project	Managing Authority
Contact person	Zainabu L John
Title	Village Executive Officer
Address	P. O. Box 663 Mvomero
Telephone	+255 676989043
Email	

Organization name	Sewe Kipera Village Council
Role in the project	Managing Authority
Contact person	Choleta J Ngavumba
Title	Village Executive Officer
Address	P. O. Box 663 Mvomero
Telephone	+255 713090605
Email	

Organization name	Chabima Village Council
Role in the project	Managing Authority
Contact person	Merrygoleth Mlengeni
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 786928515
Email	

Organization name	Dodoma Isanga Village Council
Role in the project	Managing Authority

Contact person	Fatuma I. Tengeza
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 719617020
Email	

Organization name	Gongwe Village Council
Role in the project	Managing Authority
Contact person	Mwanaharusi S. Matola
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 677615670
Email	

Organization name	Kisanga Village Council
Role in the project	Managing Authority
Contact person	Nyawebwa Wambura
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 699862410
Email	

Organization name	Kisongwe Village Council
Role in the project	Managing Authority
Contact person	Kassimu S. Danguche

Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 757563460
Email	

Organization name	Kitunduweta Village Council
Role in the project	Managing Authority
Contact person	Lucian J. Matimbo
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 712469927
Email	

Organization name	Malolo A Village Council
Role in the project	Managing Authority
Contact person	Hawa H. Kamwana
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 786563652
Email	

Organization name	Mbamba Village Council
Role in the project	Managing Authority
Contact person	Rajabu Omary
Title	Village Executive Officer

Address	P O Box 65 Kilosa
Telephone	+255 656258700
Email	

Organization name	Mhenda Village Council
Role in the project	Managing Authority
Contact person	Sylvester M. Benedict
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 677225035
Email	

Organization name	Nyali Village Council
Role in the project	Managing Authority
Contact person	Mohamed L. Kenya
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 712941418
Email	

Organization name	Rudewa Gongoni Village Council
Role in the project	Managing Authority
Contact person	Haleluya M. Nehemia
Title	Village Executive Officer
Address	P O Box 65 Kilosa

Telephone	+255 656864777
Email	

Organization name	Ulaya Mbuyuni Village Council
Role in the project	Managing Authority
Contact person	Pearon L. Peter
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 713708494
Email	

Organization name	Unone Village Council
Role in the project	Managing Authority
Contact person	Gasper D. Sija
Title	Village Executive Officer
Address	P O Box 65 Kilosa
Telephone	+255 685810559
Email	

Organization name	JUHIMM – Msimba – Community Based Organization (Msimba)
Role in the project	Forest Manager
Contact person	Samson Menasy Kahemela
Title	Secretary of Community Based Organization
Address	PO Box 77 Mikumi
Telephone	+255 717871833

Email	

Organization name	JUHIMI – Community Based Organization (Ihombwe)
Role in the project	Forest Manager
Contact person	Rashid Mohamed
Title	Secretary of Community Based Organization
Address	PO Box 01 Mikumi
Telephone	+255 715909575
Email	

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

Village Climate Solutions Limited has project ownership by meeting the VCS requirement of an enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the land, vegetation or conservational or management process that generates GHG emission reductions or carbon dioxide removals which vests project ownership in the project proponent.

The Environmental Management (Control and Management of Carbon Trading) Regulations), 2022 (GN 636), as amended by GN 721 of 2023 identifies forest owners as the Managing Authority. As of 2023, the project area contains forests from three different types of managing authorities: Village Councils, Local Authorities, and a small area owned by the University of Dar es Salaam. Village Councils own the land within the villages, as outlined in the Village Land Act CAP 114 of the laws of Tanzania. They can also establish Village land forest reserves (VLFRs) under Sections 4(c), 32, and 33 of the Forest Act CAP 323, which gives them additional right over forests such as the right to harvest them without owing royalties to the national government. Local authorities, on the other hand, own local authority forest reserves (LAFRs) in accordance with Section 4(b) and Part V of the Forest Act. Finally, the University of Dar es Salaam holds land under granted rights of occupancy, which under the Land Act, 1999 (CAP 113) is granted for 100 years.

Village Climate Solutions Limited (VCSL), as the proponent, has entered into 40-year agreements with each of the managing authorities for project areas in project instance 1 and 2 to generate carbon credits, resulting from reducing deforestation and forest degradation within the project area. VCSL secured free, prior, and informed consent (FPIC) from the managing authorities to sign the contracts through village councils, village general assemblies, and comprehensive

reviews and endorsements by local authorities. The contracts comply with Section 29 of the Environmental Management (Control and Management of Carbon Trading) Regulations), 2022 (GN 636), as amended by GN 721 of 2023.

2.1.10 Project Start Date (VCS, 3.8)

Project start date	28-May-2011 – project instance 1 09-February-2023 – project instance 2
Justification	The project start date is May 28, 2011, which is the date that the first project village (Mkanga 1) passed its forest management plan and supporting by-laws in a village assembly meeting. This represents the start of the implementation of new forest management practices aimed at reducing greenhouse gas emissions in the project area. The start date for the second instance is Feb 9th, 2023, which is the date of the first on the ground patrols supported by the project in the new instance

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

Crediting period	The project crediting period will be for 52 years from April 21st, 2012, to April 20th, 2064. The start of the project crediting period corresponds to the last Landsat imagery used in the baseline deforestation analysis. This imagery was selected because it was the cloud free, wet season Landsat imagery that was temporally closest to the project start date. The methodology used by this project allows for using satellite imagery that was captured within two years of the project start date to establish the forest cover benchmark map for the project area at the start date. The initial crediting period was to be 30 years, but this has been extended by an additional 20 years in new contracts with the participating forest owners. This project description was prepared for a revalidation of the project thus meeting all the requirements for renewal of a project crediting period. Version 4.7 of the VCS standard requires a minimum of 20-year crediting periods for AFOLU projects which can be renewed for a maximum of 100 years. The standard also sets a minimum of 40 years for AFOLU project longevity. The 52-year crediting period is sufficiently long to meet the requirements of the standard without exceeding the 100-year limit.
Start date of first or fixed crediting period	21-April-2012 to 20-April-2064

CCB benefits assessment period	Changes in climate change adaptive capacity and resilience, biodiversity, and community well-being resulting from project activities will be monitored for the remainder of fixed crediting period (21-April-2022 to 20-April-2064).

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

There is a 9-year gap in the monitoring of resilience, biodiversity and community well-being between 21-April-2013 and 20-April-2022. This is because the project part for those years, MJUMITA, was unable to continue project monitoring after failing to find buyers for the project first VCU issuance in 2015. Village Climate Solutions took over the project in 2023 and has issued a VCS-only monitoring report to for the remainder of the 2012-2022 baseline validity period and will monitor resilience, biodiversity and community well-being resulting from project activities from 21-April-2022 to 20-April-2064.

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

☐ < 300,000 tCO_2e/year (project)

☒ ≥ 300,000 tCO_2e/year (large project)

Calendar year of crediting period	Estimated reductions or removals (tCO_2e)
21-April-2012 to 20-April-2013	39,896
21-April-2013 to 31-December-2013	2,778
01-January-2014 to 31-December-2014	3,857
01-January-2015 to 31-December-2015	10,213
01-January-2016 to 31-December-2016	19,846
01-January-2017 to 31-December-2017	18,234
01-January-2018 to 31-December-2018	4,883
01-January-2019 to 31-December-2019	0
01-January-2020 to 31-December-2020	0
01-January-2021 to 31-December-2021	0
01-January-2022 to 20-April-2022	0
21-April-2022 to 31-December-2023	29,497
01-January-2023 to 31-December-2023	194,215
01-January-2024 to 31-December-2024	311,027

01-January-2025 to 31-December-2025	482,183
01-January-2026 to 31-December-2026	502,451
01-January-2027 to 31-December-2027	513,469
01-January-2028 to 31-December-2028	513,469
01-January-2029 to 31-December-2029	492,931
01-January-2030 to 31-December-2030	492,931
01-January-2031 to 31-December-2031	492,931
01-January-2032 to 31-December-2032	492,931
01-January-2033 to 31-December-2033	492,931
01-January-2034 to 31-December-2034	492,931
01-January-2035 to 31-December-2035	473,213
01-January-2036 to 31-December-2036	473,213
01-January-2037 to 31-December-2037	473,213
01-January-2038 to 31-December-2038	473,213
01-January-2039 to 31-December-2039	473,213
01-January-2040 to 31-December-2040	473,213
01-January-2041 to 31-December-2041	454,285
01-January-2042 to 31-December-2042	454,285
01-January-2043 to 31-December-2043	454,285
01-January-2044 to 31-December-2044	454,285
01-January-2045 to 31-December-2045	454,285
01-January-2046 to 31-December-2046	454,285
01-January-2047 to 31-December-2047	436,114
01-January-2048 to 31-December-2048	436,114
01-January-2049 to 31-December-2049	436,114
01-January-2050 to 31-December-2050	436,114
01-January-2051 to 31-December-2051	436,114

01-January-2052 to 31-December-2052	436,114
01-January-2053 to 31-December-2053	418,669
01-January-2054 to 31-December-2054	418,669
01-January-2055 to 31-December-2055	418,669
01-January-2056 to 31-December-2056	418,669
01-January-2057 to 31-December-2057	418,669
01-January-2058 to 31-December-2058	418,669
01-January-2059 to 31-December-2059	401,922
01-January-2060 to 31-December-2060	401,922
01-January-2061 to 31-December-2061	401,922
01-January-2062 to 31-December-2062	401,922
01-January-2063 to 31-December-2063	401,922
01-January-2064 to 20-April-2064	120,026
Total estimated ERRs during the first or fixed crediting period	18,426,925
Total number of years	52
Average annual ERRs	354,364

2.1.14 Physical Parameters (CCB, G1.3)

As of 2023, the project area covers 327,234 ha of forested land in Eastern Tanzania ranging from about 12 to 300 km from the coast. The region typically has two rainy seasons: the long rains (*Masika*) from March to May and the short rains (*Vuli*) from October to December, though the rain patterns have become less predictable in recent decades. Depending on elevation, distance from the coast and elevation, annual rainfall ranges between 700 mm in the central plateau area (like Nachingwea) to greater than 1,500 mm in the Eastern Arc Mountains. According to OpenLandMap data available on Google Earth Engine, the median precipitation for the project area is 907 mm, making it ideal for many different types of crops.

Temperatures very with seasons and elevation ranging from as low as 5°C at night at elevations above 1500 in June to highs of up to 33°C at low elevations near the coast. However, most of the project area is at mid elevations and experiences average daily highs of 25°C to 30°C year-round.

Given the temperature and precipitation levels and patterns in the project area, most of the project area falls within the tropical dry forest ecosystem. The only exception is a 2300 ha patch of montane forest called Ilole which can be described as falling in the tropical moist forest ecosystem.

Elevation ranges from 60 masl in some parts of project instance 1 in Lindi Municipality to 2060 masl in Ilole Forest in Kilosa. The median is 495 masl. Most of the project area is flat or on gentle slopes. The exception is the project areas in the Rubeho mountains in Kilosa which are very steep in places. Overall slopes in the project area range from 0 to 68 degrees with a median of 5 degrees. Almost all the project area forests are the sources of drinking water for surrounding communities. Rivers from the project areas in Kilosa district flow to the country's largest hydroelectric stations and are important sources of water for irrigation. A map of elevation and hydrology in the project area and surrounding region are shown Figure 2.

Soil quality is a major constraint on agriculture in the region. Types vary considerably in the different project area. Generally, the soils in Lindi are more sandy and less fertile while the soils in Morogoro have moderate to good fertility. The dominate soil types in the project area in Lindi region, are Orthic Ferralsols, Lithosols, Ferralic Arenosols, and Orthic Acrisols, all of which considered relatively poor for agriculture without significant soil management. In Morogoro, dominate soil types include Ferric Acrisols, Ferralic Cambisols and Chromic Cambisols. The latter 2 soil types are well suited for agriculture, though frequently occur in the project area on slopes where erosion is a concern.

The forest types in the project area are based on the soil types, temperatures and rainfall. They can broadly be separated in Miombo woodland, coastal/lowland forest, and montane forest, though they often blend into each other at the edges. There are also portions of natural grasslands in flood plains in Nachingwea and between the Miombo and montane forests in Kilosa district. The distribution of these vegetation types is shown in Figure 3. About 87% of the project area is Miombo woodland, which is the most common type of forest in Eastern and Southern Africa. It is adapted to prolonged dry seasons and fire. It is home to many threatened species including African Savanah Elephants in the project area. There is approximately 45,000 ha of coastal and lowland forest in the project area. The majority of this is found on the Noto and Chitoa plateaus at the center of the first project instance in Lindi Municipality where it consists of coastal forest and scrub. The rest is riverine forest spread throughout the project area along rivers and streams. Tanzania's coastal forests are part of the Coastal Forests of Eastern Africa Biodiversity Hotspot. The project has about 2300 ha of Eastern Arc Mountain Forest in Ilole forest in Kilosa. This forest is part of the Eastern Afromontane Biodiversity Hotspot.

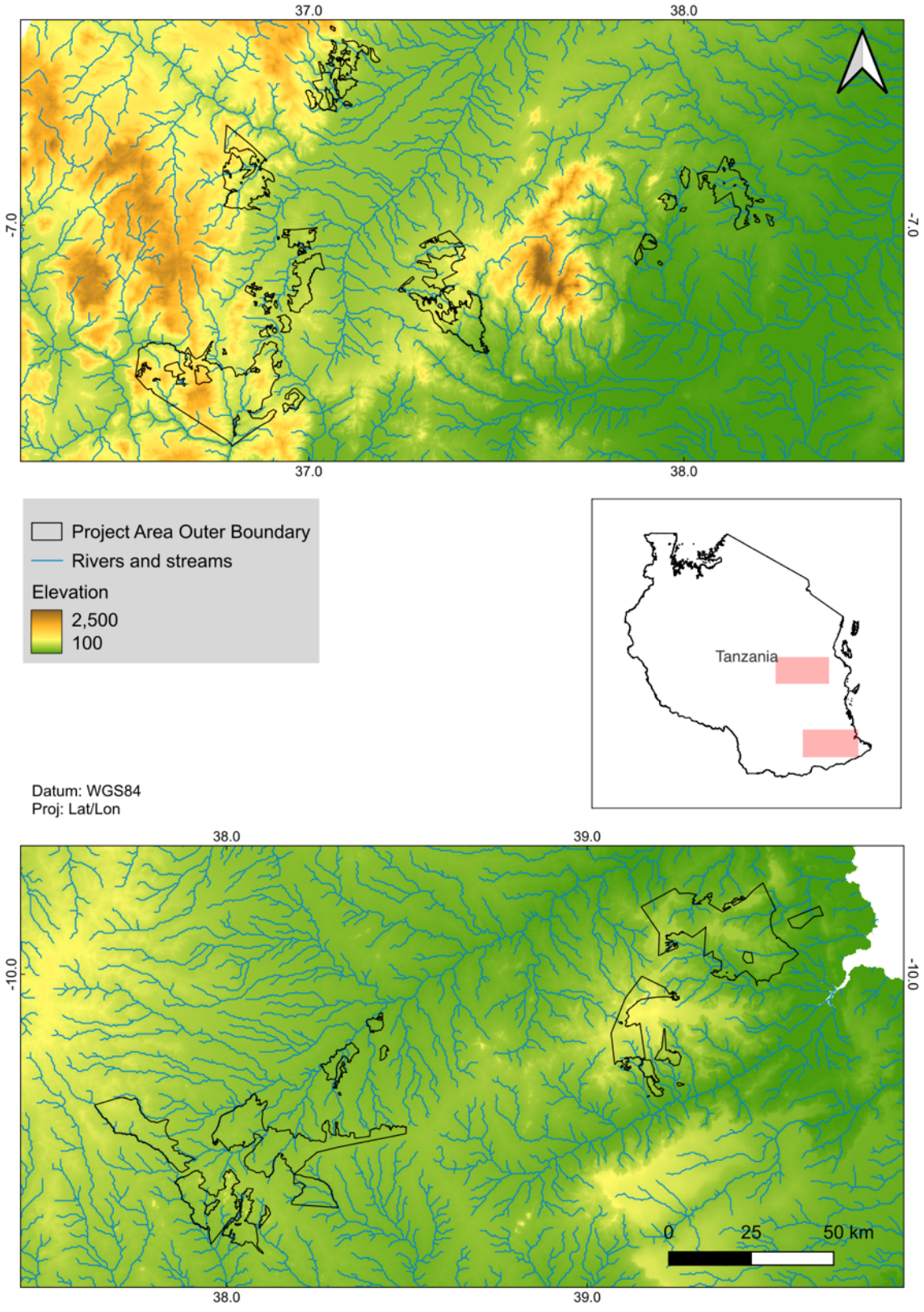


Figure 2 Elevation and Hydrology

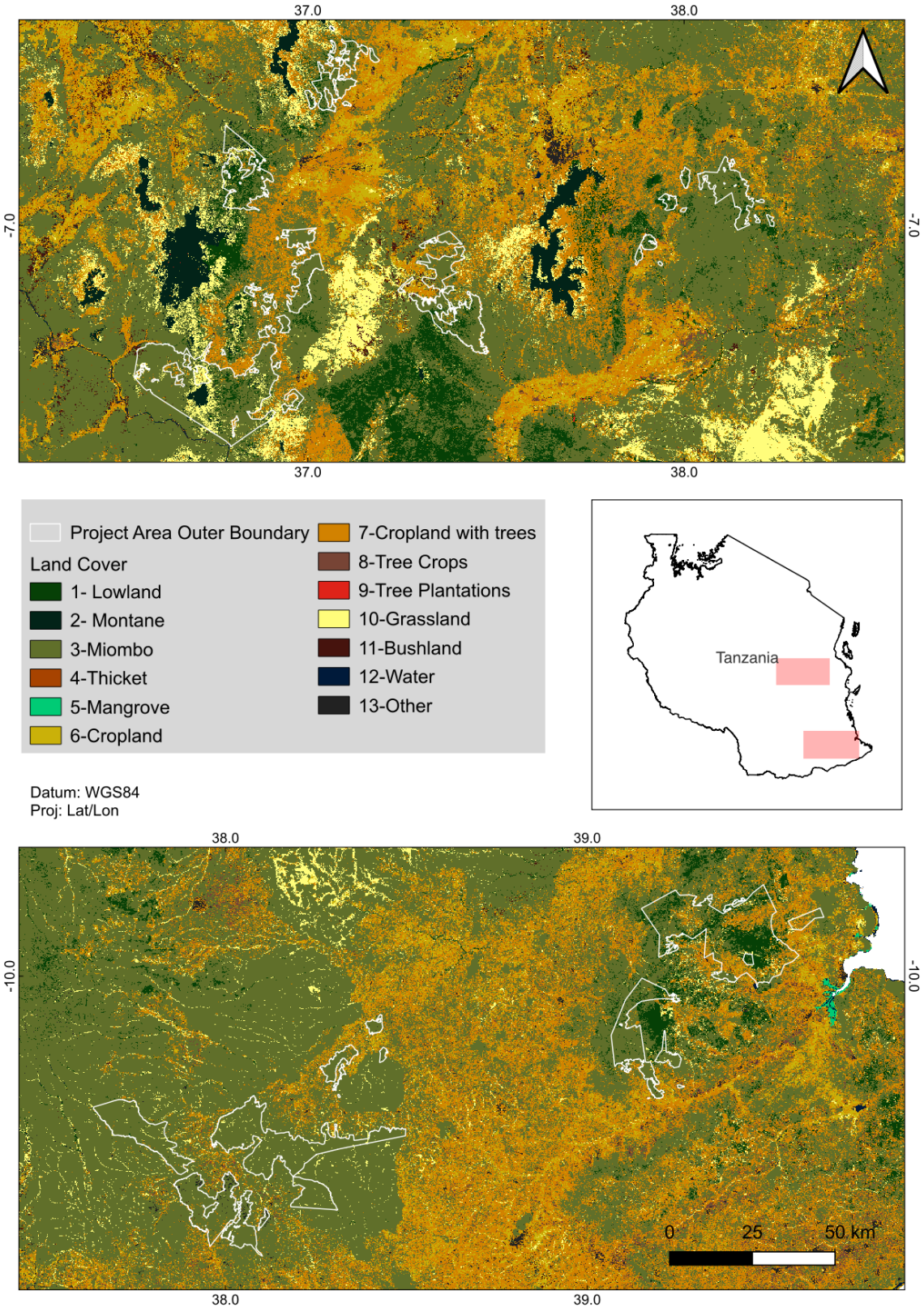


Figure 3 Vegetation types in the project area

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

Main settlements: The main settlements where communities reside near the project areas are the village centers of participating project villages, which are shown in Figure 4, Figure 5, and Figure 6. Most people reside in or near village centers because this is where social services are provided. According to forest patrol data, only 3.5% of forest disturbance agents reside farther than 10km from the project area.

Demographics: The project area comprises 36,827 households with 145,609 people (76,232 female, 69,327 male), including 84,545 adults and a working population of 70,058 (48%). Approximately 19,749 households (54%) with 68,251 people (47%) live in sub-villages adjacent to the village land forest reserves[11].

Ethnic groups: The communities in the project area predominantly speak Swahili and consist of diverse ethnic groups, each with unique cultural practices and traditions. The ethnic composition of the project area reflects the broader diversity found across Tanzania. In Lindi, more than 90% of the population belong to the Wamwera tribe, although a few villages are predominantly Wamakonde. Other notable tribes in Lindi include the Wandendeule and Wayao. Kilosa is known as the land of the Sagara and Kaguru, with Maasai, Gogo, Vidunda, and Hehe historically inhabiting certain areas. In Morogoro Rural, the Luguru dominate, with Maasai present in some villages.

Migration patterns: Forest patrol data from the project area shows people move around in the landscape, but mostly not very far. 69% of disturbance agents were either born in a project village or neighboring village and due to the nature of the questionnaire, that number may be even higher when factoring in people coming from neighboring villages where the project area is on the border of a district or regional boundary. 65% of disturbance agents have resided in their current village of residence for at least 10 years and 73% for at least 5 years. The project is gathering residence length data for all community members are part of the benefit sharing system, but this data was not yet complete a validation. It is likely that the proportion of recent migrants for all community members is lower than among disturbance agents since they are more likely to have existing farms outside the project area.

Land tenure: Land in the project area is primarily under the jurisdiction of village governments, with decisions made through the Village General Assembly as stipulated by the Village Land Act (1999). Villages in the project area have various land use categories, including areas for permanent agriculture, settlement, public services, grazing, village land forest reserves for sustainable use, forests for unrestricted use, and areas for slash-and-burn agriculture. These are

[11] Demographic data were collected by project team, through sub village leaders and villages executive officers who usually keep this kind or records in the village offices. Data was collected during the same day the project was introduced to the village council and general assembly to obtain consent letters.

interspersed with housing, investment, mining, water resources, and other uses. When considered together, aside from agriculture, public services, and settlement areas, most of the other land use types in many villages are related to forestry or potentially compatible with forestry. For example, in the latest Land Use Plan for Matekwe village in Nachingwea, 53% of the village land is designated for forestry or compatible uses or has potential for forestry expansion. This includes water resources, mountainous and rocky areas, tree plantations, mining zones, investment areas, unrestricted forests, a Wildlife Management Area, the Village Land Forest Reserve, and grazing land. The remaining 47% is allocated for agriculture.

While individuals hold land through customary tenure within villages, few possess formal Certificates of Customary Right of Occupancy (CCROs). There are only 18 villages (30%) participating in the project which had begun issuing CCROs in 2024, mostly with support from TFCG and MJUMITA. A total of 4,973 households held CCROs: 879 female-headed (18%), 3,057 male-headed (82%), and 30 households with people living with disabilities. Communities in the project area perceive land tenure as secure, where 51% consider it "well secured," and 49% "somehow secured[12]."

Community Well-being: In 2024, 3,570 households (10%) received livelihood support through TASAF, 65% of which were female-led. A total of 35,552 households (72%) had iron-sheet roofs, benefiting 97,509 people (64%)[12].

Agriculture: The project had not yet provided extension services, but baseline data show typical farmers cultivated up to 5 acres. Of 60 villages/mitaa, 21 (36%) received basic services from LGAs. Fertilizers were used by 45% and manure by 9%. About 6% accessed VICOBA loans, but no farmers had insurance. There were 736 cases of crop damage by problem animals, affecting 3,312 farmers and 1,481 acres, with an estimated 48% yield loss. All 2,501 farmers interviewed expressed interest in extension services[12].

Socio-economic Activities: Assessments conducted during land use planning and socio-economic surveys in the project areas reveal that over 99% of households are engaged in farming activities, supporting the statement that "at least every family has a plot of farm," with at least 75% involved in cash crop production. Other livelihood activities include forestry, fishing, employment, animal husbandry, and small-scale entrepreneurship. The most cultivated crops are maize, cashew nuts, sesame, cassava, pigeon peas, sorghum, and paddy. Horticultural crops are also prominent, especially in Mvomero villages in the Morogoro region. Common farm animals in the project area include cattle, goats, sheep, and poultry. Between February 2023 and June 2024, over 91% of the patrolled areas experienced deforestation, primarily due to crop farming, while 4% was attributed to charcoal production and the remaining 5% was due to other drivers such as fire which are also driven by agriculture.

[12] VCSL 2024 CCB survey data

There is variability in the ownership of livelihood assets across households. The most common assets are pesticide sprayers, wheelbarrows, motorcycles, radio, hand hoes, and bicycles. May households use hand hoes for farming, with some transitioning to tractors, ox-ploughs, and power tillers, mostly through renting.

More than 95% of households use firewood for cooking, and 36% use charcoal or a combination of both. However, there is a slight shift towards using kerosene, and Liquefied Petroleum Gas (LPG) especially by immigrants or civil servants over recent years. In terms of lighting, around 20% of households use electricity, while solar power usage is as high as 80%. Some households also utilize rechargeable and non-rechargeable lead-acid batteries[12].

Education: In 2024, there were about 7,794 secondary-school-age youth; 2,443 (31%) were enrolled. Of the 13,015 tertiary-age youth, only 427 (3%) were in tertiary education. Patrol data (Feb 2023–June 2024, 4,276 people) found that 96% of forest clearers had only primary or no education: 64% had primary, 32% none. Just 3.6% had secondary, and 0.4% had tertiary education. [12]

Primary Education: In 2024, primary schools enrolled 26,595 pupils (13,464 girls, 13,131 boys). A total of 3,742 pupils were expected to complete school: 1,796 girls and 1,656 boys. A total of 2,965 pupils completed: 1,557 girls and 1,408 boys—an 85% completion rate (86% girls, 84% boys). Lindi's first performance-based payments improved facilities in four schools, benefiting 1,818 children, including 753 girls. [12]

Lower Secondary Education: There were 5,266 students enrolled (2,764 girls, 2,502 boys). About 1,759 were expected to complete school (833 girls, 926 boys). In total, 905 students completed (477 girls, 428 boys)—a 58% completion rate (57% girls, 59% boys). [12]

Upper Secondary Education: There were 1,785 students (562 girls, 1,213 boys). Of these, 1,267 were expected to complete school (355 girls, 912 boys), and 934 actually graduated (311 girls, 623 boys)—a 74% completion rate (89% girls, 68% boys). [12]

Vocational Education (VETA): There were 890 students (293 females, 597 males). Of the 925 eligible to complete, only 48 did so (17 females, 31 males)—a 7% completion rate (5% females, 9% males). [12]

Lower College Education: There were 1,702 students (723 females, 979 males). Of the 715 enrolled to graduate, 415 completed (189 females, 226 males)—a 58% completion rate. [12]

Higher Education: There were 1,845 students (495 females, 1,350 males). Among 98 students set to graduate, 61 did (20 females, 41 males)—a 62% completion rate (65% females, 61% males). [12]

Health: No health investments were made during this period, but baseline data were collected. In 2024, 1,391 households (4%) in 36 villages had health insurance, benefiting 4,991 people (2,794 females, 2,197 males), including 71 PWDs and 55 children under five. [12]

Water: Baseline assessments showed 279 villages had piped water serving 12,872 households (35%), and 289 households (6%) used rainwater harvesting tanks. Piped water was unavailable for an average of 3.35 months yearly. [12]

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

Project zone maps for the current project instances are shown in Figure 4, Figure 5, and Figure 6. The project zones consist of the project area and leakage management area depicted in the maps. These areas have been uploaded to the verra registry as a kml. The main population centers for each project community are also shown. The project areas consist of the areas labeled as forest within the diagonal hashed project area polygons. These forests are all at least 10 years old. The project leakage management areas are where farm extension services will be targeted when the area is part of an existing farm clearing and not part of a protected area. Forests with high conservation values for biodiversity noted in section 5.1.2 area labeled in red. There are no areas with offsite climate impacts, stakeholders, or biodiversity impacts.

Due to scale limitations, the maps do not show the full extent of potential new project instances. As described in section 2.1.6.1 of the PD, new project instances before transition to VM0048, must fall within the reference region described in section 1.1.1 of the methodological annex and depicted in Figure 1. After transitioning to VM0048, new instances can be anywhere in mainland Tanzania meeting the other eligibility requirements specified in section 2.1.6.1 of the PD.

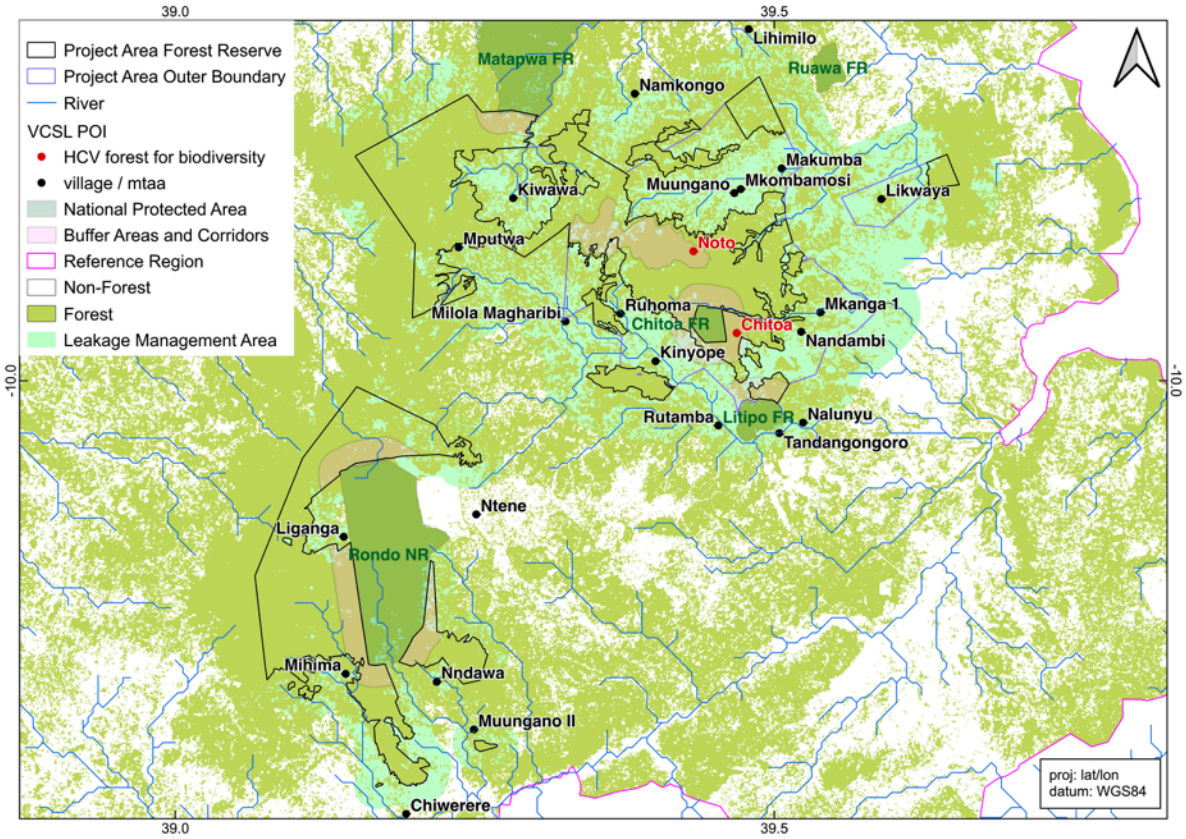


Figure 4 Project Zone in Lindi Municipality and Mtama District

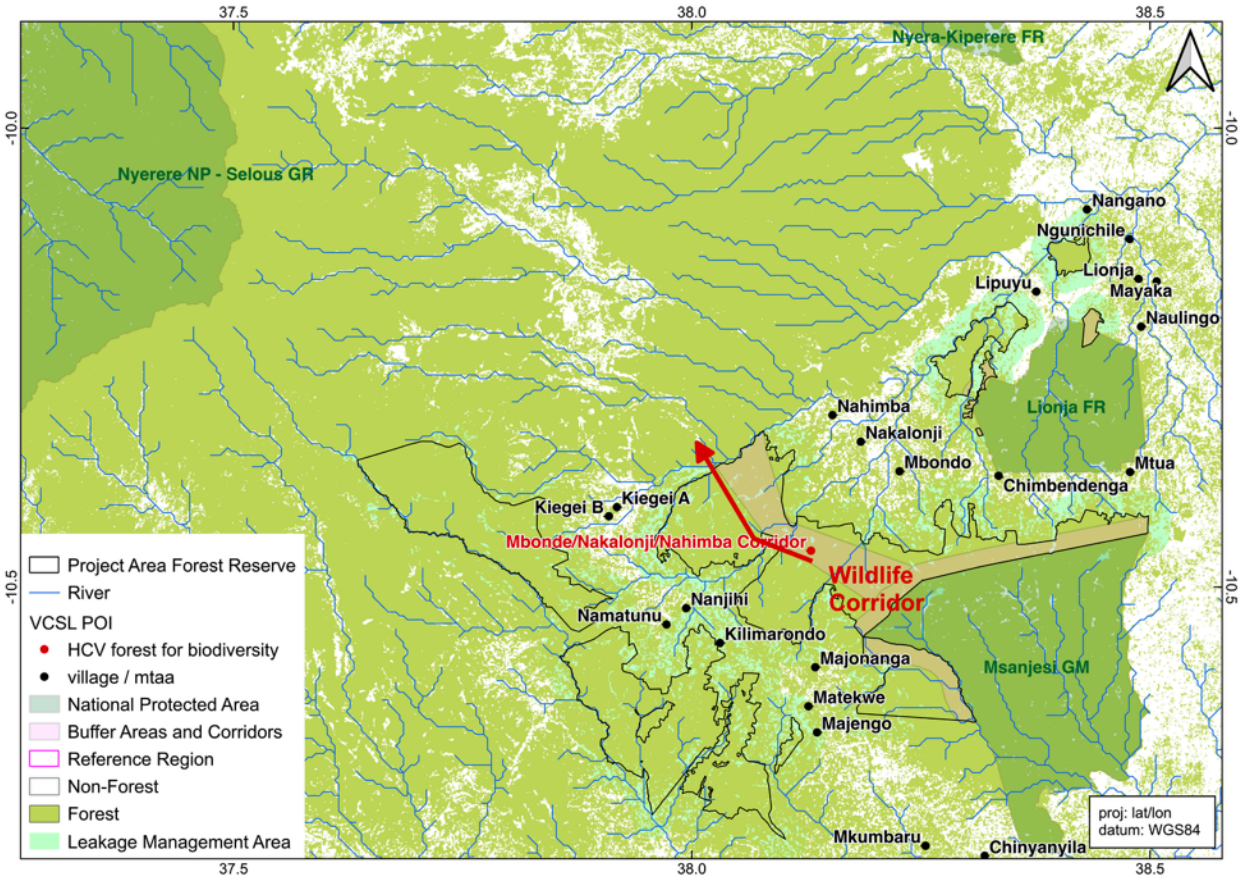


Figure 5 Project Zone in Nachingwea Districts

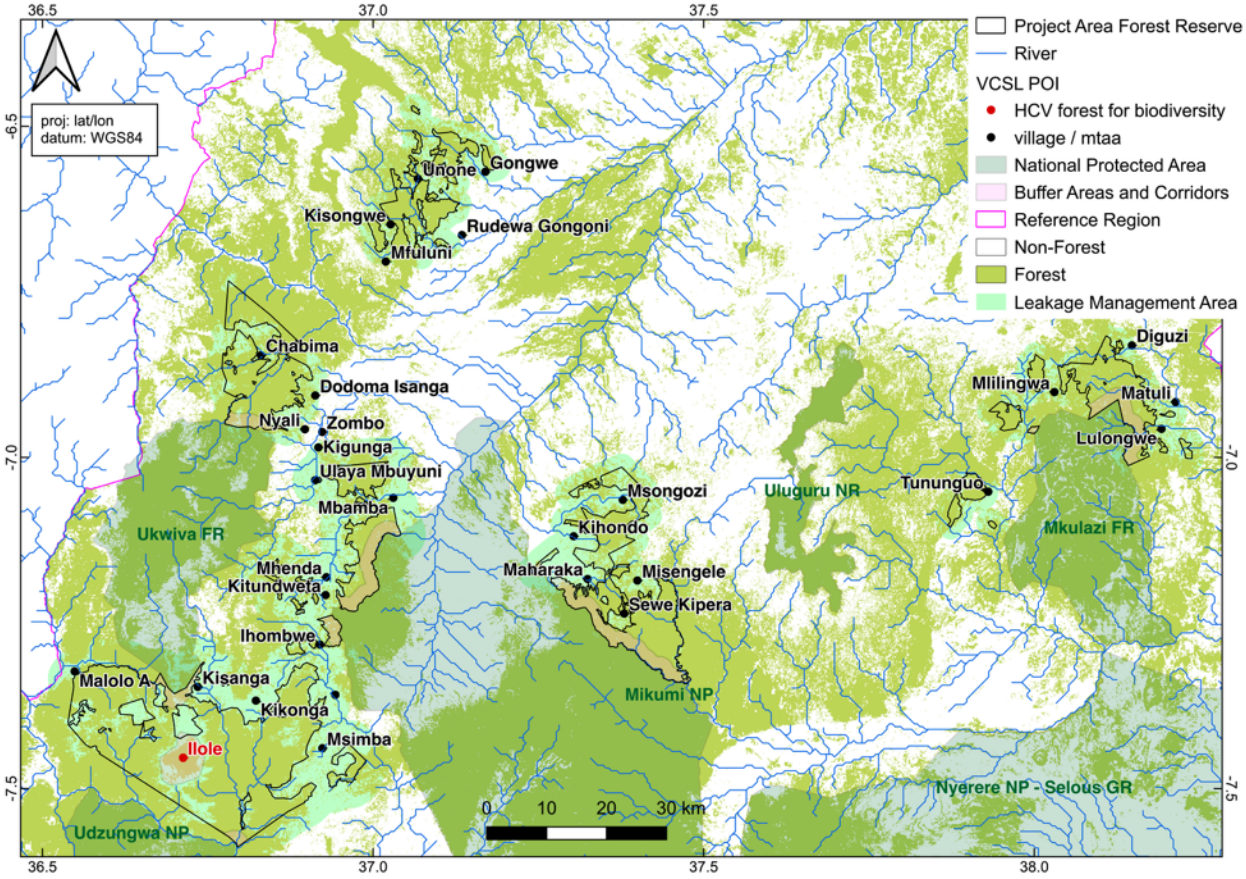


Figure 6 Project Zone in Morogoro, Mvomero, and Kilosa Districts

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

To meet the project objectives the following activities will be implemented.

Free, prior, and informed consent (FPIC)

Village Climate Solutions Limited (VCSL) has already obtained consent letters from the 60 participating communities which were submitted to the Designated National Authority during registration of the Project Idea Note. To get the consents, VCSL started by introducing the initiative to district and village councils. VCSL worked with the District Forest Officers to introduce the project idea in the 54 village councils and 6 Mitaa leaders attended by 1,610 members (507 female,1,103 male and 259 youth), followed by village general assemblies of the same villages attended by 5,456 community members, (2,270 female, 3,186 male and 886 youth) in Nachingwea, Mtama, Lindi *Municipality*, Mvomero, Morogoro Rural, Mikumi Township, and Kilosa Local Authorities. Through these meetings, VCSL presented basic requirements, procedures for project registration and benefit sharing outlined in the national carbon trading regulations and discussing risks, and opportunities of joining the project. VCSL obtained consent letters enclosed with village council and general assembly meeting minutes. Further, VCSL has consent letters to work with two Local Authority Forest Reserves (based in Lindi Municipality and Kilosa District) and

has facilitated establishment of 5 CBOs in Lindi Municipality and Mikumi Township, which will also participate in the project, by managing gazetted community forests on Municipal Land. This has allowed VCSL to continue to build REDD+ awareness in the Managing Authorities, develop project activities, register the project with the Designated National Authority, and come to terms for a long-term contract. Similar procedures will be applied to the potential expansion areas in Kilolo, Ulanga, Malinyi, Liwale, Rufiji, Tunduru, Kilwa and Ruangwa. On 11 May 2024, the proponent received a letter with reference number UDC/ADM/N.10/17/VOL/65 from Ulanga District, and on 19 June 2024, a letter with reference number LW/DC/F.20 Vol XI/51 from Liwale District, requesting the expansion of the project to the Village Land Forest Reserves, Wildlife Management Areas, and Local Authority Forest Reserves in those districts. This indicates the preliminary consent of these Local Authorities, which are within the geographical reference region of the project, to collaborate with Village Climate Solutions Limited.

Next, the proponent initiated the process of signing long-term contracts with participating Managing Authorities. The initial draft of the long-term contract was created on February 6th and 7th, 2024, with contributions from 12 Legal and Forest Officers (2 female and 10 male) from the Nachingwea, Mtama, Lindi Municipality, Mvomero, Morogoro Rural, and Kilosa Local Authorities. This draft underwent a detailed review from May 22nd to 24th, 2024, by 15 Legal and Forest Officers (5 female and 10 male) from the President's Office – Regional Administration and Local Government (PO-RALG), Vice President's Office – Division of Environment (VPO-DoE), Lindi and Morogoro Regional Secretariats, and the respective Local Authorities.

Between February and June 2024, VCSL presented the draft contract at Village Council meetings attended by 1,815 members, comprising 549 women, 1,266 men, and 183 youth. This was followed by Village and Community-Based Organization (CBO) general meetings attended by 4,939 members, including 1,744 women, 3,195 men, and 891 youth. Additionally, VCSL participated in Local Authority meetings attended by 589 Councilors and Council Management team members (164 female and 425 male) from Nachingwea, Lindi, Mvomero, Morogoro Rural, and Kilosa. In all these meetings, the progress report for the project and the carbon trade contract was presented and approved for signing. Final revision maps of the old and new Village Land Forest Reserves (VLFR) were also approved.

The contract is multi-party for each local authority, encompassing all managing authorities within that jurisdiction. It defines stock-flow payments to the managing authorities, based on their success in reducing deforestation within their forest reserves relative to the nested baseline prediction, as well as the carbon stocks of those reserves. Benefit and cost-sharing will follow regulation 34 outlined in GN 636 published on October 28th, 2022, and the amendments specified in regulation 20 of GN 721 published on October 6th, 2023. These contracts will last 40 years, with options for renegotiation as needed. VCSL has established a grievance reporting system and meets with each village annually to review village performance, address, and resolve any grievances. The same FPIC procedures will apply for the expansion areas.

Adjusting and remarking village forest reserve boundaries

Between 2022 and 2023, village forest patrol teams using a cloud-based platform verified that over 90% of deforestation in the project area resulted from slash-and-burn agriculture. Additionally, more than 77% of the individuals involved in clearing activities were unaware that they were operating within the reserve boundaries. The proponent made detailed analysis of the identified project area to identify areas with encroachments or potential for VLFR expansion. The analysis identified about 20,034 hectors with significant encroachments into forest reserves due to lack of enforcement/awareness or in some cases due to farms existing before a VLFR was established. VCSL has worked with districts and villages to adjust and remark boundaries which lead to reduction of these heavily deforested patches form the VLFRs. VCSL has also identified areas where small adjustments to VLFR boundaries align them with natural features on the ground or roads. In addition, the proponent has also looked for opportunities to expand VLFR boundaries so that more forest edge is captured within the VLFRs thereby expanding the amount of threatened forest within the project area and increasing potential village earnings. VCSL identified about 97,918 hectares potential for expansion to areas initially designated for grazing, protection of water sources, beekeeping, and uncompleted establishment wildlife management area. All these steps, combined with enhanced forest patrols described below aim to make the forests in the project area easier to protect, thereby reducing deforestation and forest degradation.

The project has begun developing boundary cutline maps for areas adjacent to high deforestation threats and those lacking clear physical boundary markers, such as rivers or roads. Cutline maps for 19 villages, encompassing 859 clearing blocks and covering 789 km (about 490.26 mi), have already been developed. Extension agents hired by the project started supervising the clearing of boundaries around Village Land Forest Reserves (VLFRs) during the dry season from September to November 2023. The project employed 566 community members (527 male and 39 female) to create cutlines covering 709 blocks, equivalent to 507 km. Prior to commencement of the boundary clearing activity, the project obtained approval of the plan from the respective village general assemblies, attended by 1,321 community members, comprising of 446 female, 875 male, and 241 youth in 14 villages. Boundary clearing involves slashing all vegetation in a 3-meter-wide swath around the outside boundary of VLFRs, avoiding any trees with a diameter of 20 cm or greater at breast height. This effort focuses on areas lacking physical features such as roads, rivers, or topographic markers to delineate boundaries. Boundaries shared with other forest reserves are not cleared and will be covered over the whole project area. These activities will also be implemented in the expansion areas.

Developing and/or Updating Forest management Plans

The proposed changes to the forest boundaries need to be approved by the decision-making bodies of the respective managing authorities before they can become official. Additionally, Forest Management Plans (FMPs) must be updated to reflect these changes and ensure the long-term protection of the forests.

The project team facilitated the Village Natural Resource Committees (VNRCs) and village councils in developing new Forest Management Plans (FMPs) and bylaws where they did not previously exist or updating them as needed. These FMPs must then be approved by the village council meeting, followed by the general assembly. When bylaws are updated or newly developed, they are submitted to the District Council for approval.

Villages adopt the final documents to manage their Village Land Forest Reserves (VLFRs). The District Forest Officer (DFO) registers the VLFRs in the District Registry, as provided in the National CBFM Guideline 2007. Final revision maps and new Village Land Forest Reserves (VLFRs) and Local Authority Forest Reserves (LAFRs) for the current project area were also approved along with the carbon trade contract as described above. The same process will be adopted for the expansion areas.

Restructuring the Managing Authorities

Based on the proponent's previous experience of Community-Based Forest Management, the company has identified factors which may necessitate restructuring of the Managing Authorities.

Splitting of Villages: It is expected that some villages might split in the future, or sub-villages within participating villages might be upgraded into separate entities. New villages may find themselves outside the Project Area, rendering them ineligible for VLFR status if they lack substantial forests within their new village land. In some cases, two new villages might be compelled to share the VLFR or divide it so that each village will have to manage its own block independently. An example of this is Majengo village in Nachingwea, which was formed from Matekwe village and necessitated to divide a portion of Matekwe forest among the two.

Municipalization: The expansion of existing townships or municipalities, or the creation of new ones, may encompass the Project Area, leading to the dissolution of the respective Village Councils. For example, the Mkanga 1 and Nandambi Village Council which were previously managing their Village Land Forest Reserves, ceased to exist due to the expansion of Lindi Municipality.

Where deforestation is caused by people from neighboring villages: I This occurs when the village center of the forest-owning village is distant from the forest edge being deforested by a neighboring village. For example, people from Ugogoni sub-village in Mbamba have been deforesting the edge of Mhenda Village Land Forest Reserve.

Addressing such a situation would likely require collaboration between communities, and local government authorities, and the project, to re-structure the managing authorities by:

Establishment of Community Based Organizations (CBOs): These organizations will be empowered to manage the gazetted community forests within municipalities or townships through Joint Management Agreements, in accordance with Section 16 of the National Forest Act CAP 323 of the Laws of Tanzania.

Formulation of JMA agreements between villages: In cases where specific villages are identified as responsible for managing a particular VLFR, JMA agreements can be developed based on Section 33 (i) (c) of the Forest Act.

Between September and December 2023, the proponent facilitated the establishment of five Community-Based Organizations (CBOs) in Nandambi and Narunyu (streets) and Rutamba (village) in Lindi Municipality, as well as in Msimba and Ihombwe (hamlets) in Mikumi Township, Kilosa District. In the process a total of 27 meetings were held, attended by 1,054 people, including 327 women, 727 men, and 180 youth. The meetings' agenda comprised of awareness rising and obtaining community resolutions to establish these CBOs, developing CBO constitutions and election of CBO leaders. The CBOs will sign Joint Management Agreements (JMAs) with the respective local authorities, enabling communities to manage and benefit from the forests in the same manner as village councils would do. A similar approach will be adopted throughout the project as the need arises.

Technical support for forest protection activities

The project does not use armed patrols as part of forest protection or property surveillance activities. Forest protection activities are implemented through community-led approaches involving Village Natural Resource Committees' patrol teams operating under village by-laws and participatory forest management frameworks.

The project applies a non-violent conservation approach and does not authorize the carrying or use of firearms, the use of deadly force, forced evictions, intimidation, or coercive enforcement measures during project implementation. Consequently, the project does not provide training on the use of weapons and does not maintain protocols governing the use of firearms or deadly force.

Forest protection is primarily expected to be achieved through community awareness and sensitization of deforestation agents, participatory governance, boundary management, and carbon incentives to forest owners, aiming to promote voluntary compliance and long-term stewardship of village land forest reserves.

The proponent has equipped each Managing Authority with Android smartphones for forest patrol teams. The project has implemented a monthly monitoring system for forest reserves, utilizing a cloud-based GIS platform to share the location of any new deforestation incidents with patrol teams. Training has been provided on smartphone usage for navigation to specific locations and recording patrol data.

A total of 454 patrol team members, 30% females and 28% youth, received training on this technology. Patrol teams sync their smartphones when network access is available to identify new deforestation areas and navigate to them. They record and upload patrol data via the same cloud-based platform.

Forest monitoring and patrol data feed into dashboards that enable Managing Authorities to monitor performance in real-time and track offenders. Patrol data also serves as a metric for compensating teams, encouraging regular patrols. This technology will be replicated in the future expansion area.

Funding for forest management activities

The project has initiated efforts to revitalize village natural resource committees and forest patrol teams, transitioning from input-based to outcome-based patrols. Initially, the project funds village patrol teams, transitioning later to requiring villages to budget for annual patrol activities from their forest-based earnings, potentially with technical support from district authorities.

Extension agents coordinate with forest patrol teams to provide technical assistance in using mobile phones for planning patrols. They conduct follow-ups on new and previously detected deforestation areas not yet visited by patrol teams. Furthermore, extension agents provide guidelines for applying for direct financing of patrols from the project. Allowances and transportation funds are provided for patrol team members, district forest officials, and motorcycle rentals upon reasonable requests submitted by forest patrol teams in response to deforestation threats identified by the project's monitoring system.

As of June 2024, the project had supported over 721 patrols, covering more than 4,853 newly deforested patches. During these patrols, culprits were identified in 69% of cases, educated, and warned against further clearing activities. Culprits caught repeating the offense are fined or reported to the police for further legal action if they persist

Facilitate Gazettement of Village Land Forest Reserves

To enhance tenure security of Village Land Forest Reserves (VLFRs) in Tanzania, they are gazetted by the Ministry of Natural Resources and Tourism under section 35(6)(b) of the Forest Act CAP 323 of the laws of Tanzania. Currently, 35 out of the 54 VLFRs in the project area have been gazetted through Government Notices number 487 dated 26/06/2020 and number 688 dated 28/08/2020. The remaining reserves are designated as declared VLFRs under sections 32 and 33 of the Forest Act, CAP 323 of the laws of Tanzania. As described in previous activities, efforts have been made to re-define forest boundaries, removing encroachments and expanding reserved areas to include lands compatible with forestry and carbon trade. This necessitated updates to existing maps of both gazetted and declared VLFRs. In instances such as Nachingwea, support was provided to villages in establishing new VLFRs. Moving forward, the same approach will be considered for the Local Authority Forest Reserves (LAFRs) and Wildlife Management Areas, where there is a need to review or complete the gazettement order. The proponent will assist Managing Authorities in applying for revised gazettement orders to reflect updated maps, or in the case of new reserves or existing ones awaiting gazettement, to secure their gazettement for the first time.

Performance based payments

Annual REDD+ payments to Managing Authorities will be based on performance. The project will use a stock-flow accounting model whereby a certain percentage of the credit income due to forest owners is divided depending on each owner's performance compared to a spatially explicit baseline less any leakage in the part of the leakage belt closest to that owner. Then, to discourage leakage between forest owners, the remaining percent will be divided based on the relative proportion of total project carbon stocks each owner holds less any emissions above the baseline emissions including emissions above baseline from the leakage belt for each owner. MJUMITA tried this system in the previous Lindi REDD+ project, where it demonstrated results in payments that villages felt were fair and provides a strong incentive to all participating villages to prevent deforestation. The system was discussed and accepted in all villages, along with the carbon trade contract. VCSL will present the basis for each village's payment in an assembly meeting with maps showing the location of ongoing deforestation in the village and calculations showing how much money the village lost as a result.

Flexible village benefit sharing.

Building on experience from the previous Lindi REDD+ project, VCSL will work with local authorities to help villages develop an improved version of the benefit sharing system. The Lindi REDD+ project's benefit sharing system was based around treating all villagers as an equal owner of the village forest reserve and as such entitled to equal dividends. Each year, villages compile households lists against residence eligibility criteria specified in their own bylaws or regulations. Then they divide the amount of money they received from REDD+ projects by that number to calculate a per person dividend. Then they discuss in a village assembly meeting how much they wanted to cut from those dividends to spend on previously discussed village development projects and forest protection. The remainder is be paid out as dividends with each resident coming to collect and sign their dividend in front of their sub-village general meeting. The system was efficient and effective at both delivering monies and creating a community wide incentive for conservation. The system also enhances accountability over community development projects since the funds for the projects come directly out of community members pockets rather than from donor funds or rents.

The VCSP will rework the system in consultation with communities, local authorities and other stakeholders. One objective will be to come up with a per ha figure or per threatened ha figure of funds that villages will set aside for forest protection activities as a priority. This would be used principally to pay for regular forest patrols. Then, the project would also look for the system to encourage villagers to fund village development activities that will have the greatest chance of creating long term change that favors forest conservation. VCSL believes increasing secondary school attendance and completion is particularly important. The opportunity cost study showed that cutting forests for farming is primarily driven by growth in the older and less educated population in the region. Small holder farming isn't something that young people want to do. They would much prefer to be engaged in business or be employed. Higher rates of secondary school attendance would help more of them do that.

Farm extension services

Between February 2023 and June 2024, 87% of the individuals encountered by the patrol team across 4,853 patches that were deforested between 2022 and 2023 in the Village Land Forest Reserves expressed interest in participating in agricultural extension services aimed at enhancing productivity. The proponent has employed 4 Extension Agents who are serving Nachingwea; Mtama and Lindi Municipality; Mvomero and Morogoro Rural; and Kilosa Local Authorities. It will hire more officers as it continues to expand. These Officers are provided with a motorcycle and fuel to provide extension services.

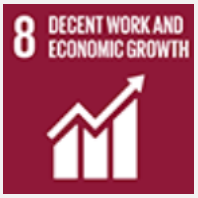
At the start, the officers are working closely with district forest officers, to help villages implement patrol technology, resolve administrative problems within the VNRCs, and supervise VLFR boundary markings. Then, the officers will provide advice to farmers on farm inputs, and conservation agriculture techniques that work in their area. They will also teach farmers about techniques and technologies to reduce crop losses to wild animals, which is a major challenge for many villagers. The extension agents will also help farmers organize to be eligible for finance from external sources such CRDB bank's Green Climate Fund supported loan fund targeted at promoting climate adaption for small-holder farmers in Tanzania. Increasing village yields by as little as 1% annually will make up for the agricultural production forgone for forest conservation and prevent any market leakage.

2.1.18 Sustainable Development Contributions (VCS, 3.17)

The project aligns with multiple SDG indicators by implementing forest management plans, reducing deforestation, and generating carbon credits that support community development and climate resilience. Activities like boundary adjustments, patrol technology, and creating new forest reserves enhance biodiversity, safeguard critical water sources, and promote educational access. Through benefit-sharing mechanisms, the project ensures inclusive governance, empowering women and marginalized groups. Additionally, farm extension services improve productivity, food security, and access to health services, contributing to better economic stability and equitable access to resources for all community members.

 Indicator 13.2.2	Re-marking Forest boundaries, reviewing forest management plans, reviving managing authorities, and implementing cloud-based forest patrol technology will reduce deforestation and forest degradation. This reduction directly contributes to decreased greenhouse gas emissions, resulting in the generation of saleable carbon credits. The revenue from these sold credits is reinvested in forest protection and community development projects, further enhancing climate resilience.

 Indicators 15.1.1, 15.2.1, and 15.5.1	Activities such as adjusting forest boundaries, reviewing management plans, reviving local forest management authorities, utilizing patrol technology, and creating new forest reserves contribute significantly to biodiversity conservation by reducing deforestation and forest degradation. This conservation initiative within the project's geographical area enhances the ecological connectivity of key national parks and game reserves, including Mikumi, Udzungwa, and Nyerere National Parks, as well as Selous, Msanjesi, and Niassa Game Reserves, all of which are vital for biodiversity. Moreover, it is part of the globally recognized Coastal Forests of Eastern Africa Biodiversity Hotspot and the Eastern Arc Mountains, which are home to endemics and threatened species.
 Target 6.1 Indicator 6.1.1	The operationalization of Forest Management Plans including implementation of cloud-based platforms for forest patrol technology, adjusting forest boundaries, and establishing new community forest reserves, the project protects critical water sources and maintains watershed health. These efforts reduce deforestation, resulting in improved forest conditions and supporting clean water availability and sanitation through preserved ecosystem services. This contributes to the conservation of nationally important catchment areas, safeguarding critical water resources for the Ruvuma, Rufiji, Ruaha, Mikumi, and Ngerengere Rivers. Additionally, the anticipated carbon revenues are expected to be used by some management authorities to improve water supply to the participating communities.
 indicator 4.1.2 and 4.3.1	The benefit-sharing mechanism adopted by the project will help villagers embrace more forest-friendly livelihoods and provide funding for village development projects. By advocating for villages to prioritize the improvement of education facilities, the project aims to enhance educational opportunities. This will enable more young people to access secondary and tertiary education, empowering them to move away from the laborious and unreliable practice of shifting cultivation. These efforts contribute to ensuring equitable access to quality education for all community members, supporting their personal development and readiness for future opportunities in a sustainable manner.

 (SDG 5.5)	Facilitating community benefit-sharing mechanisms promotes inclusive governance, ensuring that women and marginalized groups participate in and benefit from REDD+ activities. The dividend system of benefit-sharing will entitle women to collect shares on behalf of all dependents in their households and support projects with inclusive benefits, such as water supply, health, and conservation farming. This approach fosters gender equity by empowering diverse community members and ensuring equitable benefit distribution.
  SDG 1.4 and SDG 2.4)	Providing farm extension services to enhance farm productivity and implementing community benefit mechanisms that improve social services or provide dividends to families significantly enhance community well-being. These activities contribute to improving access to essential health services by boosting income and food security through improved agricultural output. They also reduce the financial burden of health care expenses on households by enhancing social services and living conditions. Overall, these efforts support better health outcomes and economic stability within the community. Through these initiatives, our project directly aligns with the SDG target of ensuring that all men and women, particularly the poor and vulnerable, have equal rights to economic resources. By increasing agricultural productivity and providing financial benefits, we empower communities with economic resources and secure access to basic services. Additionally, our focus on enhancing farm productivity and community benefits promotes ownership and control over land and property, sustainable use of natural resources, and access to new technology and financial services. Thus, our efforts contribute to the broader goal of achieving economic equality and improved living conditions.
 (SDG 8.5)	The project contributes to SDG 8.5 by creating employment opportunities linked to implementation of forest protection, governance strengthening, boundary management, community patrols, monitoring activities, and climate-resilient livelihood interventions. Most of these opportunities are short-term and activity-based, involving participation in patrols, boundary clearing, trainings, meetings, and other project-supported activities. For monitoring and reporting purposes, these temporary employment opportunities are aggregated and expressed as Full-Time Equivalents (FTEs) to estimate

	the project's overall contribution to productive employment, local income generation, and sustainable non-forest-clearing-based economic opportunities for participating communities, including women and youth.

2.1.19 Implementation Schedule (CCB, G1.9)

The following table outlines key dates and milestones in the project's development and implementation, including introductory meeting dates, start and end dates for each project activity, the GHG accounting period, the monitoring schedule, and the verification schedule

Date	Milestone(s) in the project's development and implementation
April – May 2010	Introductory meetings, FPIC activities, training and establishment of monitoring system for first project instance
June – September 2010	Initial village and sub-village consultation meetings on REDD. Consent provided by communities for MJUMITA and TFCG to proceed with REDD readiness activities.
November 2011 – February 2013	Trial payments were made to participating communities for having completed REDD readiness activities including land-use and forest management planning.
21st April 2012	Start date for the Monitoring and Verification of the 1st instance of the project with 10 Village Councils in Lindi Municipality.
March 2014	First round of performance-based payments made
May – June 2013	MoUs between communities and MJUMITA signed giving consent to MJUMITA to proceed with the validation and verification process with VCS and CCB.
Dec 2014	Top-up performance-based payments made
June 2015	First verification completed
4th September 2022	Start date for Introductory Meetings and basic training on REDD and VCSL Model to Local Government Authorities in the project area.
8th November 2022	Start date for Introductory meetings about REDD and VCSL model to obtain consent letters, as well as baseline data collection at village council level in the project villages.
9th February 2023	Start date for implementation of the village forest patrol technology using cloud-based platform developed by the project.

13th October 2023	VCSL submitted application documents for registration of the project idea note to the Designated National Authority.
22nd January 2024	VCSL obtained an official call from the Designated National Authority, to submit the Project Concept Note and pay the registration fee.
5th February 2024	Start date for discussing the carbon trade contract with stakeholders followed by obtaining approval of the Village Council, Village general Assembly and Local Government Authorities.
5th March 2024	Signing deeds of partial release, deeds of accession and communication agreement between the proponent and 10 first instance villages originally registered under MJUMITA Community Forest Project (Lindi).
28th April 2024	The proponent submitted Project Concept Note to the Designated National Authority for project registration.
29th May 2024	Village Climate Solutions Limited obtained VERRA account with ID 8183.
5th September 2024	VERRA Approved the transfer of MJUMITA Community Forest Project (Lindi) with Account ID 1325, Previously registered by MJUMITA with ID 1442, to Village Climate Solutions Limited ID: 8173
9th September 2024	Start of VCS only verification for monitoring period April 21, 2013 – April 20, 2022
20th September 2024	The proponent obtained Letter of No Objection from the Designated National Authority, allowing the project to proceed with development of the Project Document.
18th October 2024	Signing of the Carbon trade Contract with Managing Authorities in , Nachingwea, Mtama, Lindi Municipality, Kilosa, and Morogoro DC
25th October 2024	Submission of the first draft of the 2nd Instance Project Document to the Designated National Authority.
April – December 2025	Developing FMPs, bylaws and Joint Management Agreements between Local Authorities and CBOs.
November 2024	Start of verification for monitoring period April 21, 2022 – June 15, 2024
January 2025	Developing benefit sharing guidelines for communities in each participating village
January – December 2025	Gazettement or review of the gazettement Order for all the participating villages

January 2025 onwards	Expansion to new areas within the geographical reference region in Liwale, Ulanga, Kilolo, Malinyi, Rufiji, Tunduru, Masasi, and Nanyumbu.
Monthly	Monthly Forest Patrols
May – July	Yearly boundary clearing
July to December	Yearly verification and issuance from 2025 - 2060
July to December	Yearly Community meeting to present Monitoring, and Verification Reports
January - June	Issuance and payments to communities from 2025 - 2064
Monthly	Regular Agricultural Extension Services from November 2025
Once per baseline validity period	Reassess forest and post-deforestation carbon stocks
20 April 2064	End date of the project's crediting period
May – November 2064	Final verification and issuance for monitoring period from June 16, 2060 – April 20, 2064.

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

The table below outlines the likely natural and human-induced risks to the expected climate, community, and biodiversity benefits throughout the project's lifetime. It also describes the measures that have been or will be taken to mitigate these risks.

Since armed patrols are not used, the project does not anticipate risks or negative impacts associated with armed enforcement on stakeholders, local communities, or workers. Stakeholder engagement processes have consistently communicated the project's community-led and non-coercive approach to forest conservation.

Identified Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed and designed to mitigate the risk
Governance issues within the Managing Authorities	Weak governance Structures or poor community participation in decision-making processes may result in elite capture, where benefits from the REDD+ project primarily accrue to a small group of individuals. Limited transparency and accountability in project management can	Implement a comprehensive grievance monitoring and reporting system, conducting annual meetings with each Managing Authority, addressing the grievances and Forster resolutions.

	undermine trust and legitimacy within communities.	
Boundary conflicts.	Conflicts can manifest in various forms and intensities, posing significant challenges to the successful implementation of REDD+ initiatives and threatening community cohesion, sustainable forest management efforts, and the achievement of project objectives	Promote gazettement of the forests under the project area or issuance of title deeds to reduce conflicts. Facilitate boundary clearing to enhance visibility
Continuing deforestation or above baseline in the leakage belt	This risk undermines the objectives of the project, aimed at reducing emissions from deforestation and forest degradation, as well as conserving and enhancing forest carbon stocks	Promote outcome-based forest patrols using patrol technology, facilitate farm extension services, and promote climate-smart technologies to improve productivity.
Forest degradation due to resource extraction	It compromises the carbon sequestration capacity, biodiversity value, and ecosystem services provided by forests, undermining the objectives of REDD+ initiatives aimed at conserving and enhancing forest carbon stocks for generating carbon credits.	Insist on the sustainable use of timber and non-timber forest products within the project area, restricting harvesting to no more than 1% of the standing tree biomass annually
Excessive late dry season fire or fire in areas that are not fire adapted	Uncontrolled fire in non-fire adopted areas threatens ecosystem integrity and carbon sequestration capacity.	Creation of fire lines, controlled burning practices and education and awareness campaigns
Municipalization of the project area	The expansion of existing townships or municipalities, or the creation of new ones, may encompass the Project Area, leading to the dissolution of the respective Village Councils. Consequently, management of the village land forest reserve becomes ineffective.	Create community-based organizations to manage the gazetted community forests within municipalities or townships through Joint Management Agreements.
Expropriation of project land by	This action disrupts project activities, undermine community ownership and	Promote gazettement and promote Joint Management Arrangements (JMA) between

government or urban elites	trust, and compromise conservation efforts, potentially	communities and Local Authorities and Private entities.
Changes in policy	This risk entails shifts in government regulations, and laws, that could affect the project's ability to generate and sell carbon credits. For example, alterations in carbon pricing mechanisms or national forest conservation policies may impact the project's revenue streams and its capacity to meet emission reduction targets. Additionally, uncertainties in policy can undermine investor confidence, hinder project scalability, and ultimately jeopardize the project's efforts to reduce deforestation and generate revenues for communities.	Monitoring contemporary issues related to carbon trade serves as a critical mechanism for navigating policy dynamics that impacts on carbon trading activities. The project will strive to anticipate changes in the regulatory landscape and adjust their strategies accordingly to ensure compliance and continuity of the project.
Market changes	Market changes can affect the project's revenue streams, making it difficult to secure buyers for carbon credits or achieve favorable prices. Additionally, uncertainties in the carbon market can impact investor confidence and the project's financial sustainability, potentially undermining its ability to meet emission reduction targets and support community development goals.	The project will thrive to secure a long-term buyer as a crucial mechanism for managing market dynamics. This approach will involve establishing stable, enduring relationships with buyers committed to offsetting their carbon emissions sustainably

2.1.21 Benefit Permanence (CCB, G1.11)

Sustainability is affected by stakeholders having the incentive, capacity, and external network of support to continue with an initiative. All of these have been enhanced as part of the project development process and will be further enhanced during the Project Lifetime. In terms of incentive, the implementation of the activities aimed at achieving the climate, community, and biodiversity benefits will be led by the local communities. The project design reflects the priorities identified by the communities and has been carried out with a commitment to free, prior, and informed consent. The communities are the primary beneficiaries of the water and other ecosystem services provided by the current and potential project areas. This provides a long-term

incentive for maintaining the forests and their concomitant climate, community, and biodiversity benefits.

In terms of capacity, TFCG and MJUMITA, and then VCSL spent years preparing the communities to take on these responsibilities through training and by facilitating processes such as village land use planning, securing village land certificates, village boundary resolution, and establishment of community-based forest management. Their technical and legal capacity to maintain forest cover has increased, and by embedding these processes into existing government procedures and structures, a framework is in place to encourage these skills to be handed down to the next generation.

Similarly, by aligning the REDD-related activities such as land use planning and CBFM with existing processes, they are also embedded into existing government support structures. The processes provide a legal basis for conserving the forest and corresponding climate, community, and biodiversity benefits beyond the project lifetime. The communities will also be receiving back-stopping from VCSL throughout the project lifetime. As the project lifetime comes to an end, VCSL will assess what is needed to sustain the project's multiple benefits and will assist the communities to seek the support that they need to sustain these. Given national and international interest in the high biodiversity values of the forest, we consider it likely that national and international conservation organizations will prioritize this area for support even after the Project Lifetime.

Additionally, the project activities will help to transform the local economies which will reduce reliance on expansive agriculture in the long run. The agricultural extension services will shift communities towards more intensive practices where less land can produce more value. Providing communities with income while constraining deforestation, will also help diversify local economic activities towards those that are compatible with forest conservation. Finally, by increasing access to secondary school education the project will empower future generations to choose between a broader set of livelihood options, which may in many cases involve moving to urban areas and thereby lessoning demand for land-based economic activities.

2.1.22 Financial Sustainability (CCB, G1.12)

Village Climate Solutions Limited (VCSL) employs a financial mechanism to provide both immediate and long-term funding security, enabling project activities to be carried out smoothly, these include:

Advance Sales of Carbon Credits: long-term agreement with off-takers will secure advance payments, ensuring a continuous flow of funds. These payments cover up-front expenses and fund key project components, such as forest conservation activities, community engagement, and biodiversity monitoring. The agreement guarantees a base price with an agreed annual inflation rate, furthermore a share surplus revenue from the sale of carbon credits after operational costs and any funding repayment.

Reinvestment of Carbon Credit Revenues: Revenue from Verified Emissions Reductions (VERs) is reinvested into project areas to cover operational costs, including forest protection costs, expand activities, and strengthen infrastructure for monitoring, reporting, and verification (MRV). A percentage is allocated for reserve funds to cover unforeseen expenses and maintain financial stability.

Community Revenue Sharing: At least 51% of revenue is distributed to local communities, aligning with CCB requirements to incentivize local stakeholders' support for conservation goals and community development initiatives. VCSL has contracts with managing authorities meeting the minimum requirements of the National Carbon Trading Regulations. However, VCSL plans to pay a higher percentage of revenue when required to meet the opportunity costs to the stakeholders. Furthermore, when market conditions allow, VCSL will distribute additional revenue to the community as part of Corporate Social Responsibility (CSR) to support the conservation goals and community development initiatives.

Projected Funds Flow

10-Year Projected financial flows for the project ensure continuity over its lifetime and are backed by conservative assumptions on carbon credit sales, as shown in the table below.

Year	Carbon Credits Sold (tCO2e)	Carbon Credit Price $/ton	Revenue $
2025			
2026	693,055	6.62	4,586,196
2027	441,099	6.87	3,028,886
2028	454,803	7.04	3,199,960
2029	459,751	7.21	3,314,805
2030	450,556	7.39	3,328,781
2031	441,361	7.58	3,343,310
2032	441,361	7.77	3,427,168
2033	441,361	7.96	3,513,234
2034	693,055	8.16	3,601,506

By combining advance sales, reinvested carbon credit revenue, and long-term off-take agreements, the project is well-positioned to achieve climate, community, and biodiversity

benefits over its lifespan. These funds ensure ongoing implementation, aligning with VCS and CCB goals.

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 project is a REDD project which does not generate any GHG emissions for the purpose of their subsequent reduction, removal or destruction. Prior to the initiation of project activity instances, 100% of the project area was natural forest at least 10 years old. This is documented in section 1.1.2 of the methodological annex. Most of the project area is old-growth forest which had no particular human land use prior to the initiation of the project instances. Some of the project area was natural forest managed for selective timber harvesting, and natural forest managed for sustainable charcoal production. All of these land-uses continue under the project. The project's activities focus on preventing the change of land-use from forest to agriculture. The present climate, hydrology, topography, soils, vegetation, and ecosystem types in the project area at the project start are described in section 2.1.14 of the PD. Since the project area is natural forest, the present and prior environmental conditions are the same. Additional detail about the biodiversity of the different forest types in added in sections 5.1.1 and 5.1.2 of the PD.

The list of potential land use scenarios most likely to occur in the project zone in the absence of the project are described in detail in sections 2.1 and 2.2 of the methodological annex. Section 2.2 of the methodological annex provides details on the drivers and agents of land-use change in the absence of the project.

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

The most likely land-use scenario in the project area in the absence of the project is conversion from forest to small-scale crop cultivation and to a lesser extent medium scale commercial cultivation. This is justified in detail using version 3.0 of VT0001 Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities in section 2.1 of the methodological annex.

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

Barriers to the implementation of the project activities in the absence of the project are detailed in section 2.1 of the methodological annex. That section also demonstrates that most of the with-out project land-use change would have been legal in the absence of the project, but also that illegal land-use change in common practice due to low levels of enforcement.

The community benefits are contingent on the generation and sale of emissions reductions from avoided deforestation and thus would not occur in the absence of the project. Likewise, the biodiversity benefits are contingent on avoiding deforestation that would occur in the absence of the project. More detail on the threats to biodiversity in the with-out project scenario are detailed in section 5.1.3 of the PD.

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

The project is a pilot project for the Sustainable Development Verified Impact Standard (SD VISta). As such, the project is exploring the possibility of using biodiversity benefits to generate offsets distinct from the project's climate benefits. However, this is currently only at the exploratory stage as no buyers for biodiversity offsets have yet been identified.

2.3 Safeguards and Stakeholder Engagement

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

The identification of stakeholders likely to be impacted by the project was based on over 30 years of the proponent's experience in community-based forestry in Tanzania, as well as insights gained from the previous MJUMITA Community Forest Project in Lindi. This process also included a thorough literature review and extensive consultations with various stakeholders

Experience of the Proponent: The process of identifying stakeholders likely to be impacted by the project was rooted from the proponent's extensive experience in the project area. With over 30 years in the region and 12 years of specific experience in community-based forestry and carbon trade, the proponent has developed a comprehensive understanding of stakeholders at village, local authority, and national levels.

Literature Review: To systematically identify stakeholders, the proponent conducted extensive literature reviews and analyzed existing documents, policies, and reports related to community-based forest management, carbon trading, and environmental conservation in Tanzania. This review included examining Village Land Use Plans and Village Forest Management Plans and bylaws where intensive stakeholder mapping is undertaken during their development. Also, another key document reviewed was the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022 (GN 636 published on 28/10/2022), and its (Amendment) Regulations, 2023 (GN 721 published on 6/10/2023), where key stakeholders in carbon trade are well defined. Others include the Forest Act CAP 323 of the laws of Tanzania, and the Local Government Act CAP 287. Finally, the stakeholder mapping was developed from the previous Project Document and the monitoring report on the MJUMITA Community Forest (Lindi) which were reviewed to capture the main stakeholders.

Consultation: The Tanzania Forest Conservation Group (TFCG) carried out detailed stakeholder consultations during the development of the National CBFM Action Plan (2022), which was also an essential phase in the project design. TFCG facilitated the Ministry of Natural Resource and

Tourism to develop this national action plan. These consultations involved direct engagement with various stakeholders to gather insights and identify those likely to be impacted by the project. Additionally, stakeholders involved in forestry activities, beyond TFCG, were mapped during introductory meetings with Local Authorities and village councils as part of baseline data collection efforts. This inclusive approach ensured that a broad range of stakeholders, particularly those working directly with local communities, were identified and considered in the project's planning and implementation stages.

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

The project has identified key stakeholders with distinct roles and interests, critical to its success. Communities owning Village Land Forest Reserves (VLFRs) are central, acting as both managing authorities and primary beneficiaries of carbon credits. Residents within VLFRs and leakage belts are vital for reducing deforestation and are targeted for agricultural extension services. Carbon revenues will benefit young girls and boys as villages are encouraged to prioritize secondary education. Village Councils oversee VLFR protection and ensure that revenues support community development, while Village Natural Resource Committees (VNRCs) handle daily forest management. Seven Local Government Authorities (LGAs) provide technical support and help enforce by laws, sometimes also serving as Managing Authorities. Future expansion may include Authorized Associations that own Wildlife Management Areas. Five registered Community-Based Organizations (CBOs) are expected to collaborate with local authorities through Joint Management Agreements to manage forests in municipalities and townships. National institutions like the President's Office, Regional Administration, and Local Governments (PO-RALG) provide policy oversight, and the Vice President's Office (VPO) serves as the Designated National Authority to ensure compliance with carbon trading regulations. Non-governmental Organizations (NGOs) such as the Tanzania Forest Conservation Group (TFCG) and MJUMITA, support conservation, while the University of Dar es Salaam (UDSM) integrates climate education into forest management and serves as Managing Authority for its forest block in Lindi. Additionally, forest user groups, both legal and illegal, play a significant role in resource use. Carbon credit buyers and offtakes are crucial for securing markets for the project's carbon credits. More details are provided in the Stakeholder Description Table (see Appendix 1)

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

Project documentation, including project descriptions and monitoring reports, will be made accessible through multiple channels throughout the project's duration. Full reports will be available on the Village Climate Solutions Limited website, which is currently under development. These documents will also be shared via email with local authorities and national stakeholders. Each Local Authority will maintain a file for archiving project documents for reference. Additionally, a Swahili-translated summary will be printed and archived at the Village Office. The project has specific file in each village office where summaries of the project reports and related

guidelines are achieved. Summaries are also presented during Council Management Meetings, Village Council Meetings, CBO Meetings, and general assemblies.

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

The Village Climate Solutions Project (VCSL) has translated a summary of the project document into Swahili, outlining the objectives, expected benefits, and associated risks to ensure that community members are well-informed. This summary was shared with Local Authorities via email and printed copies were disseminated to each participating village. VCSL also presented the summary in meetings with the respective village councils and general assemblies. These meetings provided a platform to explain the project in detail and engage with community members.

Once monitoring results are available, VCSL will similarly translate the summary into Swahili, highlighting key facts and figures specific to each managing authority. In line with its contractual obligation outlined in Clause 14.3, the project will attend village meetings to present these results. The information will be shared using maps and detailed data displayed on flip charts, making it easy for communities to understand. The results will focus on progress in achieving project goals, including carbon income, improvements in social services, and conservation outcomes. Village leaders, village committees, and patrol groups will also receive the results through the project's WhatsApp groups, ensuring widespread dissemination.

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

Informational meetings with local communities were conducted to establish and register project activities and gather baseline information essential for developing the project document. The introductory meetings for the Village Climate Solutions Limited (VCSL) project began in September 2022, targeting the President's Office, Regional Secretariat, and Local Government Authorities (LGAs) in the Lindi and Morogoro regions. These sessions provided foundational training on the REDD project and included key local stakeholders, such as Council Management Teams (CMT), District Commissioners, and Executive Directors. The project team held a series of meetings to secure consent from village councils for REDD+ project registration. They also trained patrol teams to combat deforestation and supported the establishment of Community-Based Organizations (CBOs) for forest management. Furthermore, the team facilitated the drafting and approval of carbon trade contracts with LGAs and village authorities, culminating in the endorsement of the project's carbon trading framework at both village and LGA levels. The details of the informational meeting are as follows.

Introductory Trainings at President's Office, Regional Secretariat and Local Government Authorities level.

The project began with an introductory meeting with the Lindi Regional Administrative Secretary (RAS) on September 5, 2022. This was followed by a series of Council Management Team (CMT) meetings, accompanied by the Regional Natural Resource Officer. These meetings were held in

Lindi Municipality, Mtama, Ruangwa, Nachingwea, Liwale, and Kilwa District Councils between September 5 and 9, 2022. A total of 195 members attended, comprising 36 females and 159 males. The CMT meetings highlighted the need for more capacity building for CMT members and requested introductory meetings with councilors before VCSL began engaging with the villages.

Following the CMT meetings in Lindi, the project team conducted training sessions on the basics of the REDD project for CMT members in Kilwa, Lindi Municipality, and Nachingwea in October 2022. These sessions were attended by 80 members, including 15 females and 65 males. Additionally, meetings with councilors were held in Liwale, Ruangwa, Nachingwea, and Lindi Municipality, attended by 134 members, comprising 35 females and 99 males.

On October 3, 2022, the project team had an intensive discussion with the Lindi District Commissioner to secure his consent to start engagement with 10 villages in the municipality. Subsequently, October 31, 2022, the project team met with the District Executive Director, Village Executive Officers, and Ward Executive Officers from the potential project areas to obtain consent to begin engaging with the 6 villages in Mtama District Council.

On January 31, 2023, VCSL conducted an introductory meeting at the President's Office, Regional Administration, and Local Government, attended by five officers. In the Morogoro region, the project was introduced in a technical meeting organized by the Regional Administrative Secretary on February 23, 2023. This meeting was attended by 26 participants, including 9 females and 17 males, comprising the Council Chairperson, District Executive Directors, District Commissioners, and District Forest Officers from Malinyi, Ulanga, Morogoro Rural, Mvomero, and Kilosa. Furthermore, the project conducted introductory meetings with the district natural resource departments and executive Directors in Kilosa, Mvomero and Morogoro District Councils before starting engagement with the villages.

In general, the introductory meetings covered introduction to Village Climate Solutions Limited (VCSL), highlighting its background, experience, and capacity to design and implement REDD projects in Tanzania, as well as its specific model for such projects. The meetings also addressed the impacts of climate change, its linkage with CO2, trees, and emission reductions through reducing deforestation and forest degradation. Basic mathematics around the calculations of carbon credits under the REDD framework were explained, along with the basic requirements for implementing REDD projects and the opportunities available in Lindi and Morogoro. Additionally, national regulations for carbon trading and the procedures for project registration were discussed. After these series of meetings at Local Government Authority, Regional and national Level, the project started to engage with the villages.

Obtaining Consent Letters from the Participating Villages

After introductory meetings and training at the Local Government Authority levels, the proponent began engaging with the villages. A total of 60 community meetings and 1 Authorized Association meeting were conducted, attended by 1,610members, including 507 women, 1,103 men, and 259 youth. Through these meetings, the proponent introduced the company, its work model and

experience, its commitment to collaborating with the respective Managing Authorities to design and implement a carbon trade project through the REDD+ mechanism, and the envisaged benefits for the village.

Additionally, participants had the opportunity to discuss the maps of the existing village land forest reserve (VLFR) or wildlife management area, the existing threats, and potential expansion or reduction areas. Following these discussions, the Village Councils and the Ndonda AA meeting authorized the Executive Officer to draft a consent letter to allow the registration of the project idea note. The Consents letters were subsequently approved by the respective village general assemblies, which were attended by 5,456 people, comprising 2,270 women, 3,186 men, and 886 youth.

Meeting for introducing Patrol technology and data collection

The patrol technology was introduced to the village councils and general assembly during the introductory meetings as part of the proponent's proposal to the Managing Authorities to collaborate on reducing deforestation and forest degradation. Subsequently, a total of 454 patrol team members, including 136 females, 318 males, and 126 youth, received practical training sessions on using this technology. Smartphones equipped with closed-based technology for implementation were provided to the teams.

The patrol teams were tasked with conducting thorough surveys of proposed expansion and reduction areas, documenting potential changes and details using Point of Interest (POI) and Tract of Interest (TOI) tools in the mapping software. Additionally, between February 2023 and June 2024, the teams were facilitated to conduct patrols in 4,853 patches deforested between February 2022 and Dec. 2023. Among these, individuals accused of recent deforestation within the reserves were found in 4,276 patches. They were informed about the new REDD initiative and warned against further deforestation. It was emphasized that the intention was not to evict them but to encourage compliance with conservation efforts.

Meetings for Establishment of CBOs

Between September and December 2023, the proponent conducted a series of meetings with Local Authorities and communities in Nandambi and Narunyu (streets) and Rutamba (village) based in Lindi Municipality, and Msimba and Ihombwe (vitongoji) based in Mikumi Township, Kilosa District. The main agenda of these meetings was the legality of managing authorities for the existing Village Land Forest Reserves (VLFRs), in the municipality and townships where there is no village council as a managing authority, but the Municipal/Township Council acts as a corporate body instead.

It was resolved that the existing VLFRs would be transformed into Local Authority Forest Reserves (LAFRs) as provided by Section 4(b) of the Forest Act (CAP 323 of the laws of Tanzania). Community-Based Organizations (CBOs) would be formed and would sign Joint Management Agreements (JMAs) with the respective Local Authorities, as provided in Section 16 of the Forest

Act (CAP 323 of the laws of Tanzania). These JMAs would entitle the CBOs to manage the forests and retain benefits equivalent to those which would have been obtained by village councils.

Five CBOs have been established and registered, and a JMA has been drafted. A sum of 27 meetings attended by 1,054 people, comprising 327 women, 727 men, and 180 youth were conducted in the process of establishing these CBOs. A total of 545 members, consisting of 196 females and 349 males, reside in 385 households, with 54 headed by females and 331 by males have been registered as members of the Community-Based Organization (CBO). They live within the forest or at least 300 meters from the forest edge. The mean and median age of these members is 47 years. Their education levels comprise 41% with no formal education, 53% with primary education, 3% with secondary education, and 1% with tertiary education

Meetings to Obtain Approval of the Revision Maps and boundary clearing

Between the 8th and 19th of September 2023, 14 village general assemblies were conducted to obtain approval for the VLFR boundary revisions and boundary clearing work plan. The meetings were attended by a total of 1,222 people, comprising 418 females, 804 males, and 220 youth under 25 years. Between the 8th of August and December 2023, a total of 536 community members (39 women and 499 men) were engaged in creating cutlines, covering 323.39 acres in 14 villages.

Meetings to Obtain Resolutions for Ndonda Wildlife Management Area.

The project conducted a GIS analysis of forest cover status in the Ndonda Wildlife Management Area (WMA). Over the past 15 years, the original WMA area has declined by 51%, from 73,554 hectares stated in the WMA's constitution to 36,156.76 hectares currently available for potential REDD+ projects. A total of 29,993.96 hectares are potential Village Land Forest Reserves (VLFRs) for seven villages in Nachingwea.

The WMA area was significantly reduced due to agricultural encroachment and overlaps with Msanjesi Game Reserve and two VLFRs in Nahimba and Majonanga villages. Since the WMA was proposed 15 years ago, it has not been formalized, and recent follow-up with the Ministry between May and August 2023 did not result in substantial progress towards granting statutory wildlife user rights to communities as required by Section 32 of the Wildlife Conservation Act No. 5 of 2009. Discussions with Nachingwea Local Authority and WMA leaders during this period led to a consensus to protect the remaining woodlands within Ndonda WMA by adopting a community-based forestry approach and registering it in carbon trading.

On September 9, 2023, the proponent introduced this alternative pathway and REDD+ initiatives to the WMA secretariat and chairpersons of the nine member villages in a meeting attended by 21 stakeholders (3 women, 19 men, and 3 youth). The meeting resolved to allow individual member villages to issue consent letters for including WMA areas in the REDD+ project registration. Between September 10 and 14, 2023, the project obtained five consent letters from Matekwe, Nahimba, Mtua, and Chimbendenga, villages. The consents were issued by the village

council and Village Natural Resources Committee (VNRC) meetings and endorsed by village general assembly meetings.

Additionally, the project obtained consent letters from three other WMA member villages, namely Kilimarondo, Majonanga, and Mbondo. These villages have been declared VLFRs apart from the WMA area. The project supported the villages in implementing community-based forestry, including boundary marking, participatory forest resource assessment, preparing sustainable harvesting plans, developing forest management bylaws, and Forest Management Plans (FMPs), which were approved along with the carbon trade contract.

Informational Meetings on Carbon trade contract drafting.

On February 6th and 7th, 2024, the project held a meeting with 12 Forest and Legal Officers (2 female and 10 male) from Lindi Municipality and the Nachingwea, Mtama, Mvomero, Morogoro Rural, and Kilosa District Councils to draft a carbon trade contract between the proponent and the Managing Authorities. This was followed by another review meeting from May 22nd to 24th, 2024, attended by 5 female and 10 male participants, including the Carbon Trade Coordinator and legal officers from the President's Office – Regional Administration and Local Government (PO-RALG), Vice President's Office – Division of Environment (VPO-DoE), Lindi and Morogoro Regional Secretariats (RS), as well as Nachingwea, Mtama, Lindi, Mvomero, Morogoro, and Kilosa Local Authorities. The purpose of this meeting was to align the contract with government guidelines.

Meetings to Obtain Endorsement of contracts at village level

Between February 21st and May 10th, 2024, the proponent, alongside Local Authority Lawyers and Forest officers, conducted meetings with 60 communities to obtain approval for the Carbon Trade Contract and revised Forest Management Plans (FMPs). The approval process began with Village Council and CBO Meetings attended by 1,815 members, comprising 549 female, 1,266 male, and 183 youth. This was followed by general assembly meetings attended by 4,956 community members, comprising 1,779 female, 3,204 male, and 943 youth. The main agenda of these meetings was to discuss the carbon trade contract, including the final project area, which was subsequently incorporated into the revised FMPs.

Meetings to Obtain Endorsement of contracts at Local Government Authority (LGA) level

Between April 22nd and June 26th, 2024, the proponent participated in Local Authority meetings attended by 589 people (164 female and 425 male). Attendees included a representative from the Regional Secretariat, Council Management Team (CMT) members, ward councilors, and other local authority officers from the offices of the district commissioner and division officers in Nachingwea, Lindi, Mvomero, Morogoro Rural, and Kilosa. Discussions regarding the carbon trade contract in Mtama Local Authorities took place independently of the proponent's participation. During these meetings, the carbon trade contract with Managing Authorities under the jurisdiction of these Local Authorities was approved for signing.

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

Risks, effects and mitigation measures related to the project were identified (see Appendix 3: Project Risks Table). The project has identified risks related to governance, environmental, and social challenges. Corruption poses significant threats to carbon trade revenue management and forest reserve oversight, while elite capture may influence job allocation for patrols and boundary clearing. Additionally, risks of gender-based violence during patrols, exclusion of women, youth, and the elderly from decision-making processes, and the underrepresentation of women in project employment might be prevalent. Individuals living in or near forests might face humiliation or unfair punitive actions from patrol teams or authorities. There could be concerns regarding VNRC turnover and low community participation in meetings. Moreover, boundary disputes, legislative changes, municipalization, internal conflicts, and private sector land acquisitions could further limit community access to forest resources. Environmental risks include soil erosion and habitat disruption resulting from boundary clearing, and increased human-wildlife conflict due to improved forest cover. Lastly, unmet community expectations regarding REDD revenues may foster dissatisfaction and disengagement.

The analysis of the potential impacts of these identified risks on stakeholders, ecosystem health, and biodiversity highlights some critical concerns. Corruption, mismanagement, and misallocation of funds can result in non-performing projects, disincentivizing communities from protecting forests and undermining conservation efforts. This, in turn, may lead to illegal logging and resource exploitation, further diminishing biodiversity and eroding essential community trust, representation, and legitimacy needed for effective deforestation reduction. Additionally, reluctance among VNRCs to participate in patrols may exacerbate deforestation risks and diminish the collective knowledge and skills necessary for sustainable forest management. Inequitable access to resources could weaken community cohesion and reduce participation among women and girls, perpetuating gender inequalities and undermining inclusivity in conservation efforts. Such dynamics may lead to tensions between project activities and the residents, potentially resulting in illegal resource use, habitat destruction, and increased edge effects that compromise ecosystem stability. Continued deforestation may disrupt habitat connectivity, threaten biodiversity, and ultimately demoralize communities, further reducing their motivation to engage in conservation.

To mitigate these potential risks, the project will implement measures focused on transparency, community engagement, and sustainable practices. Effective monitoring and audit systems in collaboration with local authorities will be emphasized, alongside a dividend model for benefit-sharing to enhance accountability and encourage broader participation in community meetings. Safety protocols for patrols will be promoted through comprehensive training and provision of necessary safety gear. The project will also incorporate gender-sensitive protocols, secure reporting mechanisms for incidents, and promote educational initiatives that support the involvement of women and girls. Direct engagement with beneficiaries will ensure transparency in hiring and payment processes. Additionally, the project aims to comply with national legislation, promote land titling, and advocate for joint management agreements that empower communities

in forest management within municipalities and townships. Sustainable practices will be prioritized by limiting biomass harvesting to a maximum of 1% of the standing biomass annually, raising awareness about forest reserves, and facilitating conflict resolution to encourage local stewardship. Regular training will be provided to residents on techniques to mitigate wildlife-related crop losses, complemented by effective monitoring of forest conditions through cloud-based platforms. Finally, the project will focus on market monitoring compliance to standard will be emphasized to sustain the market and secure premium prices.

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

The project effectively provided communities with relevant and adequate information regarding the potential costs, risks, and benefits associated with the REDD+ initiative through a participatory and transparent process. This information was gathered via an opportunity cost survey and discussed during consent and contract negotiation meetings. Findings were visually documented on flip charts, and participants received printed copies of the carbon trade contract for review. Key points emphasized included a commitment to protect forests for a minimum of 40 years and the identification of potential risks, such as governance challenges and market fluctuations. National carbon trade regulations were also printed and disseminated to the villages. The project ensured communities understood that at least 51% of gross revenue from carbon trading would be allocated to them, in line with national regulations. Visual aids, including discussion maps, and patrol maps, facilitated comprehension, ensuring timely and clear communication before communities made decisions regarding project participation.

The following are details of the methods and tools used to ensure that communities received relevant and adequate information about potential costs, risks, and benefits, identified through a participatory and transparent process. This information was provided to the communities in a clear and timely manner before they were asked to make, or consider making, any decisions regarding their participation in the project:

i) Discussion Maps

Discussion maps outlined the boundaries of the Village Land Forest Reserves (VLFRs) and identified potential expansion areas which are compatible with conservation and carbon trade, such as grazing, investments, and water resources. The key message conveyed was that suitable areas for REDD+ included natural forests older than 10 years that are under threat. Besides, the discussion maps highlighted heavily encroached areas that have been consistently farmed, recommending their reduction due to their unviability for carbon trading and susceptibility to conflicts. Additionally, these maps proposed boundary revisions aligned with natural features such as roads, rivers, and mountains, aiding in forest protection. They were printed and shared with village council members or presented via PowerPoint during baseline surveys, patrol technology training, boundary revisions meetings, and the approval of revised Forest Management Plans (FMPs) and carbon trade contracts.

ii) Patrol Maps

Patrol maps, derived from the discussion maps, were uploaded onto smartphones provided to each village. These maps indicated areas of past deforestation (prior to 2022) and new deforestation occurring after the project's initiation. Patrol teams were trained to identify these features and utilize GPS within the Mergin maps to navigate to newly deforested areas. The patrol maps also enabled teams to locate proposed boundary revision areas and report findings to village councils and the general assembly during the approval of revised FMPs and carbon trade contracts.

iii) Patrol Education Forms

The project team developed patrol education forms containing a brief message about the REDD+ project, which patrol teams used to inform individuals responsible for recent deforestation. The message conveyed that the deforested area was part of the reserved land approved by the village for conservation and potential carbon trading. The aim was not to evict individuals but to restrict further clearing of trees older than 10 years within the reserve. Those responsible for clearing were encouraged to contact the village office to obtain farming land in designated areas. Additionally, the project promised future agricultural extension services to help increase productivity without the need for further forest clearing.

iv) Boundary Clearing Maps

Boundary clearing maps enhanced the discussion and patrol maps by indicating areas for creating cutlines, particularly adjacent to farms and settlements. These maps were divided into blocks with calculated lengths and areas, simplifying the tasks of village natural resource committees and extension officers regarding labor allocation, monitoring, and payment administration. The cutline maps allowed communities to visualize the project area and make informed decisions about conservation areas.

v) CBO Membership Registration Maps

These maps assisted communities in Nandambi, Narunyu, Rutamba (Lindi), Msimba, and Ihombwe (Kilosa) in identifying and registering members living within or adjacent to the forests. Registered members include those residing within 350 meters of the forest edge. These community members form the Community-Based Organizations (CBOs) that will sign Joint Management Agreements with respective Local Authorities to manage the forests in the township and municipal land, but which were originally designated as Village Land Forest Reserves. During membership review meetings in Ihombwe and Msimba, communities resolved to include all residents in these areas, recognizing their historical responsibility for managing the VLFRs.

vi) Data Collection Forms

The project developed data collection tools, uploaded to ODK and Mergin maps, to inform village councils and patrol teams about necessary information for developing project documents and guiding informed decisions. These tools include baseline survey forms, carbon inventory forms,

cutline forms, and patrol forms. Village patrol teams and extension agents were trained to collect this information effectively.

vii) Printed Manuals, Flip Charts, and PowerPoint Presentations

The project team prepared PowerPoint presentations outlining the project model, including details about the proponent's experience, the basics of REDD+, major participation requirements, carbon credit generation, and VCSL's implementation model. These presentations were delivered to Local Authorities and Village Councils. Printed manuals with the same information were disseminated to village councils and Village Natural Resource Committee (VNRC) members in participating villages. Carbon trade contracts were also printed and shared with all village council members for thorough review. Flip charts were frequently employed to elaborate on key concepts of the project model.

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

The potential for verification and validation site visits was communicated to the participating Managing Authorities during the initial introductory meetings. This obligation is also outlined in the project contract as part of the proponent's responsibilities. An official notification letter regarding the arrival of External Auditors will be sent to the Managing Authorities at least one week prior to their visit. The purpose of the visit is to verify the accuracy of the proponent's project description and ensure promises are being fulfilled will be communicated. A brief printed notice about the auditors' arrival will also be posted on public noticeboards or designated walls where such announcements are typically displayed, ensuring that the community is informed about the visit.

For future verifications, Managing Authorities will be notified at least a month in advance to allow adequate preparation and information dissemination. To inform the community, Managing Authorities use verbal announcements, a common method in Tanzanian villages Additionally, traditional word-of-mouth communication will be leveraged to spread news of the verification visits within the community, ensuring transparency and understanding.

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

Meetings will be scheduled well in advance with each Managing Authority to inform them of the auditor's upcoming site visit. To ensure timely communication, Managing Authorities will use verbal announcements, a widely practiced method in Tanzanian villages, to notify communities about the visit. In addition, Village Climate Solutions Limited (VCSL) will organize Village General Meetings to provide comprehensive information and address any questions from the community.

To facilitate direct and independent communication between communities, stakeholders, or their representatives and the auditor, the auditor will have dedicated opportunities to meet with them independently, without the presence of VCSL. This ensures that stakeholders can freely express their views and concerns directly to the auditor, promoting open and transparent communication.

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

The following tables describe how communities, including all community groups and other stakeholders, have influenced the project design to be implemented by VCSL. It does not include the stakeholder consultation work done by TFCG and MJUMITA to establish the first project instance in 2012. This is because VCSL redid the stakeholder engagement process in those villages. The tables document consultations and highlight how stakeholder input has shaped the project.

Date of stakeholder consultation	June 8th and June 22nd, 2021
Stakeholder engagement process	Consulted 102 farmers across 10 randomly selected points of deforestation from areas identified between 2017-2020, using a survey questionnaire.
Consultation outcome	Opportunity cost survey report highlighting key findings relevant for project design: Clearing forest for agriculture in the project's geographical reference area is primarily an activity of older individuals. 98% of people farming in the forest have not attained secondary education. Deforestation is predominantly driven by local population growth among the older demographic. The per tCO2e opportunity cost in Lindi was found to be approximately $4.06 per hectare.
Stakeholder input	The project design should focus on collaborating with the local population to address deforestation. Evicting people from the forest should not be the approach for reducing deforestation in the project area. Promoting secondary education and agricultural extension services to improve productivity should be priority activities in the project design.

Date of stakeholder consultation	September 2022 - March 2023

Stakeholder engagement process	Series of introductory and training meetings held with various stakeholders, including Lindi Regional Administrative Secretary, Council Management Teams (CMT), councilors, District Commissioners, District Executive Directors, Village Executive Officers, Ward Executive Officers, and national-level officers form PO-RALG. Meetings conducted in Lindi Municipality, Mtama, Ruangwa, Nachingwea, Liwale, Kilwa, Kilosa, Mvomero, Morogoro Rural, and Dodoma. Total of 440 attendees (95 females and 345 males).
Consultation outcome	Discussions on project introduction, capacity building, REDD project basics, carbon credits, CO2 linkages with forestry, emission reductions, national regulations for carbon trading, and project consent. Emphasis on project risks, costs, and benefits.
Stakeholder input	Stakeholder inputs led to enhanced capacity building for CMT members, incorporation of councilor introductory meetings, and adjustments in project planning based on consent obtained from villages, local and regional authorities. Consideration of Local Authority Forest Reserves in Kilosa and Lindi, and Wildlife Management Areas in Nachingwea and Liwale in the project, which were not there in the initial proponent's proposal, was the major input from these consultations. There was emphasis on continued engagement and clear communication.

Date of stakeholder consultation	February to October 2023
Stakeholder engagement process	Series of 54 Village Councils and 6 Mitaa meetings with total of 1,610 attendees (507 women, 1,103 men, and 259 youth), followed by general assemblies, attended by 5,456 people, comprising 2,270women, 3186 men, and 886 youth. Usually led by the village chairperson and village executive officer as secretary, everything in the same manner they conduct their quarterly meetings. Printed Swahili material provided to all members. Documentation included meeting minutes, attendance lists, and consent letters.
Consultation outcome	Introduced the company, work model, REDD+ mechanism, and benefits. Discussions on VLFR/wildlife management area maps, existing threats, and potential changes. Consent letters were drafted and approved by village general assemblies.
Stakeholder input	Inputs on VLFR/wildlife management area maps, threats, and potential changes were documented and considered. Major recommendation was

	support on forest patrols, provision of patrol equipment, and making cutline along the boundaries of Village Land Forest Reserves. Emphasis on collaboration and ongoing communication with Managing Authorities.

Date of stakeholder consultation	February 2023 - June 2024
Stakeholder engagement process	Consultative meetings with individuals who have encroached the forest reserves: Practical training sessions on the use of patrol technology were provided to 454 patrol team members, including 136 females, 318 males, and 126 youths. The focus was to equip the extension agents and village patrol teams with the skills needed to interact with those who have encroached on the forest reserves, educate them, and listen to their opinions on protecting the remaining trees. Additionally, they were trained to document these interactions using POI (Points of Interest) and TOI (Track of Interest) tools in mapping software
Consultation outcome	Discussions highlighted the risks and benefits of the project, focusing on reducing deforestation and forest degradation. Patrol teams conducted monthly patrols and interacted with encroachers, educating them on the new REDD initiative and encouraging compliance without evictions. Key points of interest, including potential areas for project expansion and reduction, were documented.
Stakeholder input	The project design was updated to include emphasis on both new and previous deforestation areas and emphasize on avoiding eviction. Information on potential expansion and reduction areas was collected and shared with the proponent.

Date of stakeholder consultation	September 2023 - April 2024
Stakeholder engagement process	Consultative meetings were held to secure ownership of the Ndonda Wildlife Management Area (WMA). Meetings included discussions with District Natural Resource Advisory Bodies in Nachingwea, as well as with the Secretariat and chairpersons of the nine member villages forming the WMA. The main agenda addressed challenges such as heavy encroachment, overlaps with protected areas, and the lack of formal user rights for the Authorized Association (AA). The meetings resolved to allow individual

	member villages to issue consent letters for including WMA areas in the REDD+ project registration.
Consultation outcome	Discussions focused on gaining consent for the project design and implementation, as well as evaluating the risks, costs, and benefits of excluding Ndonda. Stakeholders expressed consensus on protecting the remaining woodlands within Ndonda WMA. The meetings also decided to proceed with allowing individual member villages to issue consent letters for including WMA areas in the REDD+ project registration.
Stakeholder input	Stakeholders advocated for adopting a community-based forestry approach to formalize the Ndonda area, addressing issues of overlapping and heavily encroached patches while preserving the remaining woodland. No updates to the project design were necessary as stakeholder inputs aligned with the proposed project activities, including expansion into new areas.

Date of stakeholder consultation	06-February-2024 to 07-February-2024, 22-May-2024 to 24-May-2024
Stakeholder engagement process	Meetings with Forest and Legal Officers, including 2 female and 10 male participants from President's office, Regional Administration and Local Government as well as Vice President's Officer – Division of the Environment, to draft a carbon trade contract. Follow-up review meeting with 5 female and 10 male participants from regional and local government offices to align the contract with government guidelines.
Consultation outcome	Consensus on the project design, implementation, and alignment with government guidelines.
Stakeholder input	Feedback was incorporated into the contract draft, ensuring it met regulatory requirements. Major changes in the project contract including removal of Local Government Authorities as Parties except where they own forest, add periodic review of the contract (at least every five years), and adoption of the benefit sharing mechanism stipulated in the government regulations. No major updates to the project design were needed as inputs aligned with proposed activities.

Date of stakeholder consultation	21-February-2024 to 10-May-2024

Stakeholder engagement process	Meetings were held with 54 villages and three mitaa to obtain approval for the Carbon Trade Contract and revised Forest Management Plans (FMPs). The process started with Village Council followed by general assembly meetings. Copies of the carbon trade contract and maps of the project area were provided to every participant. Feedback from the patrol teams on the understanding of the project areas were presented. Discussions were conducted in a culturally appropriate manner with gender and age sensitivity. Outcomes were documented through meeting minutes.
Consultation outcome	Discussions focused on gaining consent for the project design and implementation, and evaluating the risks, costs, and benefits of the carbon trade contract. Approval was obtained, and the final project area was incorporated into the revised FMPs
Stakeholder input	All input received during consultations was considered, leading to the incorporation of the final project area into the revised FMPs. Major adjustments were on the project area, which concluded reducing the heavily encroached areas, and expansion of the project area to encompasses land uses that are compatible with forestry, including establishment of new VLFRs. No major updates to the project design were necessary as stakeholder feedback aligned with proposed activities

Date of stakeholder consultation	April 22nd - June 26th, 2024
Stakeholder engagement process	The engagement process involved attending Local Authority meetings with representatives from the Regional Secretariat, Council Management Team (CMT) members, ward councilors, and other local authority officers from district commissioner and division offices in Nachingwea, Lindi, Mvomero, Morogoro Rural, and Kilosa. Copies of the overall project progress reports, and carbon trade contract were provided to each participant. Outcomes were documented by meeting minutes and reports.
Consultation outcome	The main discussion was about the carbon trade contract, which was approved for signing by Managing Authorities under these Local Authorities. Discussions in Mtama occurred independently. Key topics included consent to project design and implementation, and the risks, costs, and benefits of the project.

Stakeholder input	Stakeholder inputs were carefully considered. There were no immediate updates to the project design as the discussions focused on obtaining approval for the carbon trade contract.

The table below summarizes how all comments received during the consultation and public comment period have been addressed.

Summary of comment received	When comment was received	Actions taken
Inclusion of Local Authority Forest Reserves (VLFR) and Wildlife Management Areas (WMA) in Kilosa and Nachingwea.	September 2022 - March 2023	Included in project planning; adjustments made based on consent obtained from villages and local authorities.
Suggestions for enhancing forest patrols and providing patrol equipment, funds for patrols and making cutlines.	November 2022	Updated project plan to include support for forest patrols and provision of necessary equipment.
Requests for community-based forestry approaches and formalization of Ndonda WMA	September 2023 - April 2024	Adopted community-based forestry approach for Ndonda area, 5 new VLFR established;
Feedback on the carbon trade contract, emphasizing regulatory compliance and periodic review.	06-February-2024 to 07-February-2024, 22-May-2024 to 24-May-2024	Incorporated feedback into contract draft, ensured alignment with government guidelines, and added benefit-sharing mechanisms as per regulations.
Approval for the carbon trade contract and revised Forest Management Plans (FMPs) from Managing Authorities.	21-February-2024 to 10-May-2024	Final project area incorporated into revised FMPs following approvals.

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

The obligation for continued communication and consultation between the Project Proponent, communities, and Local Authorities is outlined in Clause 14.3 of the Carbon Trade Contract between the Proponent and Managing Authorities. It states: “The Project Proponent shall participate in formal meetings with the Managing Authorities to discuss Project outcomes, provide a detailed presentation of the Project’s performance metrics, carbon credit generation, and the methodology used to calculate payments to ensure financial transparency.” The contract

permits the proponent to regularly collect data from the Managing Authorities, monitor their performance, and provide consistent feedback. Additionally, the requirement to report on the project's implementation status, including monitoring reports, is mandated by Regulations 41, 42, and 43 of The Environmental Management (Control and Management of Carbon Trading) Regulations, 2022, as amended in 2023. The regulations prescribe a clear reporting format in the fifth schedule, with which the proponent will comply.

The project's structure ensures a sustained collaboration between the Managing Authorities and the Proponent throughout its duration. The proponent will work with patrol teams to implement patrol technology and will conduct monthly monitoring of deforestation, updating data on cloud-based platforms. Extension agents will supervise the patrol teams, guiding them to newly deforested areas to take appropriate actions. The proponent will also collaborate with villages to ensure the effective management of cutlines, boundary markers, and other forest management activities, such as fire management and adherence to the 1% annual limit on sustainable biomass harvesting. Furthermore, the project is committed to working closely with farmers in the project area and leakage belt to enhance arable land productivity by providing agricultural extension services. Through these efforts, the project will regularly update the Managing Authorities, farmers and other stakeholders. This ensures that the proponent not only supports the effective implementation of the project but also maintains a continuous flow of information and guidance to the Managing Authorities.

2.3.12 Stakeholder Consultation Channels (CCB, G3.5)

All consultative meetings have involved local authorities, farmers within the Village Land Forest Reserves (VLFRs), Village Natural Resource Committees (VNRCs), Village Councils (VC), and communities through Village General Assemblies.

Farmers in the VLFRs and Leakage Belt: During the project design phase, a significant focus was placed on engaging with farmers accused of contributing to deforestation in the VLFRs. The opportunity cost survey consulted 102 farmers across 10 randomly selected deforestation points from the period of 2017-2020. At each site, village representatives identified the farm owner and the owners of the 10 nearest farms cleared within the past three years. Data was collected using ODK tools. Additionally, village forest patrol teams consulted farmers across 2,501 deforested polygons, gathering information on their gender, land ownership, origin, knowledge of the VLFR and carbon trade, and interest in agricultural extension services to boost arable land productivity rather than expanding new farms. Farmers involved in cutline making were also consulted about their preferences for utilizing income generated from the project.

Village Natural Resource Committees, Village Councils, and Village General Assemblies: These key community stakeholders were integral to the consultative process. Meetings focused on collecting baseline data, securing consent to join the project, agreeing on Project Area boundaries, and discussing the carbon trade contract. VNRC and VC meetings were attended by 1610 participants, including 507 women, 1103 men, and 259 youths under 25 years. Village

General Assemblies engaged 5,459 community members, including 2,270 women, 3,186 men, and 886 youths under 25.

The project has developed a socio-monitoring tool to track social indicators outlined in Section 4.4, as well as non-performance risks identified in the adaptive management strategy. Data collection will primarily be conducted by Managing Authorities themselves using ODK tools provided by the project. The proponent is contractually obligated to participate in annual meetings of each Managing Authority's highest decision-making body to present feedback on collected data. During these meetings, the proponent will present and discuss monitoring reports, while Managing Authorities will report on their implementation progress and discuss future actions.

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

The project will adhere to statutory obligations regarding the proceedings of Managing Authorities, outlined as follows:

District Councils: Quarterly meetings as per Sections 63 and 64 of the Local Government Act (District Authorities) CAP 287.

Township Councils: Quarterly meetings as per Sections 87 and 88 of the Local Government Act (District Authorities) CAP 287.

Village Councils and General Assembly: Quarterly meetings as per Sections 103, 104, and 105 of the Local Government Act (District Authorities) CAP 287.

Community Based Organizations (CBOs) and Authorized Associations (AAs): Quarterly meetings in accordance with their respective constitutions.

The carbon trade contract between the proponent and Managing Authorities mandates that the project agenda be integrated into these statutory meetings. Women and men have equal opportunities to participate in elections through which Ward Councilors, Village Council, and Natural Resource Committee members are elected. Additionally, a dividend-based benefit-sharing mechanism will be established at the village level to encourage participation in at least one annual meeting. Based on the proponent's experience from the MJUMITA Community Forest Project in Lindi, the dividend model particularly attracts women to these meetings, as they are often responsible for collecting the shares on behalf of dependents of their families. During these meetings, the project proponent will present and discuss the project's performance.

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

The proponent's Human resource manual has established a zero-tolerance policy against harassment, ensures prompt and fair investigation of reported cases, and provides support mechanisms for victims. The manual mandate that all new staff members, both permanent and

temporary, are briefed on the company's anti-discrimination policy. When a permanent employee is recruited, the new hire is notified of the policy by the Director of Operations. When groups of temporary workers are brought on board in the field, they are informed of the policy by the Extension Agents.

VCSL's Human Resource policy states:

Non-Discrimination: Treat every person with respect and tolerance, regardless of gender, race, religion or sexual orientation; must not discriminate in its labor and hiring policies and procedures along the lines of race, color, gender, age, religion, social class, political tendencies, nationality, syndicate membership, sexual orientation, civil status or any other motive as indicated by applicable laws, ILO Conventions 100 and 111. VCSL must offer equal pay, training and promotion opportunities and benefits to all employees for the same type of work. The company must not influence the political, religious, social or cultural convictions of employees.

No Harassment: VCSL and its supervisors must not threaten, sexually abuse or harass, or verbally, physically or psychologically mistreat employees for any reason. VCSL must encourage the respectful treatment of employees and have a formal mechanism to act upon employees' claims of mistreatment.

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

The table below describes the development and design of the grievance redress procedure aimed at resolving any conflicts between the project proponent and stakeholders

Development process	At local level: After consulting with the project's focal person at the local authority level, the proponent's team drafted grievance redress procedures. These draft procedures were shared with the village councils for feedback. Following this, they were summarized, printed, and disseminated to the sub-villages for beneficiaries to utilize. In addition, grievance redress procedures were discussed during consultations with lawyers, forest officers, councilors, village councils, and communities at all levels. This led to the creation of a dedicated section in the contract outlining conflict resolution procedures, including resolution, mediation, and arbitration, all compliant with Tanzanian laws
Grievance redress procedure	**Grievance Redress Procedure** The grievance redress procedure builds on existing institutional, community, and company-level mechanisms to ensure that all stakeholders can raise and participate in resolving grievances in a timely, transparent, and fair manner.

The grievance redress mechanism is accessible to all stakeholders affected by or involved in the project, including but not limited to:

- Local community members (men, women, youth, and vulnerable groups)
- Project workers and employees
- Managing Authorities
- Contractors, service providers, and suppliers
- Visitors and any other interested or affected parties

Stakeholders may submit grievances through any of the available channels, including community structures, project representatives, government authorities, or through official communication channels. Contact details of project staff and the official company email are publicly available on the VCSL website to ensure accessible and direct grievance submission.

Employee Grievance Mechanism

According to Section 7.2 of the Human Resource Policy of Village Climate Solutions Limited, employees who have a job-related problem, question, or complaint are encouraged to first report it to their immediate supervisor to obtain the fastest and most appropriate resolution. If the issue is not resolved, it is escalated to the Human Resources representative or further to senior management, including the Managing Director.

The Human Resource Policy outlines key principles of the grievance procedure, including transparency, confidentiality, non-retaliation, reasonable timelines, right of appeal, right to be accompanied, proper documentation, and compliance with applicable regulations. Employees are informed of the grievance mechanism during induction and reminded regularly through internal communication channels.

Available reporting channels include:

- Direct access to the Managing Director for serious complaints
- Confidential reporting channel for women through a designated senior female manager

Community and Stakeholder Grievance Mechanism

The project utilizes established Tanzanian administrative and traditional structures to address grievances from all stakeholders. Grievances may be submitted at the most accessible level and are addressed at the lowest appropriate level, with escalation where necessary.

- Submission and escalation levels include:
- Sub-village level (Sub-village Chairman)
- Village Natural Resources Committee
- Village Council (Village Chairman or Village Executive Officer)
- Ward level (Ward Executive Officer or Councilor)
- District level (District Forestry Officer or relevant authority)
- Regional and National levels, including relevant environmental and local government institutions

In addition, grievances may be submitted directly to project representatives, including Project Officers, or escalated to the Operational Director.

Grievances may be resolved at any level or referred to the next higher level in the administrative hierarchy. Government offices at district, regional, and national levels have designated focal persons responsible for forestry and carbon trade projects, including grievance resolution.

Grievance Resolution Timelines

Grievances are handled within reasonable and transparent timelines as follows:

- Acknowledgment of grievance: within 7 days
- Initial review and response: within 14 days
- Resolution at the same level: within 30 days
- Escalation to the next level (if unresolved): within 7 days after the resolution period

These timelines apply to all stakeholders and grievance types, except where contractual provisions specify otherwise.

Mediation and Third-Party Resolution

Where grievances cannot be resolved at community, project, or administrative levels, they may be referred to mediation through neutral third parties.

The Regional Commissioner's Office serves as an independent mediator in disputes requiring formal mediation, in accordance with the National Carbon Trade Regulations. Other government administrative authorities at district or regional level may also play a mediation role, ensuring impartial resolution in accordance with Tanzanian laws.

Contractual Dispute Resolution

For disputes arising between the Project Proponent and Managing Authorities, the following procedure applies:

- Amicable settlement: within 90 days
- Mediation by the Regional Commissioner: within 90 days
- Arbitration: initiated within 90 days following failed mediation

Arbitration proceedings are conducted in the United Republic of Tanzania at a location determined by the Arbitration Panel and are governed by the Arbitration Act, Cap. 15 of the Laws of Tanzania (R.E. 2020). The decision of the Arbitrator is final and binding upon the Parties.

Access to Legal Recourse

Where necessary, grievances may be referred to law enforcement authorities or courts of law, depending on the nature of the issue.

Documentation and Accountability

All grievances are recorded, tracked, and addressed in a transparent manner. Government and project-level institutions designate responsible officers for grievance handling, including forestry and carbon project focal persons.

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

Under the established traditional framework for addressing grievances, any stakeholder, whether a resident, worker, or visitor can submit a complaint to the village council. During Village Council

and public meetings, community members are informed that any issues with a project activity should be reported to the Village Council, which will then arrange a meeting with the project representatives. Village Councils consistently document all official activities through meeting minutes. Furthermore, the company has established a dedicated file for recording grievances, which will be regularly monitored as part of the project's ongoing oversight. This ensures that all complaints are systematically documented, tracked, and addressed. Information on grievance monitoring will be compiled in the project's annual report, which will be presented to the highest decision-making body of the Managing Authority. All Managing Authority meetings regarding grievances are open to the public, and the outcomes are communicated in a subsequent meeting.

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

The project's capacity-building initiative is carefully designed to provide comprehensive orientation and training for employees and relevant community members. The primary objective is to build locally useful skills and knowledge to enhance local participation in project implementation. The training and orientation programs for Village Councils (VC) and Village Natural Resource Committees (VNRC) are particularly important. Both entities have extensive experience in Forest Management Activities, and each village possesses Forest Management Plans (FMP) and bylaws written in simple Swahili. This ensures that even new VC, VNRC, or Village Executive Officers can easily understand and implement them. Similarly, Community Based Organizations (CBO) and Authorized Associations (AA) have well-written constitutions in simple language, making them easily comprehensible and applicable for community members. This ensures that the rules and procedures for forest management are well-known, facilitating a smooth transition for newly elected leaders.

Youth engagement and leadership retention are also central to the project. The encouragement of the election of young people in the VNRC, and a turnover philosophy which ensures at least half of the previous VNRC members are retained during each election cycle. This approach not only brings fresh perspectives but also ensures continuity and the retention of local capacity. Additionally, the use of smartphone-based technology in patrol and record-keeping is a key aspect of the project. This technology helps maintain easily traceable records, which is particularly beneficial for new employees or VNRC leaders. It is favored by youth for its ease of use and adaptability.

Furthermore, the project has employed dedicated extension agents at each Local Authority or between two closely connected Local Authorities. These agents will provide regular technical support to VCs, VNRCs, and farmers, ensuring consistent guidance and capacity building. Collaboration with established organizations like the Tanzania Forest Conservation Group (TFCG) and the Tanzania Community Forest Conservation Network (MJUMITA) is another crucial element. These organizations frequently hire interns who gain experience working on the project and similar initiatives. When hiring new extension agents, priority is given to experienced interns from the TFCG and MJUMITA pools, ensuring new hires are well-oriented with the project.

The company's Human Resource policy includes comprehensive capacity-building programs for new employees. They receive training from the Operations Director on the project's philosophy and operational duties, as well as training from the Finance Director on the company's financial and human resource policies. This structured training ensures that all employees are well-prepared for their roles. These measures collectively ensure that local capacity is not lost through staff turnover. By focusing on continuous training, engaging youth, leveraging technology, and maintaining strong partnerships, the project fosters a sustainable environment where local skills and knowledge are preserved and enhanced.

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

The Proponent relies on the accuracy of employment application information and any other data candidates provide during the hiring process. Falsifications, misrepresentations, or material omissions may result in the exclusion of the candidate from consideration for employment or, if the candidate has already been hired, termination of employment. The project is committed to ensuring that all community members are given equal opportunities to fill job positions, including management roles, provided they meet the job requirements. This commitment extends to promoting gender equity and ensuring equal pay for labor and work. The selection process for positions is transparent and based on merit, with clear criteria outlined for each role. Job announcements will be widely disseminated within the community through various channels, including community meetings, local notice boards, and social media, to ensure that all eligible candidates are aware of the opportunities. Additionally, the project conducts outreach activities to encourage applications from women and other underrepresented groups, ensuring a diverse pool of candidates. These requirements are stipulated in section 1.3 of the VCSL Human Resource Policy (2022).

Currently, the project has recruited four (4) Extension Agents, one of whom is from the Project Area. To further support equal opportunities, specific measures will be implemented to ensure that community members, including women and vulnerable or marginalized individuals, are given a fair chance to fill positions for which they can be trained. For casual labor such as making cutlines, the project presents the plan and budget at the village general assembly and advertises it through notice boards and sub-village leaders. All community members are eligible to be hired and are equally paid per unit area cleared. Patrols are coordinated by the village natural resource committee based on the procedures outlined in the Forest Management Plans (FMPs), and every committee member is eligible to participate. Moreover, the project will encourage graduates from relevant fields within the project area to apply for internships at TFCG and MJUMITA. This initiative aims to provide mentoring opportunities, develop additional skills, and enhance competitiveness for potential vacancies within the companies. The Project's Extension officers will track forestry graduates from project villages and encourage them to apply for internships.

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

The project does not use armed patrols, so, no risks related to armed enforcement are anticipated for stakeholders, local communities, or workers. The project understands the significant safety risks during implementation, particularly in activities such as forest patrolling, boundary clearing, fire management, and the use of technology in field operations. These risks include physical injuries from equipment handling, encounters with wildlife, and exposure to harsh environmental conditions. Furthermore, the use of smartphone-based technology and other digital tools introduces risks related to data security and potential distractions during field activities.

To mitigate these risks, the project will implement comprehensive measures to educate workers about potential hazards and how to minimize them. Budget allocations for first aid kits, health insurance for the patrol team, patrol gear (helmets, gloves, raincoats, rain boots), and transportation will be regularly incorporated into the village benefit sharing plan. Regular safety training sessions will cover topics such as proper equipment handling, first aid procedures, wildlife safety, and navigating forest terrain safely. All workers will be equipped with reliable communication devices to ensure connectivity in emergencies.

Some members of the Village Natural Resource Committee, particularly patrol team members, possess extensive experience in dealing with risks posed by dangerous animals and have traditional skills for evading them. Besides, the Tanzanian government, through the Tanzania Wildlife Authority (TAWA) and Tanzania National Parks (TANAPA), in collaboration with local authorities, has established ranger posts at the divisional level in areas prone to wildlife issues. Villages have already established cooperative relationships with these rangers, which the project will leverage for its benefit.

Additionally, the project will establish a buddy system, ensuring patrol teams operate in small groups of at least four members to enhance safety and provide immediate assistance as needed. Ongoing monitoring and evaluation of safety practices will identify areas for improvement and ensure adherence to safety standards.

2.4 Management Capacity

2.4.1 Project Governance Structures (CCB, G4.1)

The governance structure of the project is multi-layered, involving various entities responsible for the design and implementation of the Village Land Forest Reserves (VLFRs), Local Authority Forest Reserves (LAFRs), and Wildlife Management Areas (WMAs). The Village Natural Resource Committees (VNRCs), composed of at least 12 members elected by the Village General Assembly, manage the VLFRs. These committees form patrol teams from among their members, who conduct regular forest patrols and report to the VNRC. Occasionally, the patrol team may also include representatives from the broader community to ensure transparency. The VNRC reports first to the Village Council and subsequently to the Village General Assembly, ensuring local accountability and participation.

Local Authority Forest Reserves (LAFRs) are managed by the Forest Officer of the respective local authority, who reports to the Executive Director, with the Executive Director being accountable to the Full Council. In instances where the VLFRs are located on municipal land, management is conducted by a Community-Based Organization (CBO). The day-to-day activities of these reserves are handled by a natural resource committee, which reports to the CBO's general assembly, ensuring community representation and governance.

Legally, CBOs, VNRCs, Village Councils, and Village General Assemblies receive technical advice from their respective Local Authority. To support efficient communication, each Local Authority has designated specific project Focal Points.

As the project expands into new areas, it is expected to collaborate with Authorized Associations (AAs) for the management of Wildlife Management Areas (WMAs). The AA's Executive Committee, elected by the communities, oversees daily operations and reports to the Board of Trustees, receiving technical advice from the District Natural Resource Advisory Board. Trained Game Scouts carry out patrols and report to the Executive Committee.

Village Climate Solutions Limited (VCSL), the proponent, as a registered company with a Board of Directors, provides overall governance for the project. The Board is responsible for high-level decisions, approval of implementation plans and budgets, and review of monitoring and evaluation reports. The Managing Director, who reports to the Board, oversees the company's daily operations. The Operations Director is responsible for managing community-based forestry, carbon enterprise, benefit sharing, and agricultural extension services, while the Finance Director handles financial planning, budgeting, auditing, payments to beneficiaries, and human resource management. Both Directors report to the Managing Director. VCSL has signed an agreement with off-takers who are responsible for marketing and provision of technical assistance on the development of monitoring reports and verification of carbon credits.

Extension Officers, employed by the project, provide technical support to local communities in sustainable agriculture, forest management, and climate-resilient practices. They work in collaboration with Local Authority Officers and report to the Operations Director to ensure alignment with project goals and effective implementation of field activities.

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

Remote Sensing: Experts in remote sensing play a crucial role in providing accurate, large-scale data on land cover, forest density, and vegetation changes. By utilizing satellite imagery and aerial photography, they assess forest health, track deforestation, and detect land-use changes over time. Their skills are essential for carbon stock estimations and monitoring the impact of conservation efforts on the project area.

Community-Based Forestry: Professionals skilled in community-based forestry work closely with villages to promote sustainable forest management practices. Their role involves engaging and empowering communities to participate in forest protection. These experts help build the capacity

of Village Forest Management Institutions, ensuring that local knowledge and participation are central to project success. They will also help communities to develop and implement benefit sharing guidelines that bring about good governance in both forest management and community development programs.

Carbon Measurement: The carbon measurement specialist focuses on accurately assessing carbon stocks within forest ecosystems. He collects and analyzes data on biomass, soil carbon, and forest growth rates to estimate carbon sequestration. These measurements are critical for monitoring progress in reducing greenhouse gas emissions and ensuring the project meets its carbon reduction targets.

Biodiversity Monitoring: The biodiversity monitoring expert is responsible for evaluating the health and diversity of flora and fauna within the project area. By conducting field surveys, species inventories, and habitat assessments, he tracks changes in biodiversity. His work ensures that conservation efforts support not just carbon goals but also the protection of critical ecosystems and wildlife.

Agricultural Extension Services: Agricultural extension officers will bring expertise in sustainable farming practices and land management to the community. They will train farmers in techniques that enhance productivity while minimizing environmental impact, such as agroforestry, soil conservation, and climate-resilient farming. Their role is key in promoting sustainable livelihoods that align with the project's broader goals of reducing deforestation and enhancing ecosystem services.

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

The management team at Village Climate Solutions Limited (VCSL) boasts extensive expertise in land management and carbon projects.

Charles Meshack, the Managing Director, brings over 27 years of experience, having served as the Executive Director of the Tanzania Forest Conservation Group (TFCG). Charles has been a civil society leader in Tanzania at the forefront of national forest conservation initiatives, including participatory forest management, Tanzania's first REDD+ project, and advocacy for improved forest governance. After joining as a field officer in 1996, in 2005 he became the Executive Director of the Tanzania Forest Conservation Group, the country's most prominent national environmental Organization. Meshack has led the establishment of sustainable charcoal value chains that incentivize rural communities to reduce deforestation by generating income from natural woodlands and raised the call at home and abroad for equitable and effective forest management. BSc, Forestry, University of Sokoine Morogoro, Tanzania, 1995; MSc, Ecology and Environmental Management, University of York, 2003.

Dr. Wilson Ancelm Mugasha, a Senior Lecturer at Sokoine University of Agriculture, is Tanzania's leading expert in forest biomass measurement. His academic and research background ensures the project's scientific rigor, particularly in carbon measurement.

Aklei Albert, for over 12 years, Aklei Albert has advanced community-based forestry in Tanzania. Joining MJUMITA as Zonal Coordinator in 2011, he led the creation and rollout of a forest governance dashboard tool for 300 villages across Tanzania. In 2015, as Program Manager, he oversaw land use planning and forest management in Lindi and Ruvuma, and he developed the 2019-2023 MJUMITA's strategic plan. In 2020, he became Project Manager for TFCG's Forest Justice in Tanzania project, supervising forest condition monitoring, community forest crime tracking, and advocacy efforts for forest campaign for all villages in Tanzania. Since 2018, Aklei has also led consultancies on capacity building, climate risk assessment, and forest management planning in Tanga, Morogoro, and Lindi. Currently, as Director of Operations at Village Climate Solutions Limited, he has coordinated establishment of a REDD+ project with 65 Managing Authorities across 8 LGAs in Morogoro, and Lindi. He holds a bachelor's degree in wildlife management from Sokoine University of Agriculture (2009) and a master's degree in Natural Resource Assessment and Management from the University of Dar es Salaam (2018).

Emmanuel Walala, a Certified Public Accountant (CPA) with 20 years of experience in commercial operations, brings strong financial expertise. He specializes in budget management, financial strategy and planning, auditing complex projects, and administering payments to beneficiaries.

Magdalene Boniface, Fatuma Rashidi, Nebby Venance, and Emmanuel Mwakajumba each hold at least a bachelor's degree in agriculture or natural resources and possess over three years of experience in providing extension services. Their technical knowledge enhances sustainable agriculture, forest management, and climate-resilient practices in community-based projects.

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

Village Climate Solutions Limited (VCSL) will actively partner with Reterra Ltd and the Tanzania Forest Conservation Group (TFCG) to enhance its capacity in delivering effective climate change solutions.

Reterra Ltd, established in the UK in 2021, is dedicated to developing nature-based solutions for climate change mitigation. VCSL will benefit from Reterra's technical support in Monitoring, Reporting, and Verification (MRV), ensuring robust monitoring of the carbon credits produced. Reterra director Dr. Theron Morgan-Brown, has 13 years of experience as a REDD+ MRV expert. He previously served as the Technical Advisor for MJUMITA, where he authored Tanzania's first VCS REDD+ project document and guided it through its initial successful verification. Theron's experience extends beyond Tanzania; he has played pivotal roles in various international projects, including serving as a carbon manager for Biocarbon Partners. In this capacity, he helped achieve validation and verification for the Luangwa REDD+ project in Zambia, one of the largest REDD+ initiatives globally, covering 1 million hectares of Miombo woodland. His work has also spanned multiple countries, including Angola, Kenya, Liberia, and Vietnam, where he has applied his expertise in MRV to support the development of effective carbon management strategies.

VCSL's majority shareholder, the Tanzania Forest Conservation Group (TFCG) pioneered community-based forest management in Tanzania's biodiversity-rich forests since 1991. As a founding partner of MJUMITA, TFCG has a proven track record in developing successful REDD+ projects and will contribute its knowledge to planning and monitoring within project areas, including the project's biodiversity values. TFCG will also have a representative on VCSL's board, ensuring ongoing strategic collaboration.

Through these partnerships, VCSL aims to fill any gaps in knowledge and experience, bolstering its commitment to effective climate action and sustainable development.

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

VCSL has focused on securing reliable early funding and developing a sustainable revenue model. Currently, VCSL's primary funding comes from advance sales of carbon credits. This upfront revenue is allocated to support the initial stages of project development, community engagement, and biodiversity protection activities.

Available Cash Reserves: $150,000 (from advance carbon credit sales)

Annual Projected Operating Budget: $250,000 (for the first three years)

Total Funding Required for the First Three Years: $1.65 million (secured through pre-sale agreements and funding from the Nature Conservancy's (TNC) - African Forest Carbon Catalyst (AFCC), Palladium and UBS Optimus foundation.

VCSL has entered into pre-sale agreements with a committed buyer, securing advance payment for future carbon credits. This financing structure allows us to cover all initial costs related to the REDD project. Key details include:

Pre-Sale Agreements with Long-Term Buyers: VCSL has contracts with a reputable off-taker, providing guaranteed early-stage funding. This advance sale strategy mitigates financial risk and ensures sufficient cash flow for early project development.

Allocation of Funds: Funds from pre-sale agreements are allocated toward establishing project infrastructure, setting up community programs, biodiversity monitoring, and conservation activities. By prioritizing these foundational elements, VCSL can implement the project effectively and position itself for future growth.

Revenue Timeline: Advance sales are structured to provide consistent cash inflows over the first three years, after which regular carbon credit sales are projected to generate sufficient revenue.

The financial projections show that from year 4 (FY 2026), revenue from carbon credits sales will be sufficient to cover all operational costs, achieving self-sufficiency, this allows for reinvestment in ongoing project activities. This sustainable revenue model ensures long-term viability and funding adequacy for the project's duration.

The following table presents 10-year revenue and costs forecasts for carbon credits sales

Financial Year	Projected VCU Sale (tCO2e)	Price ($ / tCO2e)	Projected Base Revenue $	Projected Costs $	Surplus / (Deficit) $
2023		-		(28,639)	(28,639)
2024		-		(389,710)	(389,710)
2025		-		(247,766)	(247,766)
2026	693,055	6.62	4,586,196	(4,500,461)	85,735
2027	441,099	6.87	3,028,886	(2,981,613)	47,272
2028	454,803	7.04	3,199,960	(3,147,376)	52,584
2029	459,751	7.21	3,314,805	(3,258,558)	56,246
2030	450,556	7.39	3,328,781	(3,271,565)	57,216
2031	441,361	7.58	3,343,310	(3,284,960)	58,349
2032	441,361	7.77	3,427,168	(3,365,534)	61,634

Financial Risk Management

Given VCSL's reliance on presales of carbon credits, we have implemented several risk management strategies to mitigate potential financial uncertainties and safeguard project continuity:

Reserve Fund: A portion of the advance sale revenue is allocated to a contingency reserve, designed to cover unexpected expenses or financial shortfalls during the start-up period.

Diversified Partnerships: VCSL actively seeks partnerships with conservation NGOs, development agencies, and governmental bodies to secure additional support for community and biodiversity programs. These partnerships provide both in-kind resources and financial support to supplement carbon credit revenue.

Adaptive Financial Planning: As the market for carbon credits evolves, VCSL regularly revisits its pricing strategy and revenue projections to adapt to changes. This flexibility ensures VCSL can maximize income while maintaining competitive rates for future credit sales.

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

The VCSL's Code of Ethics and Code of Conduct, as outlined in the company's HR manual, provides assurance that the project proponent and any other entities involved in the project design and implementation are not involved in, nor complicit in, any form of corruption, including bribery, embezzlement, fraud, favoritism, cronyism, nepotism, extortion, and collusion. The standards of ethics and conduct at Village Climate Solutions Limited encompass the principles

and guidelines of the Company's Business Integrity Policy, Ethical Guidelines, Whistleblowing Policy, and Confidentiality Agreement. Employees are expected to adhere to these codes and standards in conducting the Company's business. Any deviation from these rules can lead to disciplinary action, including termination of employment.

Section 5.1.2 of the company's HR Manual establishes a "Zero Tolerance Policy" regarding corruption. In Village Climate Solutions Limited's employment contracts and any legal agreements with partners, VCSL includes provisions to ensure compliance with local and international laws and best practices. Specifically, VCSL does not tolerate:

Making or receiving payments meant to achieve undue advantages, including through agents or consultants, nor facilitation payments intended to secure or expedite actions to which one has a legal entitlement.

Giving or receiving gifts that could be interpreted as influencing business decisions.

Making political contributions to political parties or candidates.

Abusing confidential or material non-public information.

Financial or economic crimes, including money laundering.

Illegal or deceitful recording and reporting of financial or tax information.

Business transactions where the price for goods or services is artificially manipulated.

Clause 5.2 outlines nine provisions regarding Ethical Guidelines, including non-discrimination, no harassment, adherence to the rule of law (observing national and international law), prohibition of gifts for business influence, no facilitation fees or illegal payments, and policies against patronage of sex workers, along with mandates for transparency and accountability.

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

No commercially sensitive information has been withheld.

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 has identified relevant national, regional, and local laws, statutes, and regulatory frameworks in Tanzania that apply to its activities, as listed below. Compliance with these instruments is assured through the contractual obligations set forth in Clause 13 of the Carbon Trade Contract with the Managing Authorities. Furthermore, the project is registered with the Designated National Authority under the Vice President's Office, which holds the legal mandate to monitor compliance and enforce penalties for any violations.

List Tanzania Legislations and Regulations relevant to the project activities

United Republic of Tanzania (URT), (2022). The Environmental Management (Control and Management of Carbon Trading) Regulations), Vice President's Office, Division of Environment, Dodoma.

United Republic of Tanzania (URT), (2023). The Environmental Management (Control and Management of Carbon Trading) Regulations) Amendments, Vice President's Office, Division of Environment, Government Printer, Dodoma (final draft)

United Republic of Tanzania (URT), (2002a). The Forest Act, No. 14, 2002. Ministry of Natural Resources and Tourism, Forestry and Beekeeping Division, Dar es Salaam.

United Republic of Tanzania (URT), (1999a). The Land Act, No 4, 1999. Ministry of Lands and Human Settlement, Dar es Salaam.

United Republic of Tanzania (URT), (1999b). The Village Land Act, No 5, 1999. Ministry of Lands and Human Settlement, Dar es Salaam.

United Republic of Tanzania (URT), (1982). The Local Government (District Authorities) Act, Cap. 287 R.E. 2002.

United Republic of Tanzania (URT), (2007). Land Use Planning Act, No. 10, 2007. Dar es Salaam.

List Tanzania Strategies, Plans, Programs and Guidelines relevant to the project activities

United Republic of Tanzania (URT (2013). Tanzania National REDD+ Strategy, 2013. Vice President Office, Division of Environment, Dar es Salaam.

Ministry of Natural Resources and Tourism (MNRT), (2006). Community Based Forest Management; Guidelines For the establishment of Village Land Forest Reserves and Community Forest Reserves, Forestry and Beekeeping Division, 2007.

Ministry of Natural Resources and Tourism (MNRT), (2007). Joint Forest Management Guidelines; For the establishment of Joint Management Agreements in Protection and Production Forests, Forestry and Beekeeping Division, 2007.

Ministry of Natural Resources and Tourism (MNRT), (2021). The Community Based Forest Management (CBFM) Action Plan (2021-2031), 2021.

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

Tanzania's framework for worker rights includes key legislation such as the Employment & Labor Relations Act No. 6 (2004), the Occupational Health and Safety Act (No. 5, 2003), the Public Health Act (Act No. 01/09, 2009), the Social Security Regulatory Authority Act (2008), the Workers' Compensation Act (2008), and the Vocational Education and Training Act (1994). Together, these laws ensure workers' rights to fair treatment, non-discrimination, and health and safety protections. Employers are mandated to make statutory payments to the National Social

Security Fund (NSSF) for employee pensions, the Workers Compensation Fund to cover work-related injuries, and the Skills Development Levy to support workforce training and development.

When a new full-time employee is contracted, they are informed of their rights, including working hours, paid holidays, and union membership rights. Additionally, employees have the right to join unions, negotiate working conditions, and access skills development programs. These regulations align with VCS (3.18.2) and CCB (G3.11) requirements by promoting fair labor practices, safe work environments, and comprehensive worker protections.

2.5.3 Human Rights (VCS, 3.19)

The project follows a decentralized forestry approach that empowers local communities (LCs) by vesting in them the rights and responsibilities of forest management. Through village general assemblies, these communities act as the final decision-makers regarding forest protection and the utilization of benefits derived from these resources. This model respects and strengthens the role of Local Communities (LCs) as customary rights holders, ensuring their direct involvement in governing their lands and natural resources.

In alignment with applicable international human rights law, including the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and ILO Convention 169 on Indigenous and Tribal Peoples, the project actively promotes the protection of customary rights. Specifically, it addresses Article 14 of ILO Convention 169, which recognizes the rights of local communities to their natural resources, and Article 26 of UNDRIP, which affirms the right of communities to own, use, develop, and control their traditionally occupied lands. The project advocates against the eviction of individuals residing within forest reserves and incentivizes them to protect remaining natural forests through carbon revenues, ensuring that these communities are rewarded for safeguarding the forests. Without this initiative, they could face eviction under national laws or village bylaws.

In situations where communities do not own the forests they inhabit, the project facilitates partnerships with forest owners by assisting in the formation of community-based organizations (CBOs). These CBOs will enter Joint Management Agreements (JMAs) with forest-owning village councils, thereby protecting the rights of communities living near forests. This approach aligns with Article 6 of ILO Convention 169, which emphasizes the importance of consultation and good-faith cooperation with local communities to ensure their participation in land management decisions.

Furthermore, farmers within the leakage belt will receive agricultural extension services aimed at improving crop yields without expanding into forested areas, thereby preventing further encroachment and securing their livelihoods. The project will also promote the issuance of Certificates of Customary Rights of Occupancy (CCROs) to households, which will secure their statutory land rights and enhance tenure security in accordance with international standards.

The revenue-sharing model of the project allows villages to utilize income generated to enhance local services such as health, education, water, and transport, or for individual households to invest in their livelihoods. This model respects the rights of women, youth, and dependents, encouraging women to manage finances related to these payments, thus aligning with international commitments to gender equality and inclusive participation.

Overall, the project's design adheres to key principles of international human rights law and ILO Convention 169 by recognizing and promoting the rights of local communities and customary rights holders, ensuring their participation in decision-making, securing land tenure, and facilitating equitable benefit-sharing while supporting sustainable forest management and community livelihoods.

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

The project preserves and protects cultural heritage by building on existing community structures and promoting participatory governance. It leverages village forest management institutions such as the village general assembly, village council, and village natural resource committees, all of which are statutorily recognized, democratically elected, and accountable to community members. This ensures that local knowledge and traditions are integrated into project activities, alongside modern cloud-based techniques for forest protection. The project's approach avoids the displacement of people living within or near the reserved lands, recognizing that forced relocation would negatively impact their cultural heritage.

The project promotes a dividend model for benefit-sharing, ensuring that village councils invest REDD+ revenues in community-approved projects or distribute funds directly to households. This model empowers communities to make decisions that sustain their livelihoods and preserve their cultural practices. Another aspect of the project is the prioritization of issuing Certificates of Customary Rights of Occupancy (CCROs) to individual households, thereby safeguarding traditional land rights and customs. Additionally, the project will develop an extension services strategy that integrates traditional agricultural methods, such as mulching, cover cropping, the use of organic fertilizers like compost, and intercropping, with modern sustainable practices. This combination of traditional and contemporary approaches ensures that the cultural heritage and sustainable livelihoods of the communities are preserved and enhanced.

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

Land tenure: Approximately 89% of the Project Area consists of communal land that is legally vested in the Village Council as a corporate body, as stipulated by the Village Land Act CAP 114. Ninety-six percent of that land has been established as Village Land Forest Reserves (VLFRs) under Sections 4(c), 32, 33 and 35 of the Forest Act CAP 323. The remainder is still under village council authority, but not legally protected. Four other VLFRs were originally established on village land but have since been vested in a Municipality or Township, as defined by the Land Act of 1999 (CAP 113). The municipality and townships have agreed to allow legally registered

community-based organizations comprised of the community members living around the forests to manage most of those forests on their behalf though amounting to 9.73% of the total project area. The remaining village forests converted to municipal or township land consisting of 0.94% of the total project area is under municipal management with no formal protection. Additionally, one forest block covering 172 hectares of a former village land forest reserve is now owned by the University of Dar es Salaam, in the form of private property, through a 100-year granted certificate of occupancy. They have also agreed for a registered community-based organization to manage that forest on their behalf. There is one forest block (0.34% of total project area) owned by the Local Authority (Lindi Municipality), in accordance with Section 4(b) and Part V of the Forest Act, which follows state property regime.

Uses: In general, all types of forest use that do not contribute to deforestation are allowed in the project area. These include passing through the forest, collecting non-timber forest products such as mushrooms, fetching water, gathering wild fruits, wild vegetables, firewood, grass, and traditional medicines, beekeeping, wildlife hunting and fishing, grazing, visiting the Village Forest Reserve for training, research, and tourism, as well as harvesting trees for poles, timber, and charcoal.

Access: Access to forest products is regulated by conditions outlined in the forest management plans and local bylaws developed by each Managing Authority independently. Residents and nearby communities are permitted to pass through the forest and collect water without a permit. They are also allowed to gather most non-timber forest products, such as mushrooms, wild fruits, wild vegetables, firewood, grass, honey, and traditional medicines, for subsistence use, with a permit but no payment required. In some villages, residents organize special days to collectively enter the forest and gather these products. Grazing is allowed in certain reserved forests with designated grazing zones but is legally restricted in most forests, though often this is not enforced. Hunting and fishing are typically regulated through permits issued by wildlife and fisheries officers at the local government level. Harvesting wood products for commercial purposes requires a permit from the Village Natural Resource Committee, following approval from both the Village Council and the District Harvesting Committee.

Management: Decisions regarding the issuance of permits are outlined in Forest Management Plans (FMPs), which must comply with relevant national legislation and regulations. These FMPs are policy documents typically approved by the Village General Assembly after receiving technical advice from Local Government Authorities. For subsistence purposes, decisions to issue permits for non-forest products at the village level are made by the Village Council. However, permits for harvesting non-wood and wood forest products for commercial purposes are initially decided by the Village Council and then approved by the District Harvesting Committee. The harvesting of wood products, such as timber and charcoal, is guided by a sustainable harvesting plan developed by the Village Natural Resource Committee, with technical support from the District Forest Officer, and submitted to the Forest and Beekeeping Division for final approval.

Tenure Maps: Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, and Figure 15 show the details for project zone area legal status and management. Note that the national protected area polygons are semi-transparent so that the underlying forest cover for the leakage belt can be seen. The leakage management areas are all the non-forest areas in the project zone where, when the area is owned by a household, the project may provide agricultural extension services to the owner. Appendix 5 provides detailed information on size, ownership, legal status, and management for every part of the project area.

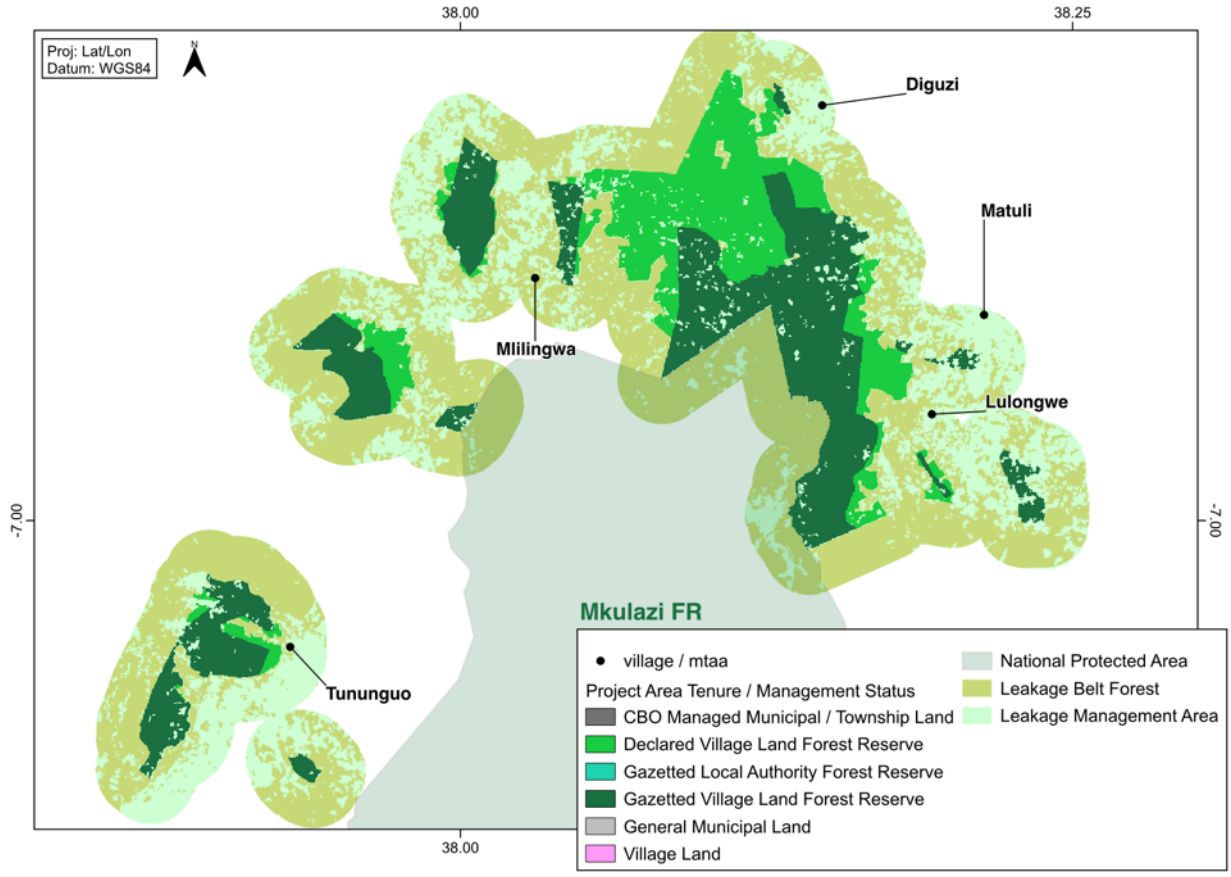


Figure 7 Project zone legal status and management in Morogoro Rural District

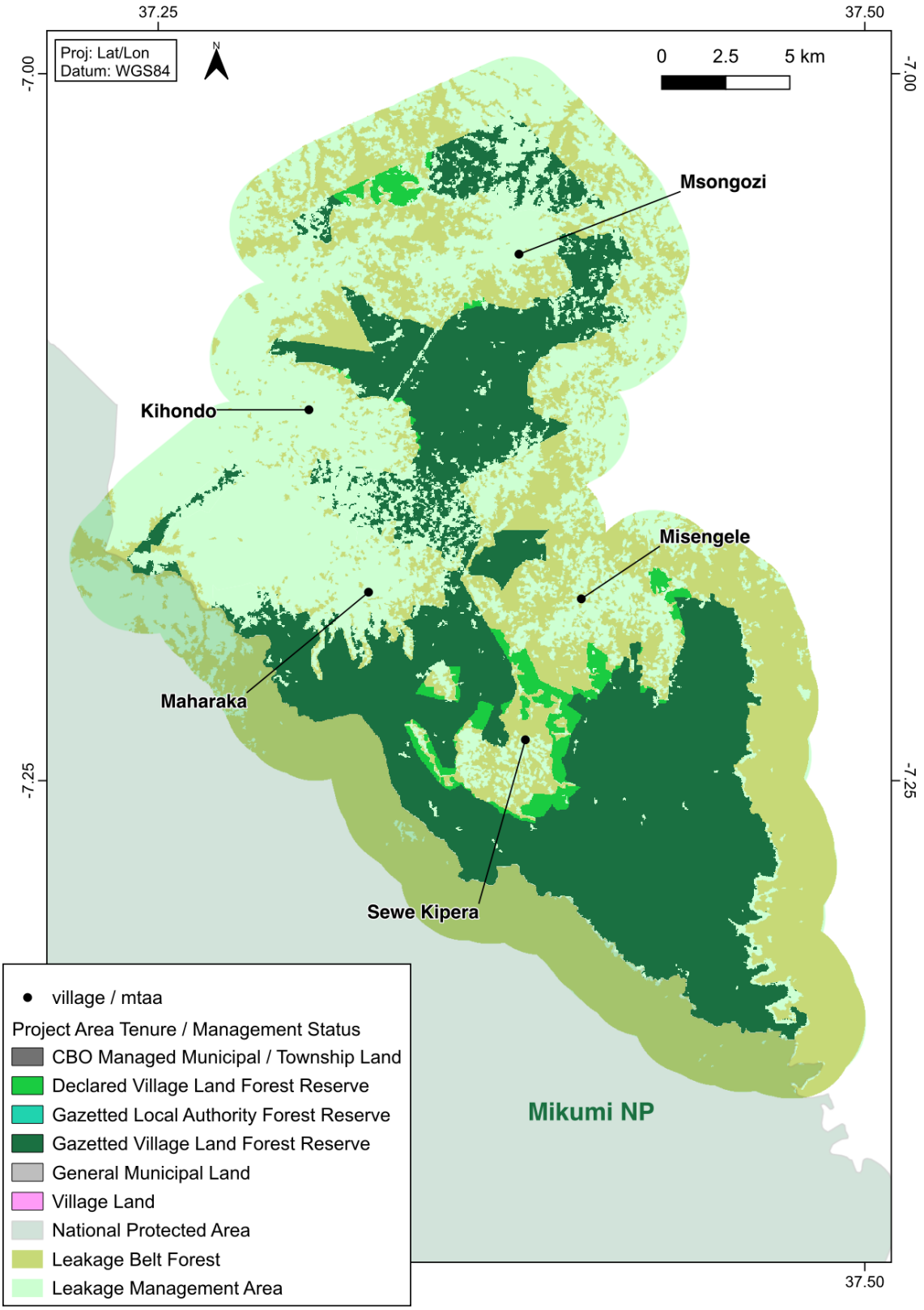


Figure 8 Project zone legal status and management in Mvomero District

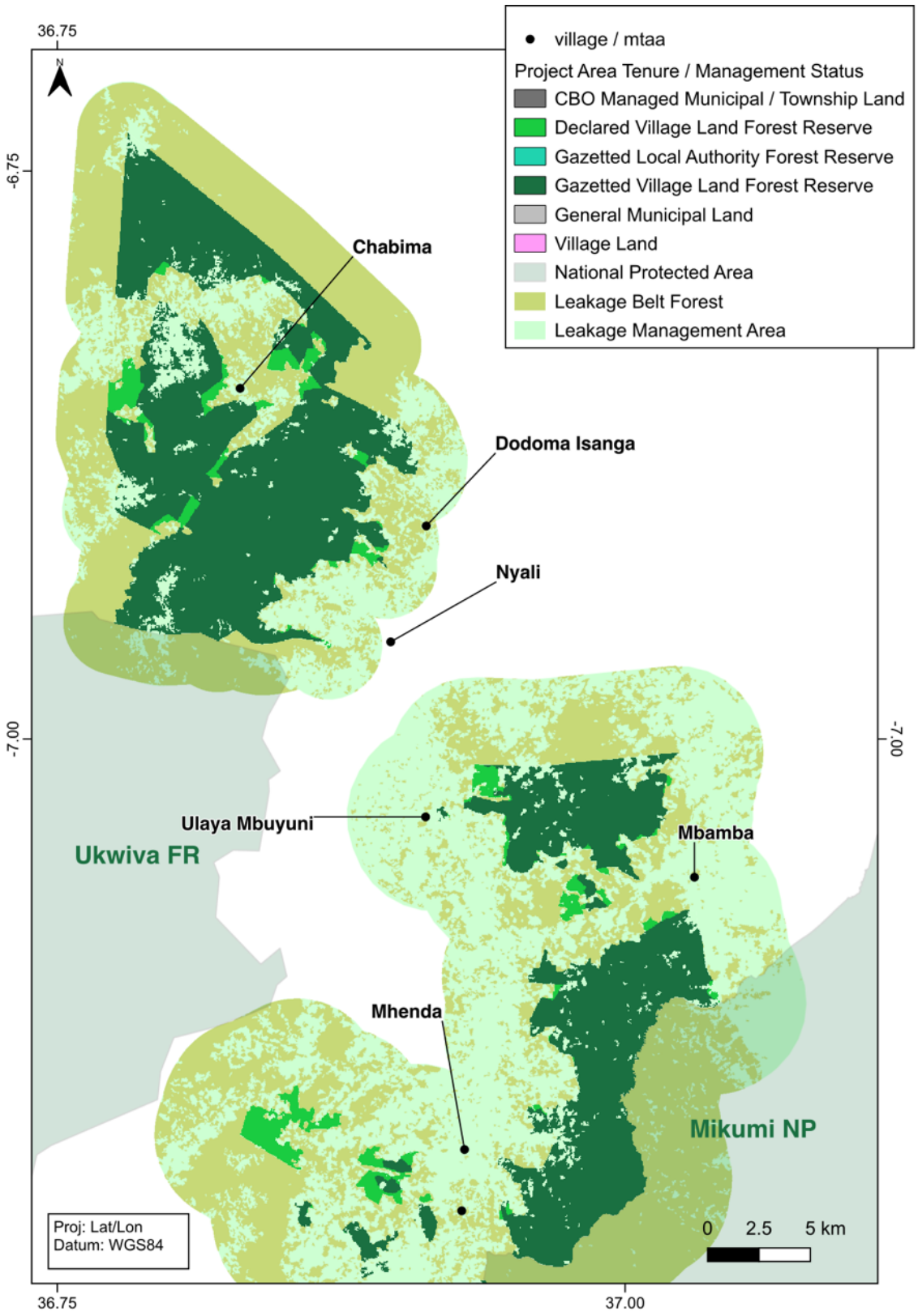


Figure 9 Project zone legal status and management in central Kilosa District

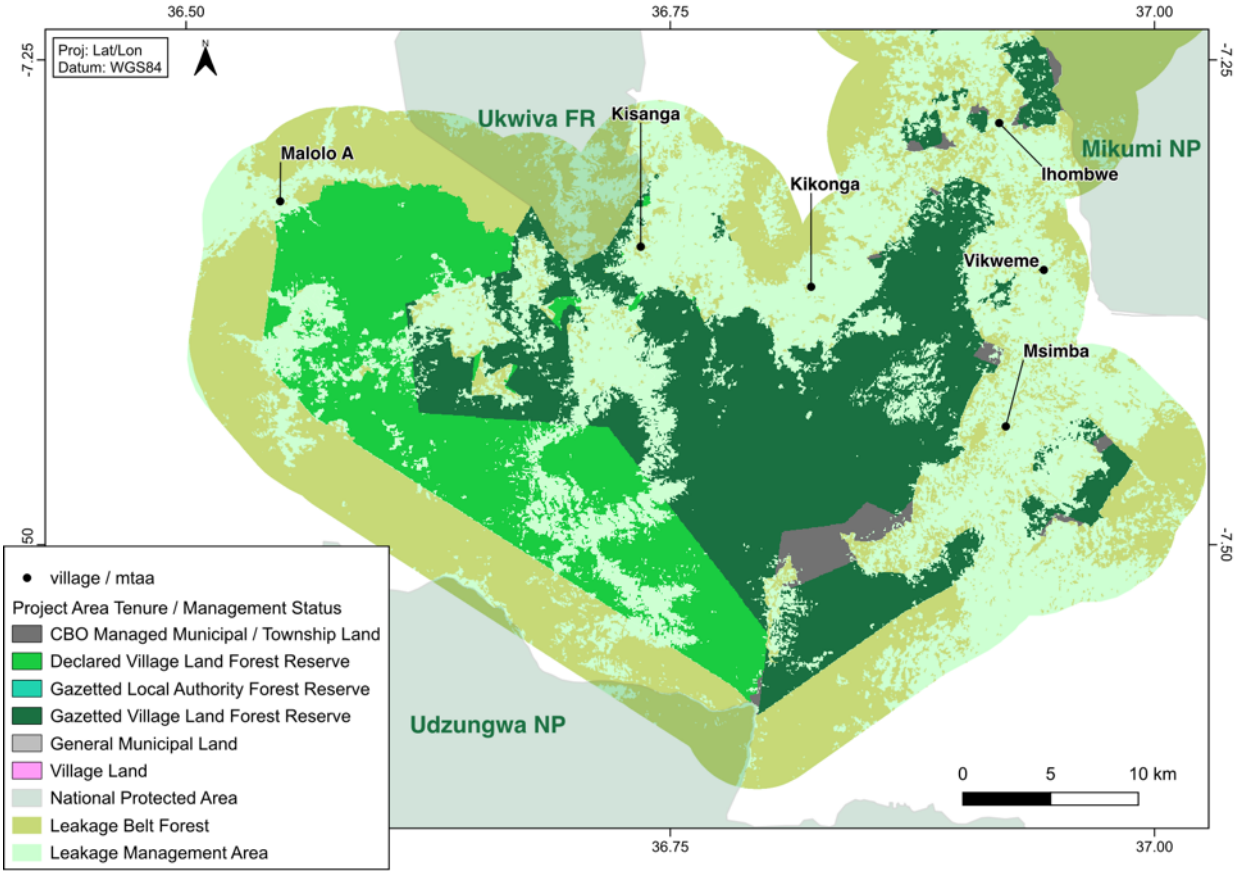


Figure 10 Project zone legal status and management southern Kilosa District

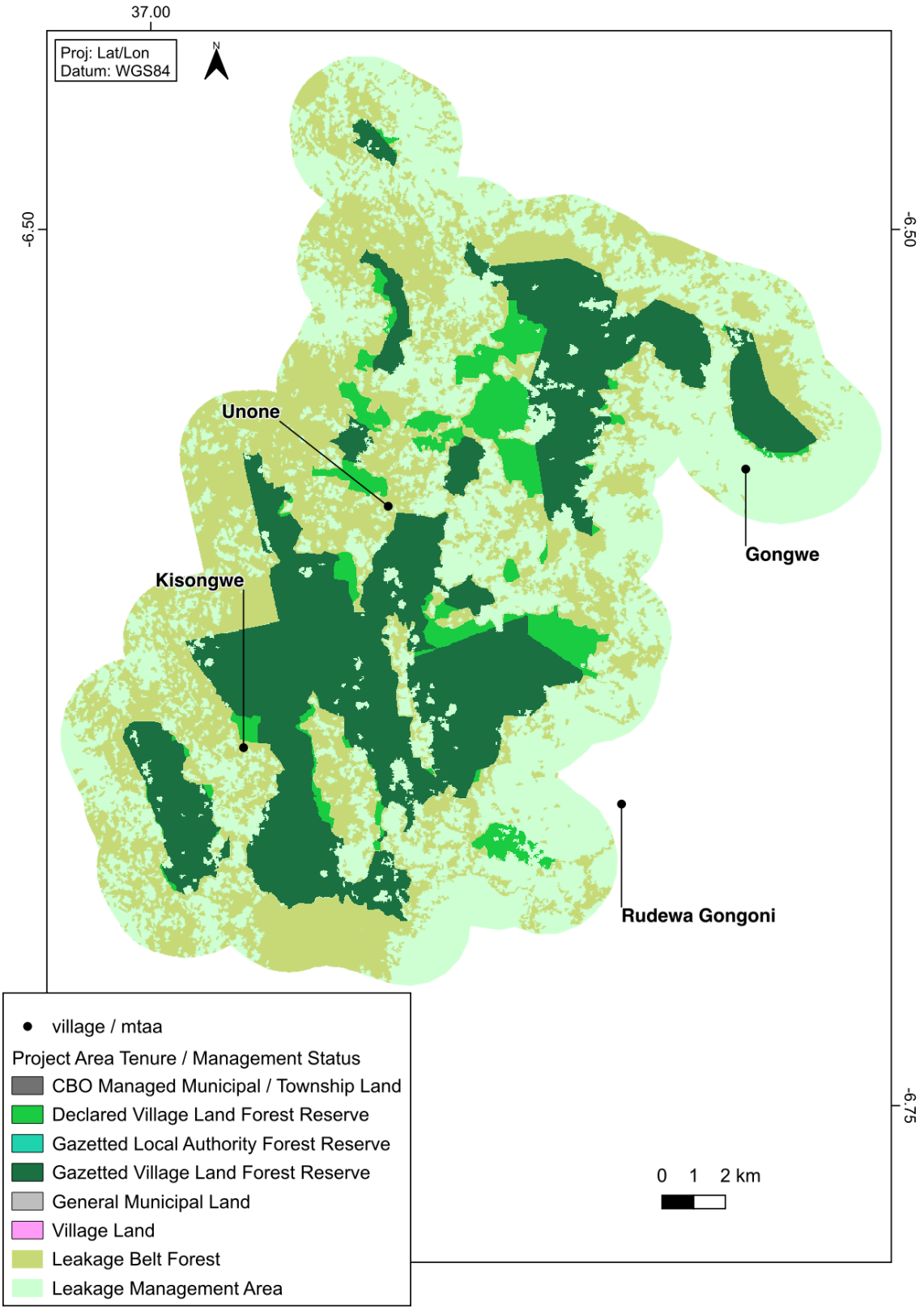


Figure 11 Project zone legal status and management in northern Kilosa District

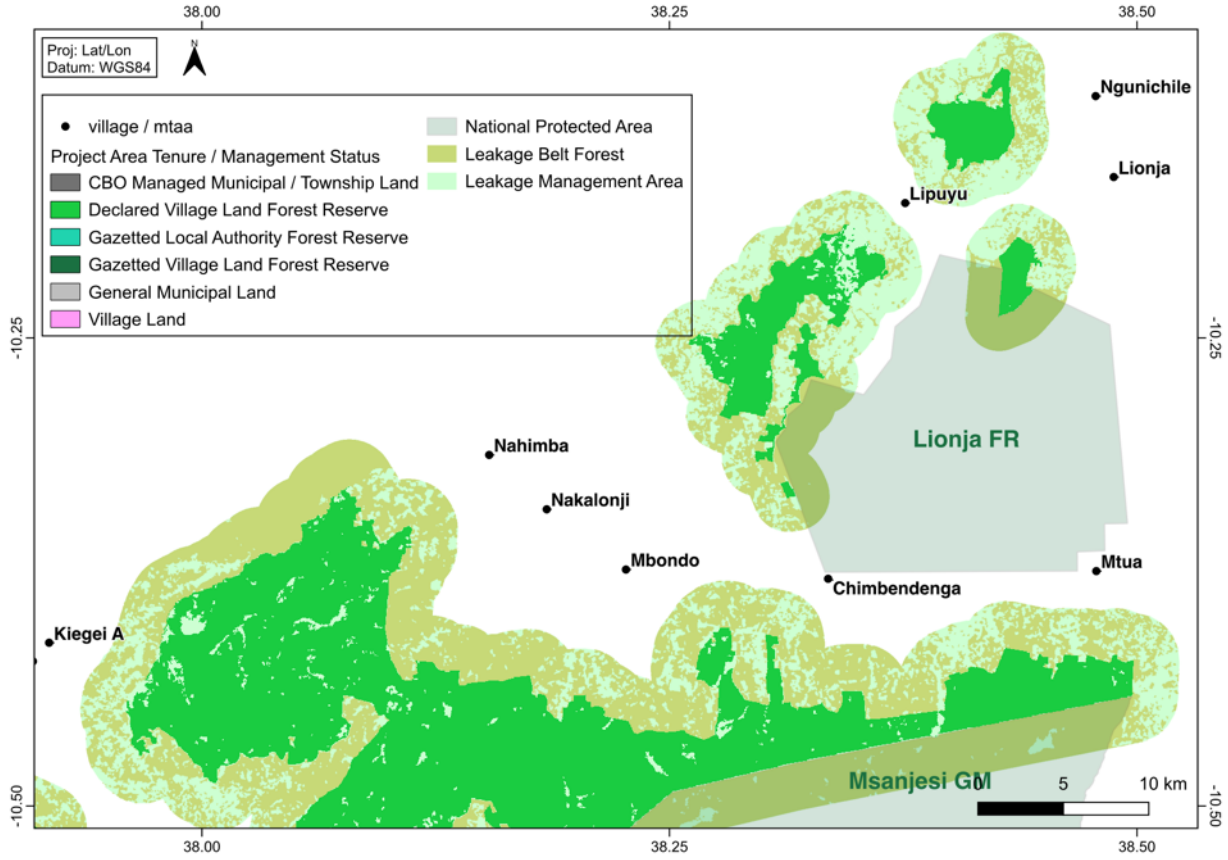


Figure 12 Project zone legal status and management in northern Nachingwea District

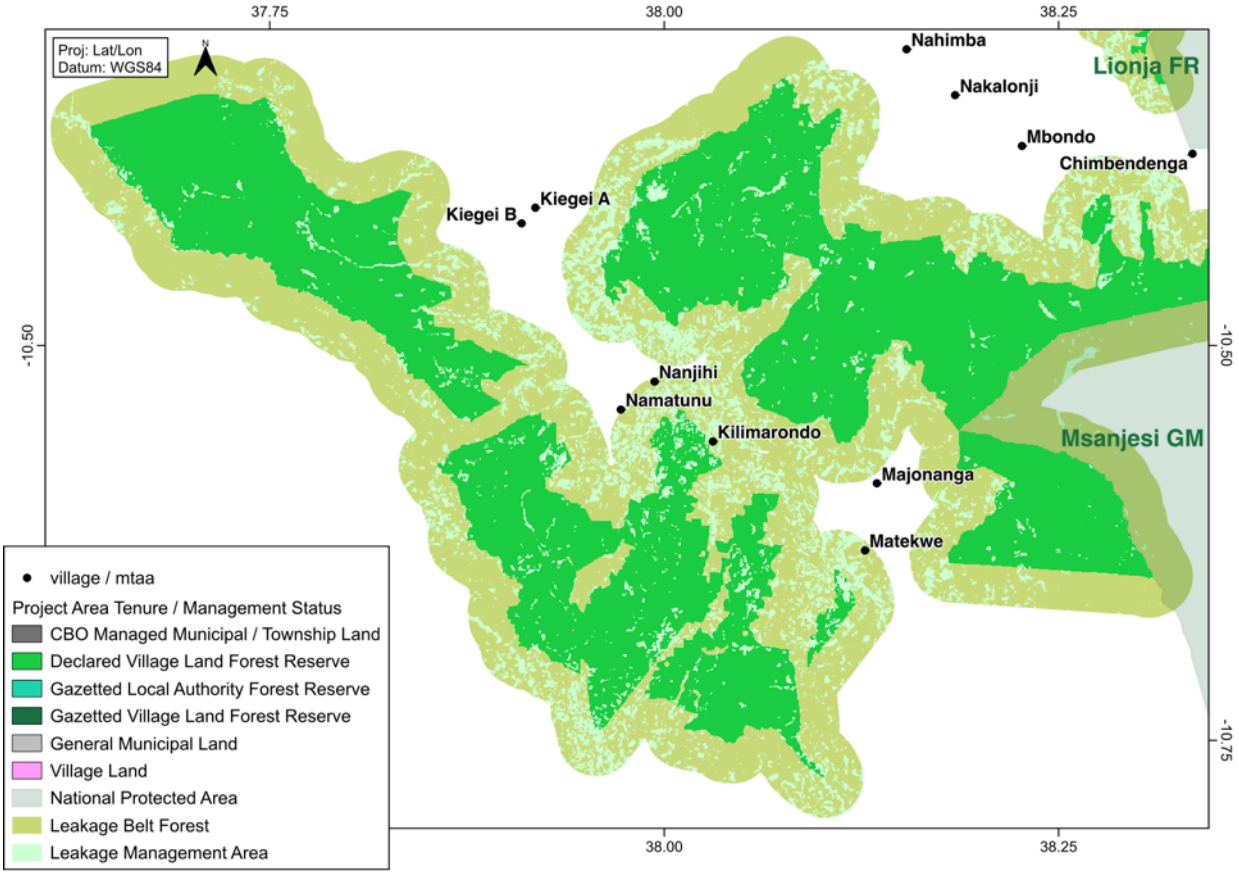


Figure 13 Project zone legal status and management in Southern Nachingwea District

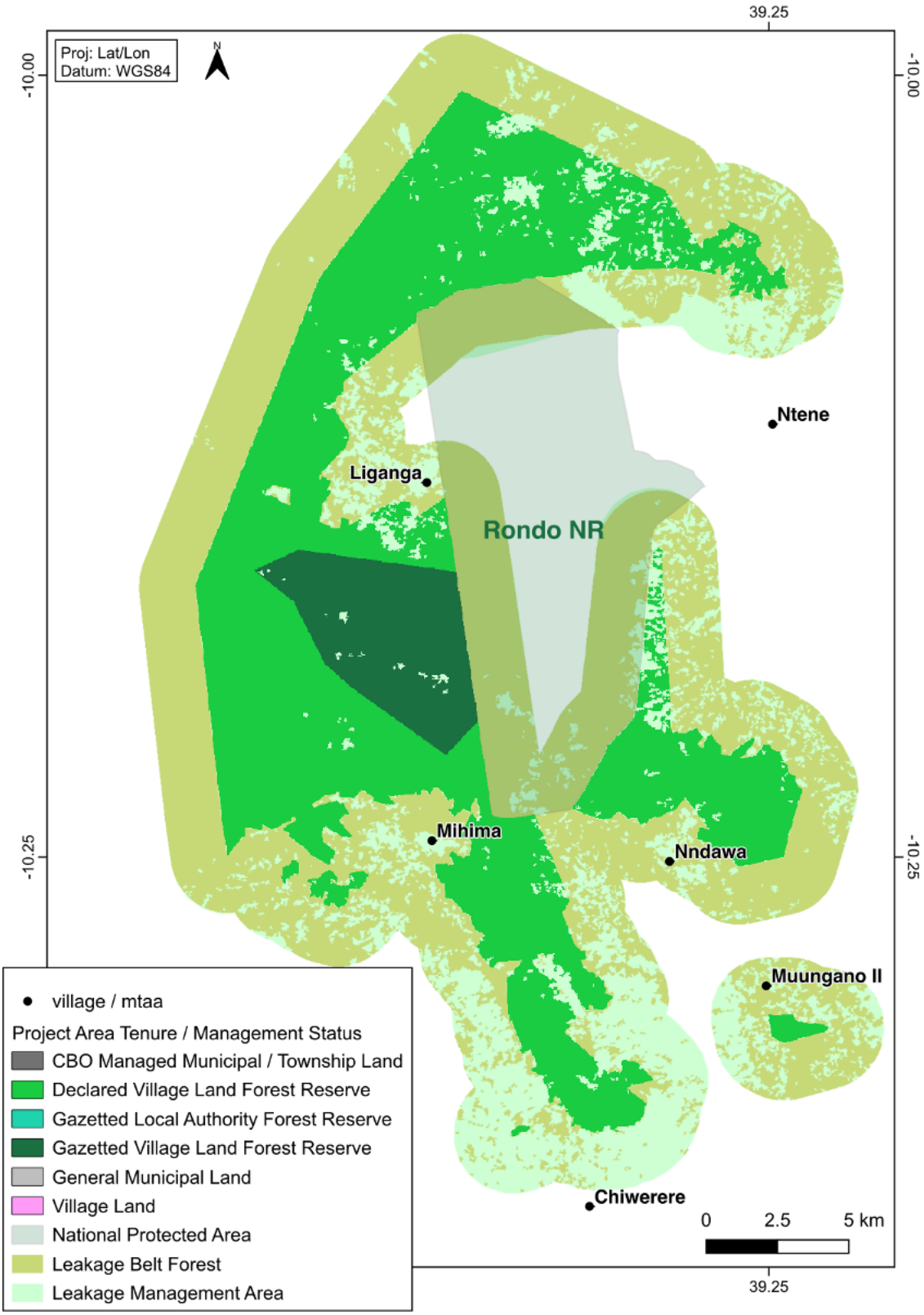


Figure 14 Project zone legal status and management in Mtama District

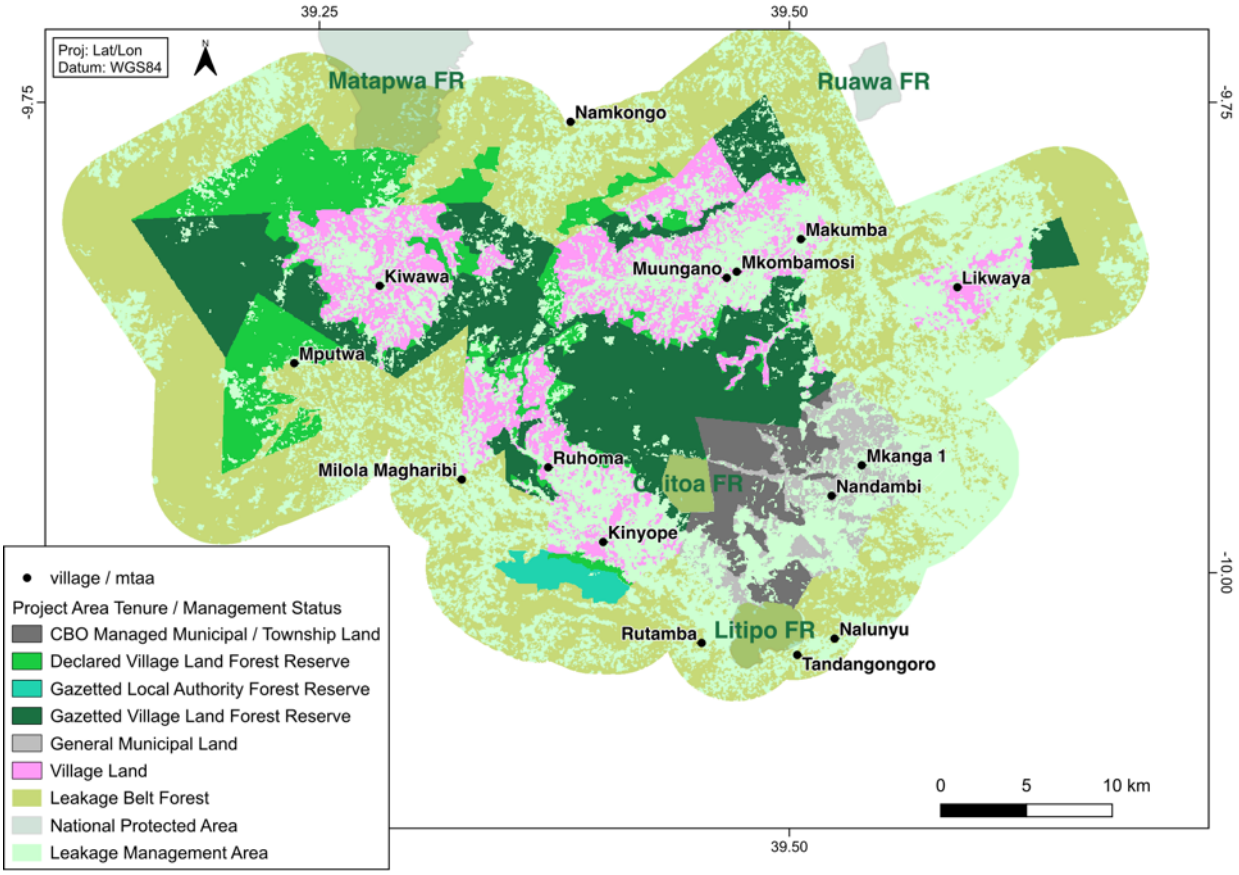


Figure 15 Project zone legal status and management in Lindi Municipality

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

The project recognizes, respects, and supports all property rights through two key approaches. First, it assists villages in identifying and reserving additional forests outside the existing Village Land Forest Reserves (VLFRs), transforming these areas from open access to communal property. To further secure statutory rights, the project facilitates the gazetting of all VLFRs through the Ministry of Natural Resources and Tourism. Second, the project promotes the issuance of Certificates of Customary Rights of Occupancy (CCROs) to individual households, particularly those residing within the leakage belt, so that they secure statutory land rights. This will be achieved by encouraging villages to prioritize the use of their carbon revenues to support the CCRO issuance process.

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

The table below outlines the outcome of the FPIC process within the stakeholder consultation.

Description of process for obtaining consent	The project is established on Village Land, where consent to create Village Land Forest Reserves was obtained through Community Based Forest Management Process, a process which had been completed by most villages prior to commencement of the instance 2 of this project. Land allocated for conservation is usually formalized as a Village Land Forest Reserve (VLFR) in accordance with Sections 32 to 35 of the National Forest Act, CAP 323, and the National Guideline for Community-Based Forest Management13. The process begins with raising community awareness about forest conservation and the benefits of establishing a VLFR. The Village Natural Resource Committee (VNRC) is formed by the Village Council and approved by the General Assembly to lead the initiative, initiate discussions, and draft a management plan. The draft is reviewed by the Village Council before being presented to the General Assembly for approval. Local authority experts provide technical advice throughout the process. Boundary demarcation and resource assessments are conducted with community involvement, and bylaws are created to regulate the reserve's use. The plan is then submitted to the District Council for approval, and once approved, the VLFR is formally declared, granting the village legal rights to manage and benefit from the forest. The villages may subsequently apply for gazettement through the Local Authority to the Ministry of Natural Resources and Tourism (MNRT). To establish a carbon trading project in areas designated for conservation, the proponent followed procedures outlined in Sections 26 to 29 of the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022, as amended in 2023. The process began by sensitizing communities about the REDD process and VCSL's model through meetings held with the Village Council and General Assembly. VCSL then revised Village Land Forest Reserve (VLFR) maps to exclude areas that were already deforested and consistently used for farming, while including forested areas with land uses compatible with conservation, such as grazing. The boundary resurvey was participatory, led by Village

[13] https://maliasili.go.tz/assets/pdfs/Community-BasedForestManagementGuidelines_2007.pdf

	Natural Resource Committees (VNRCs), and the revised maps were approved by both the Village Council and General Assemblies. Forest patrol technology was introduced to assist village patrol teams in identifying newly deforested areas and educating those involved in deforestation on conservation and the REDD process. Forest management plans were then updated to reflect these changes, and carbon trade contracts were drafted, presented, and discussed in Village Council and General Assembly meetings for approval.
Outcome of FPIC process	Approved Forest Management Plans: A sum of 50 villages participating in the project had approved FMPs prior to commencement of instance 2 of this project. The project created revision maps which were displayed to communities during consent process, where communities were informed about potentials for reducing or expanding the VLFRs by including other forested areas initially zoned for land uses that are compatible with REDD. Declared/Gazetted Village Land Forest Reserves (VLFRs): Under the project, all VLFRs have approved Forest Management Plans and bylaws. The community consent led to the formalization of these VLFRs, following the procedures outlined in Sections 32, 33, and 34 of the Forest Act CAP 323. Of the 62 VLFRs, 45 have been gazetted through Government Notice Number 688 and 487 of 2020, in accordance with Section 35 of the Forest Act, with the remaining gazettement to be facilitated by the project. Communities were thoroughly informed about the legal basis of VLFRs, which empowers them to own and manage their forests, promote biodiversity, protecting water sources, and mitigating climate change. Additionally, the VLFRs allow communities to retain 100% of the royalties that would otherwise be centralized. In the first instance of the project, both LUP and CBFM processes were entirely facilitated by the project. The second instance focused on areas where these processes had already been implemented by supporting NGOs, primarily the Tanzania Forest Conservation. Additionally, the second instance established 5 new VLFRs. Approved Revision Maps in 2024: The villages have approved forest revision maps and revised Forest Management Plans, which include the removal of encroached areas and the addition of proposed

expansion zones. Key information shared with communities during the approval process included:

a) The removal of deforested areas that have been consistently farmed to avoid conflicts and to focus limited resources on protecting remaining forest patches.

b) The inclusion of forests older than 10 years, outside the VLFRs, to bring them under formal management, particularly for land uses compatible with conservation, such as grazing or investment areas. This would increase the carbon trade potential by protecting additional threatened forests.

c) The clarification of boundaries by aligning them with physical features such as rivers and roads or straightening them to make them easier to protect.

Registered Carbon Trade Project: Community consent also led to the registration of the Project Idea Note and Project Concept Note. VCSL obtained a Letter of No Objection from the Designated National Authority.

Approved Carbon Trade Contract: VCSL received approval for the long-term carbon trade contract from the 62 Village Councils, General Assemblies, and seven Local Authorities.

Key information shared with communities to secure consent included:

a) The proponent's expertise in carbon trade, demonstrated by their success in a previous REDD project financed by the Norwegian Embassy, where the Lindi project achieved Verified Emission Reduction (VER) units.

b) Proponent's technical support for forest conservation, including monthly funding of patrols to reduce deforestation and forest degradation.

c) A secured market for carbon trade, with a minimum price equivalent to the opportunity cost of $4.06 per VER unit.

d) The continuity of sustainable forest use, allowing timber and charcoal harvesting to continue within sustainable limits, not exceeding 1% of total biomass annually.

	e) A commitment to permanence, requiring a minimum 40-year carbon trading contract, between the proponent and managing authority f) Proponent's commitment towards provision of agricultural extension services to enhance productivity in the project area and leakage zones, thereby reducing the need for forest clearing. g) Performance-based payments, using a stock-flow accounting approach, encouraging communities to invest in secondary education, helping younger generations adopt sustainable livelihoods that do not promote deforestation. The project model takes a progressive stance to the right-holders by discouraging the eviction of people from the Village Land Forest Reserves (VLFRs)and Local Authority Forest Reserves (LAFR, contrasting with the common practice in many parts of Tanzania, where communities residing within protected areas often face eviction. The approach is supported by sections 24 (2) (a) and 42 of the National Forest Act, CAP 323. The initiative successfully demonstrated to village governments and local authorities that conservation can be achieved without displacing residents. This was accomplished by introducing cloud-based technology that allows patrol teams to remotely detect new forest clearings. As a result, individuals living within or adjacent to the forests are incentivized to act as guardians of forest conservation rather than contributing to deforestation. The project's focus is on preventing new clearings within the VLFRs and local authority forest reserves, ensuring that the rights and lands of local communities are preserved.

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

The table below describes the project's benefit-sharing agreement, demonstrating that smallholders and community members have fully and actively participated in defining both the decision-making process and the distribution mechanism for benefit sharing.

Process used to design the benefit sharing plan	The project's benefit-sharing arrangement includes both cost-benefit sharing among stakeholders and benefit sharing among community members within the participating villages. The cost-benefit sharing framework is based on Regulation 34 of the Environmental Management (Control and Management of Carbon Trading) Regulations,

	2022, published in Government Notice (GN) 636 on October 28, 2022, along with amendments in Regulation 20 of GN 721 issued on October 6, 2023. To ensure that expected revenues are used for development projects that directly benefit individuals and communities impacted by the project, the benefit-sharing arrangement among community members will be designed with effective involvement of community members from sub village level. This process draws on the proponent's experience with the previous Lindi REDD+ project. To facilitate this, Village Climate Solutions Limited (VCSL) will work closely with local authorities to improve the first instance project's existing benefit-sharing guidelines. This collaboration will involve developing an enhanced template for benefit sharing, customizable to the unique contexts of each participating village. VCSL will also engage District Planning Officers to assist villages in tailoring this template to their specific needs and circumstances. This approach ensures that the benefit-sharing agreement complies with regulatory requirements while also reflecting the distinct socio-economic dynamics of each community. The individual village benefit sharing guideline will be discussed in the village council and then approved by the village general assembly.
Summary of the benefit sharing plan	As outlined in Regulation 34 of the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022, along with the 2023 amendments, benefit sharing among stakeholders will be distributed based on gross revenues as follows: A minimum of 61% of gross revenues will be paid to the managing authority, allocated as: A minimum of 51% to the villages, 8% to the local authority, 1% to the regional administration, and 1% to the President's Office - Regional Administration and Local Government. 8% of gross revenues will go to the Designated National Authority/Focal Point. 31% of gross revenues will be retained by the project proponent.

	The regulations allow flexibility for the proponent to provide additional benefits to communities as needed and based on opportunity cost surveys. According to Sections 22 and 26 of the Local Government Act (CAP 287 of the Laws of Tanzania), each village council is issued a certificate of incorporation, making it a corporate body with perpetual succession and a common seal. This legal status enables village councils to sue, be sued, and acquire both movable and immovable property. This provision also allows communities to maintain privacy around certain elements of the benefit-sharing plan if they choose. With support from the project, each village will develop clear guidelines to govern the benefit-sharing process. These guidelines will define transparent, participatory procedures for making decisions on revenue allocation, ensuring funds are used for forest management, community development projects, and/or household dividends. Typically, the benefit-sharing system is designed to treat all villagers as equal owners of the village forest reserve, entitling them to equal dividends. Each year, villages will compile household lists according to residence eligibility criteria set in their guidelines. The total revenue from REDD+ projects will be divided by the number of eligible residents to calculate a per-person dividend. In a village assembly, community members will discuss how much of their dividends to allocate to previously agreed-upon development projects and forest protection efforts. The remaining amount will be distributed as dividends. Each resident will collect and sign for their dividend in front of their sub-village. The project will encourage communities to prioritize village development activities with the potential for long-term impact, particularly those that support forest conservation. Increasing secondary school attendance and completion is seen as especially critical for fostering sustainable development and ensuring lasting benefits from the project.
Approval and dissemination of benefit sharing plan	The benefit-sharing arrangement, as outlined in national regulations, was initially presented to the village councils and general assemblies during the first consent meetings held by the project. This arrangement is clearly detailed in Clause 10 of the Carbon Trade Contract between the project proponent and the managing authorities. In village meetings to discuss the contract, the benefit-sharing terms were visibly displayed

on flip charts and posted on the wall to ensure all participants could easily see and understand the content. Furthermore, each village will develop its own customized community benefit-sharing guidelines, which will be presented to the village council for discussion and adaptation based on the village's specific circumstances. Once finalized, the guideline will be approved by the village general assembly. This process ensures that the benefit-sharing agreement is culturally appropriate, inclusive, and accessible to stakeholders, who can review it at any time through the village council or general assembly.

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

The project is firmly committed to recognizing, respecting, and promoting the protection of the rights of local communities (LCs), and customary rights holders. Crucially, the project activities do not involve or lead to the involuntary removal or relocation of property rights holders from their lands or territories, nor do they force rights holders to relocate activities that are important to their culture or livelihood. The project respects customary property rights in three ways.

First, the project addresses those who may have previously contributed to deforestation within the Village Land Forest Reserves (VLFRs) before the project's start. Instead of following national forest laws that could mandate their eviction, the project advocates for allowing these individuals to continue their farming activities, if they refrain from further forest clearing. This approach not only respects their existing livelihoods but also promotes sustainable land use. Additionally, the project has facilitated the removal of heavily encroached and consistently farmed areas from the reserved land, enabling farmers in those areas to legally own and continue their farming activities without interference from patrol teams.

Second, the project actively promotes the formalization of more unreserved forests within the open access land, gazettement of VLFRs, and the implementation of more effective forest management activities. This ensures that the VLFRs gain stronger legal recognition at the national level, protecting them from the threat of nationalization. The project's management efforts also prevent the illegal sale or municipalization of these lands, which would otherwise strip local communities of their customary rights over the resources. By securing these lands, the project strengthens the community's long-term control and guardianship over their forests.

Finally, the project seeks to promote the issuance of Certificates of Customary Rights of Occupancy (CCROs) to individual households. Villages will be encouraged to prioritize the use of their carbon revenues to support this effort, providing formal land tenure to local households. This initiative further enhances the security of land rights, empowering communities to manage their land and resources in a way that aligns with their cultural practices and livelihoods. Through these actions, the project ensures that the rights of local communities are respected and that their land and cultural practices remain intact.

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

Possible illegal activities that could negatively impact the project include land clearing for farming, illegal wood harvesting for charcoal and timber, and arson. These activities reduce the potential for generating carbon credits, meaning project benefits cannot be realized from such illegal actions. The project employs cloud-based patrol technology and consistent boundary marking to deter or quickly identify and address illegal activities. Additionally, the project model permits sustainable wood harvesting for timber and charcoal, provided it does not exceed 1% of the standing biomass annually. To prevent forest fires, the project will implement early burning measures to reduce fuel loads along forest edges, thereby limiting fire intensity and spread within the project area. Furthermore, the project adheres to the Ten Principles of the UN Global Compact, ensuring that no victims of human trafficking, forced labor, or child labor are involved in its operations, as outlined on the UN Global Compact website.

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

The project area currently has no disputes over land, territory, or resource rights. During the second phase of the project, potential disputes were identified and resolved, particularly in gazetted Village Land Forest Reserves (VLFRs) that had been encroached upon and consistently farmed. Disputes could have arisen with farmers accused of recent deforestation, and conflict was anticipated if there were any attempts to evict them. To avoid such conflicts, the project's approach has been to refrain from eviction attempts if these individuals do not cause further deforestation. Moreover, the project collaborated with managing authorities to remove heavily encroached areas, creating more defensible boundaries for patrol teams and thereby eliminating potential disputes.

However, potential issues remain in a few forest patches, where patrol teams have not yet managed to patrol effectively or demonstrate to have started deterring deforestation. These areas are found in 6 out of 62 Managing Authorities based in 2 out of the 8 Local Authorities involved in the project. These potential conflicts relate to portions of VLFRs already gazetted by the Ministry of Natural Resources and Tourism through Government Notice (GN) 688 of 28th August 2020, and GN 487 of 20th June 2020. The primary issue is the lack of visible boundaries, which has led farmers from neighboring villages to unknowingly cultivate in the reserved land, a fact largely uncovered through the patrol tool (Mergin Maps) developed by the project. Typically, the center of the villages owning the VLFR is farther from the potential conflict areas than the centers of the villages or sub-villages where the encroaching farmers reside, complicating enforcement of bylaws. According to the patrol teams, farmers in these areas fear eviction, making them skeptical to engage with the patrol team and learn about the project's philosophy of avoiding eviction and discouraging the clearing of natural trees older than 10 years. The areas with potential conflicts are as follows:

Gongwe: A potential dispute may exist at a forest block called "Kidongo Chekundu," where the VLFR borders Msowero village. Reports suggest that farmers from Msowero claim this forest patch as part of their arable land.

Msimba and Ihombwe: A key area of concern is at "Visu" junction in Kikonga sub-village, Kisanga village. Farmers have expanded their farms into a valley bordering the two VLFRs, claiming they believed it to be part of Kisanga's open-access land.

Makumba: Conflict appears to be happening at the border between Makumba VLFR and Kitohavi village, a new village formed from Kikomolela. The lack of clear boundaries has led farmers from Kitohavi to believe that part of the Makumba VLFR is within their open access village-land.

Muungano: The conflict may arise in Kipunga sub-village, where residents believe they belong to Milola Magharibi village and that Muungano has no authority to reserve the area.

Namkongo: The issue may potentially arise at the border with Kiwawa village, where farmers from Kiwawa have encroached and opened farms within Namkongo VLFR, believing the land belongs to them.

The project plans to have land officers visit these areas to confirm village boundary maps and work with the Ministry of Natural Resources and Tourism to clarify that the areas in question are gazetted VLFRs. Additionally, the project will engage district officials to visit the sites and meet with farmers, educating them about the project's non-eviction philosophy and offering extension services to improve productivity on existing arable land without causing further deforestation. Finally, the project will promote collaboration between Village Councils (forest owners) and communities potentially implicated in deforestation within disputed areas. These communities will be supported in forming a Community-Based Organization (CBO) and entering into a Joint Management Agreement (JMA) with the village that owns the affected forest, in accordance with Section 16 (1) (c) of the Forest Act, CAP 323 of Tanzania's laws. This approach will transform these communities from being viewed solely as encroachers to partners in protecting the remaining natural forests. The JMA will outline benefit-sharing mechanisms, incentivizing the accused communities to cease deforestation and actively participate in conservation efforts.

2.5.12 Approvals (CCB, G5.7)

According to Tanzania's regulatory framework, the approval process for carbon trade projects is based on Statutory Regulations, outlined in Sections 26 to 29 of the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022 (GN 636), as amended by GN 721 of 2023. Based on these regulations, the project has secured the following approvals:

i) **Approval of the Project Idea Note:** Consent letters from all participating villages were obtained to register the project idea note, as required under Regulation 26. These letters were accompanied by the meeting minutes of the respective village councils and general assemblies. The project received formal approval of the idea note, confirmed through a letter with reference

number SUA/NCMC/CT.1/10/10 dated January 22, 2024, from the Designated National Authority.

ii) **Approval of the Concept Note:** After submitting the complete Concept Note, along with the required registration fee, the project received a Letter of No Objection with reference number CBC.78/200/01/22 dated September 20, 2024, from the Designated National Authority, in compliance with Regulation 27 of the regulations. Finally, the project submitted the Full Project Document as required by the regulations.

iii) **Approval of the Long-Term Carbon Trade Contract:** The project has entered a 40-year carbon trade contract with the Managing Authorities. These contracts were approved by the respective Village Councils, Village General Assemblies, and Local Authorities, as per Regulation 29, of the regulations.

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 registered under any other GHG programs?

☐ 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)

As defined in Sections 1.1.3 and 1.1.4 of the Methodological Annex, the leakage belt refers to the land surrounding the project area that is monitored for the displacement of deforestation activities due to the project's interventions. To manage leakage, the project has planned to implement two key interventions.

The first initiative is performance-based payments through stock-flow accounting. Annual REDD+ payments to Managing Authorities will be based on their performance. The project will employ a stock-flow accounting model, where a portion of the credit income allocated to forest owners is determined by their performance relative to a spatially explicit baseline, adjusted for any leakage in the part of the leakage belt closest to the respective owner. To discourage leakage between forest owners, the remaining percentage of the income is distributed based on the relative share of total project carbon stocks each owner holds, less any emissions above baseline levels, including those from the leakage belt. This system was successfully piloted by MJUMITA in the Lindi REDD+ project, where it yielded results that villages considered fair, providing a strong incentive for all participating villages to prevent deforestation.

The second initiative involves the provision of agricultural extension services to farmers, primarily within the leakage belt. This initiative targets improving yields on land already deforested as of 2022, both within the project area and leakage belt. Extension agents will support farmers in adopting conservation agriculture practices, aimed at increasing productivity. They will also assist farmers in organizing to become eligible for external financing, such as CRDB Bank's Green Climate Fund supported loan, which promotes climate adaptation for smallholder farmers in Tanzania. The goal is to achieve at least a 1% annual increase in agricultural yields, which would offset the agricultural production lost to forest conservation and prevent market-driven leakage.

Both the provision of performance-based payments and farm extension activities is subject to available funding with performance-based payments specifically contingent on VCU sales. However, a high level of leakage is not anticipated during the first 1-3 years of improved forest protection due to 3 project-specific factors:

1. There is a structural lag between new clearing in large contiguous forest blocks and meaningful agricultural production. In the 2021 opportunity cost survey of farm clearings in Lindi Region from the previous 3 years, 92% of respondents reported crop damage from wild animals (most commonly baboons and bush pigs, but also elephants) resulting in drastically reduced production. The economic value of farming in the surveyed clearings was on average net negative. Thus, initial clearing is primarily a land-speculation activity rather than an immediate production decision, delaying a significant proportion of displacement leakage pressure by one to three years. Additionally, the project made a specific effort to bring nearly all remaining frontier forest into expanded or new village forest reserves; the remaining leakage belt forest is therefore more fragmented than the project area and less suited to speculative clearing, though still suitable for productive farm expansion at the edges of existing holdings.
2. Second, patrol teams will operate under a zero-eviction policy for 2022-2024, focusing on education and requiring only that encroaching farmers not expand existing clearings — containing new encroachment without generating the displacement pressure an eviction-based approach might cause.
3. Third, farmers can adjust fallow cycles on existing land rather than seek new clearings. The 2021 opportunity cost study recorded fallow lengths ranging from 0 to 10 years with a mean and median of 4 years, and communities with little remaining forest already operate on much shorter fallow cycles than those near forest frontiers.

2.6.2 Further Information

All relevant information bearing on the eligibility of the project, the GHG emission reductions, carbon dioxide removals, and quantification of the project's reductions are documented in this PD and methodological annex.

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	VM0015	AVOIDED UNPLANNED DEFORESTATION	1.2
Tool	VT0001	VCS VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities	3.0
Tool		VCS AFOLU Non-Permanence Risk Tool	4.2

3.1.2 Applicability of Methodology (VCS, 3.1)

Reference ID/Title	Applicability condition	Justification of conformance
VM0015	Baseline activities include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agriculture or grazing activities as long as the category is Avoiding Unplanned Deforestation according to the most recent VCS Standard.	The baseline is the result of conversion of forest to non-forest primarily through agricultural activities and rarely charcoal making.
VM0015	Project activities include one or a combination of the eligible categories defined in the description of the methodology scope (Table 1 and Appendix 1).	The project activities correspond with categories A, B, C, D, G, and H from Table 1 Appendix 1 in VM0015 which are all eligible activities.
VM0015	The project area includes one or a combination of forest types, such as, but not limited	100% of the project area meets the definition of forest at the project start date or project instance start date.

	to, old-growth forest, degraded forest, secondary forests, planted forests or agro-forestry systems meeting the definition of "forest."	
VM0015	At the start of the project, the project area includes only land qualifying as "forest" for a minimum of 10 years prior to the project start date.	100% of the project area has been forested for at least 10 years prior to the project start date or project instance start date.
VM0015	The project area does not include forested wetlands growing on peat (e.g., peat swamp forests).	The project area contains no wetland forests on peat soils.
VT0001	AFOLU activities the same or similar to the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project shall not lead to violation of any applicable law even if the law is not enforced. The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario. Project proponent(s) proposing new baseline methodologies shall ensure consistency between the determination of a baseline scenario and the	The project activities are legal. See section 2.5. The project is not proposing a new baseline methodology.

	determination of additionality of a project activity.	
AFOLU Non-Permanence Risk Tool	No applicability conditions specified in the document	This is the required tool for all AFOLU projects, and this is an AFOLU project.

3.1.3 Project Boundary (VCS, 3.12)

This section was modified to align clearly with VM0015. VM0015 treats emissions as either stock changes in carbon pools or emissions from non-CO_2 greenhouse gases. All carbon pools and sources of GHG emissions included in the baseline scenario must also be included in the project scenario.

VM0015 Table 2 Carbon Pools Included in or Excluded from the Boundary of the Proposed AUD Project Activity

Carbon pools	Included / Excluded	Justification
Above-ground biomass	Tree: Included	The largest carbon pool subject to change
	Non-tree: Excluded	The only perennial crops in the baseline final land-cover are tree crops and are thus captured in the tree pools. The project area is not suitable for sugarcane plantations and pigeon peas are cleared and replanted each season.
Below-ground biomass	Included	This is a significant carbon pool subject to change
Dead wood	Excluded	The carbon stocks in the standing dead tree pool are higher on average in the baseline scenario due to residual unfelled ringbarked trees left in the first 1-2 years after deforestation. However, subsequent burning, cutting, and termite activity remove these residual trees leaving a stock in this pool comparable to the project scenario. The difference between the long-term average post deforestation stock in this pool and average stock in the project forest classes weighted by projected baseline deforestation is 1.98t CO_2e/ha, which is 1.2% of the average emissions factor weighted by projected baseline deforestation. Thus, excluding this pool will not lead to significant

		overestimate of GHG reductions. Lying dead wood was measured in a subset of forest and post-deforestation biomass plots. The volume of lying dead wood in the forest plots was higher than in the post-deforestation plots, so excluding that pool is conservative.
Harvested wood products	Excluded	Most of the biomass cleared in the baseline scenario is simply burned on site as part of farm preparation. A minority (less than 10%) is turned into charcoal, but that does not translate into a long-lived wood product. An even smaller amount (less than 1%) is turned into timber. The level of timber extraction in both the baseline and project scenario is low because only a minority of tree species are considered suitable for timber and only a minority of those trees are large enough to produce timber. Finally, there isn't likely to be a significantly difference between scenarios as sustainable timber harvesting is allowed in the project scenario. Thus, excluding this pool does not lead to an overestimation of net GHG emissions reductions.
Litter	Excluded	Most of the project area is Miombo woodland, which is subject to periodic burning, so this pool is temporary even in the project case.
Soil Organic Carbon	Excluded	The predominate land-use change in the baseline scenario is conversion from forest to cropland, which results in reductions in soil organic carbon. Excluding SOC is conservative for now, though the project may decide to include SOC when it transitions to VM0048.

VM0015 Table 3 Sources and GHG to be Included in or Excluded from the Boundary of the Proposed AUD Project Activity

Sources	Gas	Included/Excluded	Justification
Biomass burning	CO_2	Excluded	Counted as carbon stock change
	CH_4	Included	Slash-and-burn is the method of forest clearance in the baseline scenario

	N_2O	Included	Slash-and-burn is the method of forest clearance in the baseline scenario
Livestock emissions	CO_2	Excluded	Not a significant source as per the methodology
	CH_4	Excluded	The project activities have no effect on livestock numbers or emissions
	N_2O	Excluded	The project activities have no effect on livestock numbers or emissions

The project area, leakage belt, and reference region are shown in Figure 16. For full descriptions of each area and how they meet the requirements of methodology, see section 1.1 of the methodological annex.

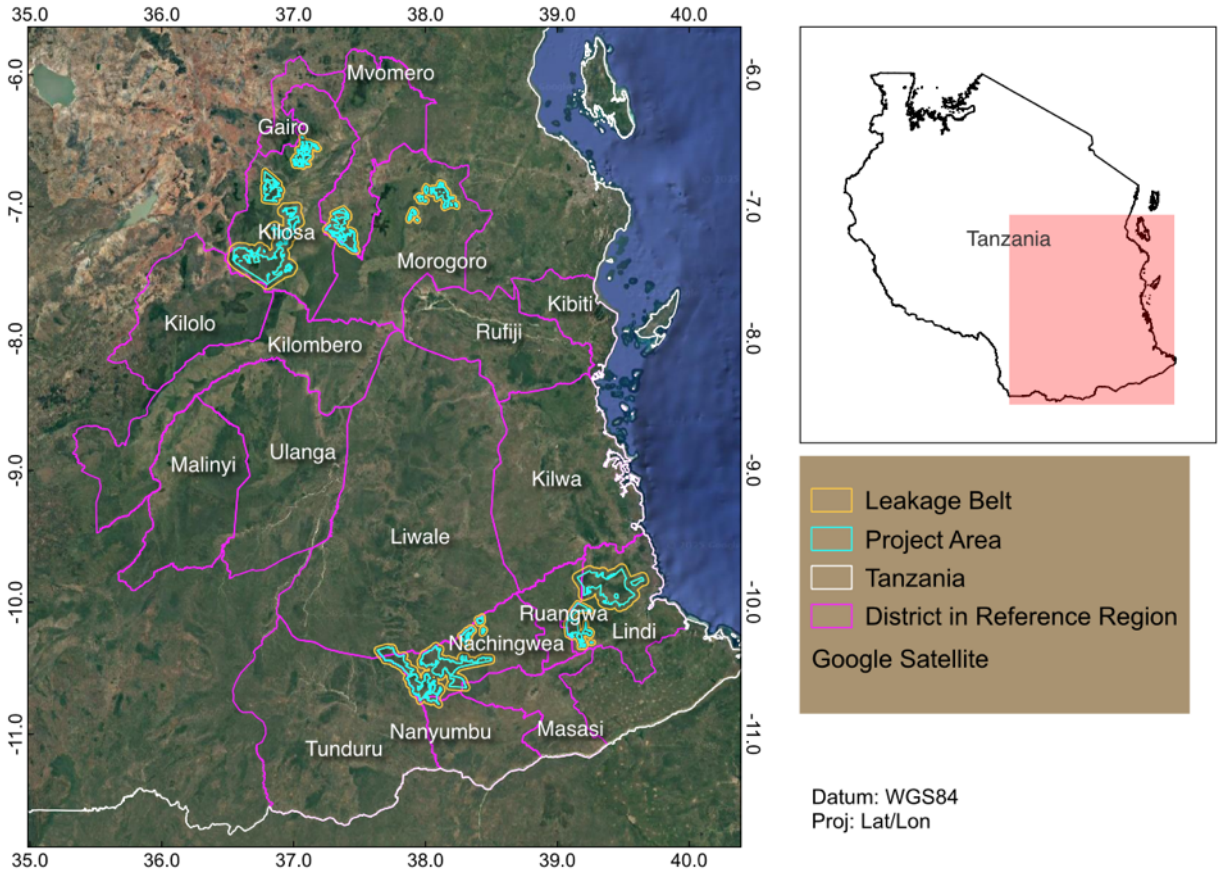


Figure 16 Reference region with project area and leakage belts

3.1.4 Baseline Scenario (VCS, 3.13)

The methodology requires an analysis of the agents, drivers, and underlying causes of deforestation and their likely future development. Each of these steps in described in detail in section 2.2 of the methodological annex. The conclusions are summarized in the next paragraphs.

The primary agents of deforestation are primarily men (90%) with primary school or less education (96%) from the communities surrounding the project areas. Due to Tanzania's high fertility rates, very young population (49% under 18), and low rates of secondary school obtainment rate in the communities surrounding the project area (only 33.6% enrolled and even less will finish), the population of deforestation agents will increase substantially in the baseline scenario.

Based on extensive data on recent disturbances in the project area, over 95% of deforestation in the baseline scenario would be driven by conversion to cropland and this would primarily be by small-holder farmers. Farming is both subsistence and for cash crops, though there seems to be an increasing amount of cash crop cultivation, especially for sesame seed, which is an export commodity. Given trends in commodity prices, it is likely that this trend will continue. Charcoal harvesting was listed as the primary driver for about 2% of forest clearing in recent disturbance records, though technically it only leads to deforestation if it is subsequently followed by cultivation. Otherwise, the areas harvested for charcoal would rapidly regenerate from coppicing and root suckers. However, since it is impossible to know the future of areas cleared for charcoal harvesting and distinguish them from farming with remote sensing, they are both treated as deforestation in the historical reference period and in project monitoring.

Drivers explaining the location of baseline deforestation area also explored. The strongest predictor is accessibility which can be most clearly mapped by distance to historical deforestation. An analysis of deforestation in the reference region showed the 50% of 2016-2022 deforestation occurred within 141 meters of 2010-2016 deforestation, 75% within 351 meters and 95% within 1105 meters. Other factors include the land-tenure status, protective status, and favorability for farming.

The underlying drivers of deforestation were identified as:

- Local and national population growth which creates demand for farmland and agricultural commodities
- Effective open-access land use regime that would have existed in the absence of REDD for most of the project area. People can simply claim land by clearing it.
- Poor enforcement of forest management plans occurs even where forest reserves would be created in the baseline scenario due to lack of forest revenue or ongoing donor funding and technical capacity
- Farming conditions incentivize farmers to practice expansion rather than intensive agriculture. This is due to a combination of environmental and policy conditions

- Lack of alternatives to farming. With only primary school education or less, people's economic opportunities are constrained.

In summary, in the baseline scenario, continued rural population growth, particularly growth in the number of people with less than secondary education and with few livelihood options beyond farming will lead to increased demand for agricultural land for both subsistence food and cash crop production. Continue urban population growth will also help ensure an expanding market for farm products and charcoal. Variable weather, market conditions, and poor soils lead farmers to practice expansive and shifting rather than intensive agriculture practices, further expanding the total quantity of land required for farming. Most of the remaining forested land in the project areas would be under open access tenure, open to whoever had the labor necessary to clear it and convert it from communal to household ownership. Furthermore, even areas set aside for protection would be encroached at increasing rates as populations expand, donor funding for conservation ends, and the value of sustainable forest use remains uncompetitive with farming due to both ecological and policy factors.

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)

As per the methodology and VCS standard, the additionality of the project is assessed using the most recent version (3.0) of VT0001 Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities. This assessment is updated for the baseline revision and expanded project area, though largely remains the same because the conditions have not changed much in the 10 years since the project start. See section 2.1 of the methodological annex for a step-by-step implementation of VT0001.

The results show that the baseline scenario summarized in section 3.1.4 of the PD and described in detail in section 2.2 of the methodological annex is the most plausible scenario and that the project activities would not occur in the absence of climate finance due to investment, ecological, and social barriers and that these same barriers facilitate rather than hindering the baseline scenario. Finally, it is demonstrated that the scope, scale (both spatial and temporal), and effectiveness of the project's proposed activities are not common practice.

3.1.6 Methodology Deviations (VCS, 3.20)

VM0015 calls for future deforestation to be predicted in terms of specific pixels. The pixels are selected by working backwards from the highest risk pixels until the projected number of pixels to be deforested in year t in the reference region have been selected. The project deviated from this approach in favor of the approach from VT0007 where future deforestation location is predicted as a density map where each pixel in the map is assigned a density representing the proportion of pixels in the same risk class projected to be deforested in each year of the baseline validity period. The proportions are represented in terms of fractions of a hectare so they can be summed to calculate the predicted area of projected deforestation for any discrete area in the landscape. This approach was chosen to align the baseline with that which will be produced by Verra under VM0048, which the project will likely adopt in 2025 subject to data availability from Verra. The accuracy of both approaches was assessed using polygon level Figure of Merit (FOM) as recommended by VM0015 (see section 4.2.2 of the methodological annex). The FOM for the best model using the VT0007 approach was 0.658, whereas the FOM for the same model using the VM0015 approach was 0.507. Therefore, since this is only a deviation in deforestation risk measurement and the VT0007 approach is more accurate than the prescribed approach in VT0015, this is an acceptable deviation.

In section 8.3.1.2 of the methodology, it states that ex ante activity displacement leakage should be calculated, "multiplying the estimated baseline carbon stock changes for the project area by a Displacement Leakage Factor (DLF) representing the percentage of deforestation expected to be displaced outside the project boundary. Where deforestation agents do not participate in leakage prevention activities and project activities, the DLF is 100 percent. Where leakage prevention activities are implemented, the factor is equal to the proportion of baseline agents estimated to be given the opportunity to participate in leakage prevention activities and project activities". However, this ignores the fact that the project is not expecting 100% effectiveness and unavoided deforestation in the project area during the with project scenario is deforestation which does not leak because it was not displaced. Thus, rather than multiplying the DLF by the baseline carbon stock changes, the DLF was multiplied by the difference between the baseline and the ex-ante estimates of project scenario carbon stock changes (which changes over time as anticipated effectiveness changes). Therefore, as the participating project villages become more effective at preventing deforestation, leakage would also rise since a greater number of deforestation agents will be displaced.

This is a much more realistic means of estimating leakage ex ante. However, as this has no effect on the calculation of emissions ex post, it does not negatively affect the conservativeness of estimates.

VM0015 does not provide detail on how land cover change monitoring within project area should be carried out. It only says that monitoring of land cover change must be carried out by creating ex post tables of activity data per stratum. It lists VM0015 table 9 as one of the table for which ex-post activity data should be created. Table 9 is for the reference region, which does not factor into calculations of project or leakage belt emissions and thus serves no monitoring purpose. This could imply that the methodology expects projects to create wall to wall maps of land-cover

change for the entire reference region and use these to then assess land-cover change in the project area and leakage belt. However, this is not possible for this project because the PALSAR-2 mosaic products used by the project for creating the historical land-cover change maps don't typically become available on Google Earth Engine until many months after the end of a monitoring period which would cause an unreasonably long delay in monitoring. Therefore, the project uses a land-cover change monitoring system like VMD0055, which uses visual inspection of high-resolution imagery covering a stratified sample of points in the leakage belt and project area. If the uncertainty of the estimated deforestation exceeds 10%, then the estimates are adjusted upwards. Since this approach produces uncertainty estimates that are specific to just the project area and leakage belt, which is the data used for monitoring, it should be more accurate than basing the estimates from wall-to-wall maps of land-cover change. Since the guidance from VM0015 is not clear, it is not clear that this is a deviation, but if the intended requirement from VM0015 is a wall-to-wall map, then estimating activity data using sample points only covering the project area and leakage point should be more accurate and as such is a justifiable deviation.

There is a small discrepancy between the reference region boundary and the leakage belt near Malolo A village in Kilosa. The required leakage belt buffer would extend outside the reference region and cover 316 ha of forest outside the reference region falling in Mpwapwa district. This is equivalent to 0.09% of the forest in the leakage belt. This occurred because the project forgot that the leakage belt might extend more than 2km from the project area in some areas. Fixing the mistake would require redoing all the GIS work from the risk mapping step. However, the forest in that area was not included for the purpose of calculating the leakage belt buffer, so the leakage buffer for that section of the project was expanded to capture an equivalent amount of forest from the reference region. Then, one random land-cover monitoring point was added in missing portion of the leakage belt and considered to be part of the LB-A-4 strata. This is a conservative deviation since there were only 58 sample points in the LB-A-4 strata prior to adding the extra point and almost no deforestation projected for the strata since it is in the lowest risk strata.

When mapped deforestation for the reference region during a monitoring period falls below the projected baseline deforestation, the project will use a dynamic baseline instead. The procedure is described in section 3.3.3. This deviation only affects the method of calculating baseline deforestation and is conservative because it can only decrease baseline deforestation compared to the baseline from the applied methodologies.

3.2 Quantification of Estimated GHG Emission Reductions and Removals

3.2.1 Baseline Emissions (VCS, 3.15)

The procedure for the quantification of baseline emissions and/or carbon stock changes in accordance with VM0015 is detailed in sections 1 and 3 through 6 of the methodological annex.

Methodological annex sections for calculation of Baseline Emissions:

Section 1: Spatial Boundaries

Section 3: Analysis of Historical Land Use and Land Cover Change

Section 4: Projection of Future Deforestation

Section 5: Definition of Land Use and Land Cover Change Component of the Baseline

Section 6: Estimation of Baseline Carbon Stock Changes and Non-CO2 Emissions

Beyond the static baseline described in the methodological annex — which projects future deforestation using historical average annual deforestation rates weighted by a spatial risk map — the project will employ a dynamic baseline when cumulative observed deforestation in the reference region falls below the projected cumulative baseline quantity within a given monitoring period (per VM0015 Table 9). Deforestation mapping for each monitoring period will be conducted using the PALSAR-based detection model detailed in Section 3 of the methodological annex, or alternatively using any method demonstrated to produce deforestation estimates within ±10% of the PALSAR-derived values.

When a dynamic baseline is triggered, class-specific deforestation rates for both the project area and leakage belt will be estimated from stratified random samples drawn from the reference region, excluding the project area and leakage belt. These samples capture forest persistence and loss during the monitoring period and must contain a minimum of 100,000 pixels per forest class. Stratification ensures that the sample distribution of deforestation density values (see Figure 50, Section 4 of the methodological annex) mirrors that of either the project area or leakage belt for each respective forest class. With two forest classes currently defined, this procedure yields four independent stratified samples in total — one per forest class for each of the two spatial units (project area and leakage belt).

Once the stratified samples are drawn, the dynamic baseline for each forest class and spatial unit is calculated by computing the proportion of sampled pixels classified as forest loss versus forest persistence during the monitoring period. This loss proportion is then applied to the total forest area of the corresponding forest class within the respective spatial unit — either the project area or leakage belt — to yield a dynamic estimate of expected deforestation for that monitoring period. Where this dynamic estimate is lower than the static projected deforestation for a given forest class and spatial unit, the dynamic value supersedes the static one and is substituted into the corresponding cell in VM0015 Table 14 or VM0015 Table 15, as appropriate. All subsequent calculations follow the same procedure as for the static baseline.

The dynamic baseline is a methodological deviation which is justified since it will only result in conservatively reducing the baseline relative to the baseline produced by the applied methodologies.

3.2.2 Project Emissions (VCS, 3.15)

The procedure for the quantification of project emissions (ex-ante and ex post) and carbon stock changes in accordance with VM0015 is detailed in section 7 of the methodological annex.

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

The procedure for the quantification of leakage emissions (ex-ante and ex post) and carbon stock changes in accordance with VM0015 is detailed in section 8 of the methodological annex. The definition of the leakage belt and leakage management areas are described, respectively, in section 1.1.3 and section 1.1.4 of the methodological annex.

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

The procedures for the quantification of estimated (ex-ante and ex-post) GHG emission reductions is detailed in section 9 of the methodological annex.

As per the methodology, the annex only provides ex-ante annual GHG reduction estimates for the new baseline validity period, 21-April-22 to 20-April-28. The vintage table below includes the actual GHG reductions for the first baseline validity period and then ex-ante estimates for the rest of the crediting period. The ex-ante estimates are extended from what is calculated in the methodological annex to the entire remainder of the crediting period assuming that the baseline deforestation for each future 6-year baseline validity period will be 4% less than the final year of the previous period, which is the percentage of reference region deforestation projected to occur in the project area in this baseline validity period. The non-permanence risk score used is the stock change weighted average score from the 21-April-22 to 30-June-2024 monitoring report as shown in Table 2.

Table 2: Calculation of weighted average non-permanence risk score

Project Area Legal Status	Stock change from 21-April-22 to 30-June-2024 monitoring report (tCO_2e)	Non-permanence Risk Score
Ungazetted	310,308	18%
Gazetted	371,285	17%
Weighted Average		17.455269%

State the non-permanence risk rating (%)	17.455269%

Has the non-permanence risk report been attached as either an appendix or a separate document?	☒ Yes ☐ No
For ARR and IFM projects with harvesting, state, in tCO2e, the Long-term Average (LTA).	Not an ARR or IFM project
Has the LTA been updated based on monitored data, if applicable?	☐ Yes ☐ No Not an ARR or IFM project
State, in tCO2e, the expected total GHG benefit to date.	634,446
Is the number of GHG credits issued below the LTA?	☐ Yes ☐ No Not an ARR or IFM project

Vintage period	Estimated baseline emissions (tCO2e)	Estimated project emissions (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated buffer pool allocation (tCO2e)	Estimated reduction VCUs (tCO2e)	Estimated removal VCUs (tCO2e)	Estimated total VCU issuance (tCO2e)
21-Apr-2012 to 20-Apr-2013	135,552	95,656	0	3,725	36,171		36,171
21-Apr-2013 to 31-Dec-2013	85,451	76,760	1182	1,665	1,113		1,113
2014	121,090	108,879	1786	2,340	1,517		1,517
2015	120,975	92,825	548	5,393	4,820		4,820
2016	117,208	63,571	0	10,275	9,571		9,571
2017	112,769	63,487	0	9,445	8,789		8,789
2018	107,756	112,855	0	2,530	2,353		2,353
2019	107,168	139,246	0	0	0		0

2020	105,271	127,364	0	0	0		0
2021	102,787	124,761	92	0	0		0
01-Jan-2022 to 20-Apr-2022	30,646	37,913	39	0	0		0
21-April-2022 to 31-Dec-2023	99,150	64,448	5,205	5,744	23,753		23,753
2023	674,377	445,889	34,273	37,758	156,457		156,457
2024	753,590	387,676	54,887	60,549	250,478		250,478
2025	770,874	203,600	85,091	94,036	388,148		388,148
2026	788,158	197,040	88,668	98,198	404,253		404,253
2027	805,442	201,361	90,612	100,461	413,009		413,009
2028	805,442	201,361	90,612	100,461	413,009		413,009
2029	773,225	193,306	86,988	96,442	396,489		396,489
2030	773,225	193,306	86,988	96,442	396,489		396,489
2031	773,225	193,306	86,988	96,442	396,489		396,489
2032	773,225	193,306	86,988	96,442	396,489		396,489
2033	773,225	193,306	86,988	96,442	396,489		396,489
2034	773,225	193,306	86,988	96,442	396,489		396,489
2035	742,296	185,574	83,508	92,584	380,629		380,629
2036	742,296	185,574	83,508	92,584	380,629		380,629
2037	742,296	185,574	83,508	92,584	380,629		380,629
2038	742,296	185,574	83,508	92,584	380,629		380,629
2039	742,296	185,574	83,508	92,584	380,629		380,629
2040	742,296	185,574	83,508	92,584	380,629		380,629
2041	712,604	178,151	80,168	88,881	365,404		365,404
2042	712,604	178,151	80,168	88,881	365,404		365,404
2043	712,604	178,151	80,168	88,881	365,404		365,404

2044	712,604	178,151	80,168	88,881	365,404		365,404
2045	712,604	178,151	80,168	88,881	365,404		365,404
2046	712,604	178,151	80,168	88,881	365,404		365,404
2047	684,100	171,025	76,961	85,326	350,788		350,788
2048	684,100	171,025	76,961	85,326	350,788		350,788
2049	684,100	171,025	76,961	85,326	350,788		350,788
2050	684,100	171,025	76,961	85,326	350,788		350,788
2051	684,100	171,025	76,961	85,326	350,788		350,788
2052	684,100	171,025	76,961	85,326	350,788		350,788
2053	656,736	164,184	73,883	81,913	336,756		336,756
2054	656,736	164,184	73,883	81,913	336,756		336,756
2055	656,736	164,184	73,883	81,913	336,756		336,756
2056	656,736	164,184	73,883	81,913	336,756		336,756
2057	656,736	164,184	73,883	81,913	336,756		336,756
2058	656,736	164,184	73,883	81,913	336,756		336,756
2059	630,466	157,617	70,927	78,636	323,286		323,286
2060	630,466	157,617	70,927	78,636	323,286		323,286
2061	630,466	157,617	70,927	78,636	323,286		323,286
2062	630,466	157,617	70,927	78,636	323,286		323,286
2063	630,466	157,617	70,927	78,636	323,286		323,286
01-Jan-2064 to 20-Apr-2064	188,276	47,069	21,181	23,483	96,543		96,543
Total	30,598,070	8,933,280	3,237,863	3,620,120	14,806,806		14,806,806

Adding the total buffer contributions and VCUs from the table above gives a total reduction in GHG emissions of 18,426,925 t CO_2e over the project lifetime. To estimate the approximate number of hectares of avoided deforestation over the project lifetime, we can divide this number by the risked weighted average emissions factor. This is calculated by subtracting the average post deforestation stocks (VM0015 Table 26) from the starting stocks of each forest class

(VM0015 Table 23), adding the avoided non-CO_2 emissions from biomass burning in each forest class (VM0015 Table 41), and then combining the emissions factors for each forest class using the relative proportion of projected deforestation in each risk class from the first baseline validity period (VM0015 Table 14). This gives an average emissions factor of 170.17 t CO_2e. Thus, the total GHG reduction over the project lifetime is equivalent to avoiding deforestation of approximately 108,283 ha of forest.

3.3 Monitoring

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

Note that this methodology potentially has hundreds of parameters available at validation, but many are not used to calculate the baseline, project or leakage emissions, or are simply summaries of combinations of other parameters which are not used elsewhere in the methodology. Others are fixed defaults provided by the methodology. The parameters listed here are those which are not fixed defaults, and which are necessary to repeat the calculations baseline, project and leakage emissions. They are listed in order of appearance in the methodological annex.

Data / parameter	wd_j
Data unit	tCO_2e/ha
Description	Wood density for species *j*.
Source of data	BIOMASS package in R.
Value applied	See carbon_stocks.xls
Justification of choice of data or description of measurement methods and procedures applied	Calculated by the BIOMASS package in R which matches species or genus names to species, genus, or family average wood density values from published literature.
Purpose of data	Calculation of baseline, project, and leakage emissions
Comments	Only used for plots in lowland forest where the allometric equation that includes wood density is more accurate.

Data / parameter	rs_j
Data unit	tCO_2e/ha

Description	Root to shoot ratio for species *j*.
Source of data	Mokany, K., Raison, R. J., & Prokushkin, A. S. (2006). Critical analysis of root: shoot ratios in terrestrial biomes. Global change biology, 12(1), 84-96.
Value applied	0.27
Justification of choice of data or description of measurement methods and procedures applied	Lower bound of the root to shoot ratio for tropical dry forests with > 20t/ha. IPCC 2019 refinement provides a much higher root to shoot value for tropical dry forests in Africa but has very high uncertainty.
Purpose of data	Calculation of baseline, project, and leakage emissions
Comments	Only used for plots in lowland forest where there was no reliable allometric equation to directly calculate belowground biomass.

Data / parameter	*EI*
Data unit	%
Description	Ex ante estimated Effectiveness Index (%)
Source of data	Previous project experience
Value applied	35-75%
Justification of choice of data or description of measurement methods and procedures applied	The initial effectiveness is based on experience from the first year of the first project instance. Effectiveness is then expected to increase over 3 years to eventually reach 75% once all project activities are being implemented on a regular basis.
Purpose of data	Calculation of ex-ante project emissions
Comments	

Data / parameter	*DLF*
Data unit	%
Description	Displacement leakage factor (%)

Source of data	Previous project experience and future projections
Value applied	15%
Justification of choice of data or description of measurement methods and procedures applied	Project did not have any leakage previously but was also not very effective. With regular REDD income and implementing the new project activities, effectiveness will increase, as will the potential for displacement leakage. Project leakage prevention activities will reach nearly every deforestation agent, but some leakage is still possible.
Purpose of data	Calculation of baseline emissions
Comments	

3.3.2 Data and Parameters Monitored (VCS, 3.16)

The parameters listed below comprise all data and parameters monitored during the project crediting period that are used by this project to quantify emission reductions. Parameters from Section 9.1 of VM0015 v1.2 that are not listed here are either: (a) intermediate calculations derived from the parameters listed below; (b) cumulative summations of annually monitored parameters listed below; or (c) applicable only to project modules or activities not implemented under this project.

Data / parameter	$ABSLRR_{i,t}$
Data unit	ha
Description	Annual area of baseline deforestation in stratum *i* within the reference region at year *t* (ha/yr)
Source of data	See section 4.1 of the methodological annex
Description of measurement methods and procedures to be applied	Calculated by applying the risk density map approach to the updated historical reference period at the beginning of each new baseline validity period, following the approach described in section 4.1 of the methodological annex.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 9 in the methodological annex

Monitoring equipment	Remote sensing tools (QGIS, JAXA PALSAR mosaics, Dinamica EGO)
QA/QC procedures to be applied	Bias correction of the deforestation estimate using the approach described in section 4.1 of the methodological annex. Cross-checking results against prior baseline period estimates.
Purpose of data	Calculation of baseline emissions
Calculation method	Calculated by dividing the bias corrected estimate of historical reference period deforestation (Table 27 in methodological annex) by the length of the historical reference period in years (12 years).
Comments	

Data / parameter	$ABSLPA_{icl,t}$
Data unit	ha
Description	Annual area of baseline deforestation in initial forest class icl within the project area at year *t* (ha/yr)
Source of data	See section 4.2.3 of the methodological annex
Description of measurement methods and procedures to be applied	Calculated by summing pixel values in the updated risk density map for each initial forest type within the project area at the beginning of each new baseline validity period, following the approach described in section 4.2.3 of the methodological annex.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 14 in the methodological annex
Monitoring equipment	Remote sensing tools (QGIS, JAXA PALSAR mosaics, Dinamica EGO)
QA/QC procedures to be applied	Ensure that the risk density map covers the full project area and that pixel values are summed correctly within each initial forest class stratum.
Purpose of data	Calculation of baseline emissions

Calculation method	Calculated by summing the pixel values in the risk density map for each initial forest type within the project area.
Comments	

Data / parameter	$ABSLLK_{icl,t}$
Data unit	ha
Description	Annual area of baseline deforestation in initial forest class icl within the leakage belt at year *t* (ha/yr)
Source of data	See section 4.2.3 of the methodological annex
Description of measurement methods and procedures to be applied	Calculated by summing pixel values in the updated risk density map for each initial forest type within the leakage belt at the beginning of each new baseline validity period, following the approach described in section 4.2.3 of the methodological annex.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 15 in the methodological annex
Monitoring equipment	Remote sensing tools (QGIS, JAXA PALSAR mosaics, Dinamica EGO)
QA/QC procedures to be applied	Ensure that the risk density map covers the full leakage belt area and that pixel values are summed correctly within each initial forest class stratum.
Purpose of data	Calculation of baseline emissions
Calculation method	Calculated by summing the pixel values in the risk density map for each initial forest type within the leakage belt.
Comments	

Data / parameter	Cab_{icl}
Data unit	tCO_2e/ha

Description	Average carbon stock per hectare in aboveground biomass carbon pool of initial forest class icl
Source of data	Stratified forest plot data. See section 6.1 of the methodological annex and carbon_stocks.xls
Description of measurement methods and procedures to be applied	Forest biomass plots are measured and analysed using the equations and approaches described in section 6.1 of the methodological annex. Plots are stratified by initial forest class and the average carbon stock per hectare is calculated for each stratum.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 25 in methodological annex
Monitoring equipment	Field measurement equipment (diameter tapes, clinometers, GPS units); R software (BIOMASS package) for allometric calculations
QA/QC procedures to be applied	Target precision of less than 10% uncertainty at the 90% confidence interval for aboveground forest carbon stock estimates, as per VM0015. QA/QC procedures described in section 6.1 of the methodological annex.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	Calculated using the equations listed section 6.1 of the methodological annex depending on the plot forest type.
Comments	

Data / parameter	Cbb_{icl}
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in belowground biomass carbon pool of initial forest class icl
Source of data	Stratified forest plot data. See section 6.1 of the methodological annex and carbon_stocks.xls
Description of measurement methods	Forest biomass plots are measured and analysed using the equations and approaches described in section 6.1 of the methodological annex. Belowground biomass is estimated using

and procedures to be applied	root-to-shoot ratios or direct allometric equations as appropriate for the plot forest type.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 25 in methodological annex
Monitoring equipment	Field measurement equipment (diameter tapes, clinometers, GPS units); R software (BIOMASS package) for allometric calculations
QA/QC procedures to be applied	Target precision of less than 10% uncertainty at the 90% confidence interval for belowground forest carbon stock estimates, as per VM0015. QA/QC procedures described in section 6.1 of the methodological annex.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	Calculated using the equations listed section 6.1 of the methodological annex depending on the plot forest type.
Comments	

Data / parameter	Cab_{fcl}
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in aboveground biomass carbon pool of final post-deforestation class fcl
Source of data	Stratified forest plot data. See section 6.1 of the methodological annex and carbon_stocks.xls
Description of measurement methods and procedures to be applied	Post-deforestation biomass plots are measured and analysed using the equations and approaches described in section 6.1 of the methodological annex. Plots are stratified by post-deforestation class and the average carbon stock per hectare is calculated for each stratum.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 26 in methodological annex

Monitoring equipment	Field measurement equipment (diameter tapes, clinometers, GPS units); R software (BIOMASS package) for allometric calculations
QA/QC procedures to be applied	Where the target precision of 10% uncertainty at the 90% confidence interval is not achieved, estimates are adjusted for uncertainty as per VM0015. QA/QC procedures described in section 6.1 of the methodological annex.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	Calculated using the equations listed section 6.1 of the methodological annex depending on the plot forest type.
Comments	

Data / parameter	Cbb_{fcl}
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in belowground biomass carbon pool of final post-deforestation class fcl
Source of data	Stratified forest plot data. See section 6.1 of the methodological annex and carbon_stocks.xls
Description of measurement methods and procedures to be applied	Post-deforestation biomass plots are measured and analysed using the equations and approaches described in section 6.1 of the methodological annex. Belowground biomass for post-deforestation classes is estimated using root-to-shoot ratios or allometric equations as appropriate.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 26 in methodological annex
Monitoring equipment	Field measurement equipment (diameter tapes, clinometers, GPS units); R software (BIOMASS package) for allometric calculations
QA/QC procedures to be applied	Where the target precision of 10% uncertainty at the 90% confidence interval is not achieved, estimates are adjusted for uncertainty as per VM0015. QA/QC procedures described in section 6.1 of the methodological annex.

Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	Calculated using the equations listed section 6.1 of the methodological annex depending on the plot forest type.
Comments	

Data / parameter	$\Delta Cab_{icl,t}$
Data unit	tCO_2e/ha
Description	Average change in carbon stock per hectare in aboveground biomass carbon pool in initial forest class I in year t
Source of data	Table VM0015 Table 25 in methodological annex
Description of measurement methods and procedures to be applied	Derived from updated Cabicl values obtained from forest biomass plots at the beginning of each new baseline validity period. All aboveground stock assumed to be lost immediately during deforestation as per the methodology.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See versions of VM0015 Table 33 in methodological annex
Monitoring equipment	Derived from field measurement data and allometric calculations; no additional equipment required beyond that used for Cabicl
QA/QC procedures to be applied	Values cross-checked against previous baseline period estimates. QA/QC procedures for the underlying Cabicl values apply.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	All aboveground stock assumed to be lost immediately during deforestation as per the methodology.
Comments	

Data / parameter	$\Delta Cbb_{icl,t}$
Data unit	tCO_2e/ha

Description	Average change in carbon stock per hectare in belowground biomass carbon pool in initial forest class I in year t
Source of data	Table VM0015 Table 25 in methodological annex
Description of measurement methods and procedures to be applied	Derived from updated Cbbicl values obtained from forest biomass plots at the beginning of each new baseline validity period. As per the methodology, 1/10 of initial belowground biomass is expected to be lost per year post deforestation.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See versions of VM0015 Table 33 in methodological annex
Monitoring equipment	Derived from field measurement data and allometric calculations; no additional equipment required beyond that used for Cbbicl
QA/QC procedures to be applied	Values cross-checked against previous baseline period estimates. QA/QC procedures for the underlying Cbbicl values apply.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	As per the methodology, 1/10 of initial belowground biomass is expected to be lost per year post deforestation
Comments	

Data / parameter	$\Delta Cab_{fcl,t}$
Data unit	tCO_2e/ha
Description	Average change in carbon stock per hectare in aboveground biomass carbon pool in final post-deforestation class in year t
Source of data	Table VM0015 Table 26 in methodological annex
Description of measurement methods and procedures to be applied	Derived from updated Cabfcl values from post-deforestation biomass plots at the beginning of each new baseline validity period. Assumed to accumulate at 1/10 of final average post-deforestation stock per year. Adjusted for uncertainty by adding 10% error at the 90% confidence interval for the project area and subtracting for the leakage belt.

Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See versions of VM0015 Table 33 in methodological annex
Monitoring equipment	Derived from field measurement data and allometric calculations; no additional equipment required beyond that used for Cabfcl
QA/QC procedures to be applied	Values cross-checked against previous baseline period estimates. Uncertainty adjustments applied per VM0015 where target precision is not achieved.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	As per the methodology, assumed to accumulate at 1/10 of final average post deforestation stock per year post deforestation. Adjusted for uncertainty by adding 10% error at the 90% confidence interval for project area and subtracting for the leakage belt.
Comments	

Data / parameter	$\Delta Cbb_{fcl,t}$
Data unit	tCO_2e/ha
Description	Average change in carbon stock per hectare in belowground biomass carbon pool in final post-deforestation class in year t
Source of data	VM0015 Table 26 in methodological annex
Description of measurement methods and procedures to be applied	Derived from updated Cbbfcl values from post-deforestation biomass plots at the beginning of each new baseline validity period. Assumed to accumulate at 1/10 of final average post-deforestation stock per year. Adjusted for uncertainty by adding 10% error at the 90% confidence interval for the project area and subtracting for the leakage belt.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See versions of VM0015 Table 33 in methodological annex

Monitoring equipment	Derived from field measurement data and allometric calculations; no additional equipment required beyond that used for Cbbfcl
QA/QC procedures to be applied	Values cross-checked against previous baseline period estimates. Uncertainty adjustments applied per VM0015 where target precision is not achieved.
Purpose of data	Calculation of baseline, project, and leakage emissions
Calculation method	As per the methodology, assumed to accumulate at 1/10 of final average post deforestation stock per year post deforestation. Adjusted for uncertainty by adding 10% error at the 90% confidence interval for project area and subtracting for the leakage belt.
Comments	

Data / parameter	$\Delta CBSLPA_t$
Data unit	tCO_2e
Description	Total baseline carbon stock change within the project area at year *t* (t CO_2e)
Source of data	VM0015 Table 36 in methodological annex
Description of measurement methods and procedures to be applied	Recalculated at the beginning of each new baseline validity period using updated values of ABSLPAicl,t, ΔCabicl,t, ΔCbbicl,t, ΔCabfcl,t, and ΔCbbfcl,t in VM0015 Equation 10.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 64 in methodological annex
Monitoring equipment	Derived calculation from other monitored parameters; no additional equipment required
QA/QC procedures to be applied	Results cross-checked against previous baseline period estimates and reviewed for consistency with input parameters.
Purpose of data	Calculation of baseline emissions

Calculation method	Calculated with VM0015 Equation 10 in methodological annex
Comments	

Data / parameter	$\Delta CBSLLK_t$
Data unit	tCO_2e
Description	Total baseline carbon stock change within the Leakage Belt at year *t* ($t\ CO_2e$)
Source of data	VM0015 Table 37 in methodological annex
Description of measurement methods and procedures to be applied	Recalculated at the beginning of each new baseline validity period using updated values of ABSLLKicl,t, ΔCabicl,t, ΔCbbicl,t, ΔCabfcl,t, and ΔCbbfcl,t in VM0015 Equation 10.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 63 in methodological annex
Monitoring equipment	Derived calculation from other monitored parameters; no additional equipment required
QA/QC procedures to be applied	Results cross-checked against previous baseline period estimates and reviewed for consistency with input parameters.
Purpose of data	Calculation of baseline emissions
Calculation method	Calculated with VM0015 Equation 10 in methodological annex
Comments	

Data / parameter	$Fburnt_{icl}$
Data unit	%
Description	Proportion of forest area burned during the historical reference period in forest class *icl* (%)
Source of data	Table 15 in the methodological annex

Description of measurement methods and procedures to be applied	Estimated from the project's updated disturbance data at the beginning of each new baseline validity period as being proportionate to the percent of forest disturbances where agriculture was a driver of deforestation, since slash-and-burn is the standard practice for all agriculture in the baseline scenario.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 41
Monitoring equipment	Remote sensing tools used to map disturbance data during the updated historical reference period
QA/QC procedures to be applied	Values cross-checked against previous baseline period estimates and consistency with observed fire occurrence in the historical reference period.
Purpose of data	Calculation of baseline emissions, project and leakage emissions
Calculation method	Estimated from the project's disturbance data (Table 15) as being proportionate to the percent of forest disturbances where agriculture was a driver of deforestation since slash-and-burn is the standard practice for all agriculture in the baseline scenario
Comments	

Data / parameter	$Pburnt_{icl}$
Data unit	%
Description	Proportion of forest area burned during the historical reference period in forest class *icl* (%)
Source of data	VM0015 Table 25 and VM0015 Table 26
Description of measurement methods and procedures to be applied	Estimated as the difference between updated starting AGB (Cabicl) and uncertainty-adjusted long-term average post-deforestation AGB (Cabfcl) in each forest class at the beginning of each new baseline validity period.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period

Value applied	See VM0015 Table 41
Monitoring equipment	Derived from field biomass measurement data; no additional equipment required
QA/QC procedures to be applied	Values cross-checked against previous baseline period estimates and consistency with updated carbon stock data.
Purpose of data	Calculation of baseline emissions, project, and leakage emissions
Calculation method	Estimated as the difference between starting AGB and uncertainty adjusted long term average post deforestation AGB in each forest class
Comments	

Data / parameter	$ERCH_4$, ERN_2O, NCR, $CE_{p,icl}$
Data unit	dimensionless
Description	Emission ratio for CH4 ($ERCH_4$ = 0.012), emission ratio for N_2O (ERN_2O = 0.007), nitrogen to carbon ratio (NCR = 0.01), and combustion efficiency by carbon pool p and forest class icl ($CE_{p,icl}$; default 0.5 where no pool-specific value is available). Used in VM0015 Equations 12, 13, and 14.
Source of data	IPCC default values as specified in VM0015 v1.2. Combustion efficiencies are sourced from IPCC GPG LULUCF Table 3.A.14 and since the table does not cover the project scenario, the VM0015 default of 0.5 is applied.
Description of measurement methods and procedures to be applied	Default values are taken directly from the IPCC guidelines as referenced in VM0015 v1.2. Values are reviewed at the beginning of each new baseline validity period to confirm they remain current under the applicable methodology version.
Frequency of monitoring/recording	Each renewal of baseline validity period
Value applied	$ERCH_4$ = 0.012; ERN_2O = 0.007; NCR = 0.01; $CE_{p,icl}$ = 0.5
Monitoring equipment	No equipment required; values sourced from IPCC guidelines and VM0015 v1.2

QA/QC procedures to be applied	Cross-check against current version of VM0015 and any applicable Verra errata or clarifications at each baseline renewal to confirm values remain unchanged.
Purpose of data	Calculation of baseline, project, and leakage non-CO_2 emissions from biomass burning
Calculation method	Applied directly in VM0015 Equations 12, 13, and 14
Comments	These are fixed IPCC and methodology defaults considered unlikely to change independently of a methodology revision. They are listed here for completeness.

Data / parameter	GWP_{CH4}, GWP_{N2O}
Data unit	dimensionless
Description	100-year global warming potential for CH4 (GWP_{CH4}) and N2O (GWP_{N2O}), used to convert non-CO_2 biomass burning emissions to CO2e in VM0015 Equations 12 and 13.
Source of data	IPCC Fifth Assessment Report (AR5), as required by VCS Standard v4.7 for reductions and removals occurring on or after 1 January 2021.
Description of measurement methods and procedures to be applied	GWP values are determined by the IPCC assessment report specified in the applicable version of the VCS Standard. Values are reviewed at the beginning of each new baseline validity period to confirm that the correct IPCC assessment report is being applied per the current VCS Standard requirements.
Frequency of monitoring/recording	Each renewal of baseline validity period
Value applied	GWP_{CH4} = 28; GWP_{N2O} = 265 (AR5 values, applied per VCS Standard v5 for the 2022–2028 baseline validity period)
Monitoring equipment	No equipment required; values sourced from IPCC AR5
QA/QC procedures to be applied	Cross-check against the current VCS Standard at each baseline renewal to confirm the applicable IPCC assessment report and corresponding GWP values. Note that VCS Standard v5 requires AR5 values for all reductions and removals occurring on or after 1 January 2021.

Purpose of data	Calculation of baseline, project, and leakage non-CO2 emissions from biomass burning
Calculation method	Applied directly in VM0015 Equations 12 and 13
Comments	VM0015 v1.2 references IPCC first assessment report / AR2 GWP defaults (GWP_{CH4} = 21, GWP_{N2O} = 310). However, VCS Standard v4.7 explicitly requires AR5 GWP values for reductions and removals occurring on or after 1 January 2021, which supersedes the methodology defaults. AR5 values (GWP_{CH4} = 28, GWP_{N2O} = 265) are therefore applied for this and all subsequent baseline validity periods. This also necessitates recalculation of all non-CO_2 biomass burning emission estimates relative to values that would have been obtained using the AR2 defaults stated in VM0015 v1.2.

Data / parameter	$EBBtot_{icl}$
Data unit	t CO_2e / ha
Description	Total GHG emissions from biomass burning in forest class *icl* in year *t* (t CO_2e/ha)
Source of data	Calculated
Description of measurement methods and procedures to be applied	Recalculated at the beginning of each new baseline validity period using updated values of Fburnt and Pburnt with VM0015 Equation 11.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 41
Monitoring equipment	Derived calculation from other monitored parameters; no additional equipment required
QA/QC procedures to be applied	Results cross-checked against previous baseline period estimates and reviewed for consistency with Fburnt and Pburnt input values.
Purpose of data	Calculation of baseline emissions, project, and leakage emissions

Calculation method	VM0015 Equation 11
Comments	

Data / parameter	$EBBBSLPA_t$
Data unit	tCO_2e
Description	Sum of (or total) baseline non-CO_2 emissions from forest fires at year *t* in project area
Source of data	See VM0015 Table 41
Description of measurement methods and procedures to be applied	Recalculated at the beginning of each new baseline validity period using updated values of ABSLPAicl,t and EBBtoticl in VM0015 Table 42.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 42
Monitoring equipment	Derived calculation from other monitored parameters; no additional equipment required
QA/QC procedures to be applied	Results cross-checked against previous baseline period estimates and reviewed for consistency with ABSLPA and EBBtot input values.
Purpose of data	Calculation of baseline emissions
Calculation method	Calculated in VM0015 Table 42
Comments	

Data / parameter	$EBBBSLLK_t$
Data unit	tCO_2e
Description	Sum of (or total) baseline non-CO_2 emissions from forest fires at year *t* in Leakage Belt

Source of data	See VM0015 Table 41
Description of measurement methods and procedures to be applied	Recalculated at the beginning of each new baseline validity period using updated values of ABSLLKicl,t and EBBtoticl in VM0015 Table 42.
Frequency of monitoring/recording	Updated at the beginning of each new baseline validity period
Value applied	See VM0015 Table 42
Monitoring equipment	Derived calculation from other monitored parameters; no additional equipment required
QA/QC procedures to be applied	Results cross-checked against previous baseline period estimates and reviewed for consistency with ABSLLK and EBBtot input values.
Purpose of data	Calculation of baseline emissions
Calculation method	Calculated in VM0015 Table 42
Comments	

Data / parameter	$\Delta CPAdPA_t$
Data unit	t CO_2e
Description	Cumulative decrease in carbon stock due to all planned activities at year *t* in project area
Source of data	Project boundary clearing records
Description of measurement methods and procedures to be applied	Mapping the boundaries that require clearing is done by Reterra Ltd using project boundaries and visual interpretation of recent high resolution satellite imagery. Boundary clearing records are then recorded by extension officers in the project's Mergin maps Patrol_Data project. The stock changes associated with these clearings are then calculated using an ex-post version of VM0015 Table 43 in the methodological annex.

Frequency of monitoring/recording	Annually. However, changes are assumed to be permanent and thus only accounted for the first time a particular boundary area is cleared.
Value applied	Ex-Ante estimates are provided in VM0015 Table 43 in the methodological annex
Monitoring equipment	Remote sensing for the boundary mapping and mobile phones for the clearing records
QA/QC procedures to be applied	Ensure that each boundary to be cleared is mapped accurately by comparing to the latest high-resolution imagery and filtering clearing records by unique values to make sure that each boundary section is only counted once in the first year that it is cleared.
Purpose of data	Calculation of project emissions
Calculation method	See VM0015 Table 43 in the methodological annex
Comments	

Data / parameter	$\Delta CUDdPA_t$
Data unit	t CO_2e
Description	Total actual carbon stock change due to unavoided unplanned deforestation at year t in project area
Source of data	Estimated unplanned deforestation at year *t* in the project area in each initial forest class and baseline the emissions factors for deforestation in the project area for each class from VM0015 Table 33 in the methodological annex.
Description of measurement methods and procedures to be applied	The procedure for monitoring unplanned deforestation ex-post will follow VMD0055 and is described in section 7.2.1 of the methodological annex. These are then combined with the emissions factors for the project area from VM0015 Table 33 to create an ex-post version of VM0015 Table 43 for unplanned deforestation.

Frequency of monitoring/recording	Annually
Value applied	Ex-Ante estimates are provided in VM0015 Table 47in the methodological annex
Monitoring equipment	Remote sensing done in QGIS using Planet.com basemaps for monitoring changes in sample points.
QA/QC procedures to be applied	Sample size must be sufficient to achieve a total deforestation estimate for the project area and leakage belt which has below 20% error at the 90% confidence interval. Where there appears to be a shift in the Planet.com imagery near the edge of deforestation, Sentinel-2 imagery is used to determine whether the sample pixel is affected.
Purpose of data	Calculation of project emissions
Calculation method	Ex post version of VM0015 Table 43 in the methodological annex
Comments	

Data / parameter	$EBBPSPA_t$
Data unit	t CO_2e
Description	Sum of actual non-CO_2 emissions from forest fires at year t in project area
Source of data	Areas of estimated unplanned deforestation in each forest class and $EBBtot_{icl}$ for each class from VM0015 Table 41.
Description of measurement methods and procedures to be applied	The procedure for monitoring unplanned deforestation ex-post will follow VMD0055 and is described in section 7.2.1 of the methodological annex. These are then combined with the emissions factors for non-CO2 emissions from biomass burning in the project area VM0015 Table 41.
Frequency of monitoring/recording	Annually

Value applied	Ex-Ante estimates are provided in VM0015 Table 48 in the methodological annex
Monitoring equipment	Remote sensing done in QGIS using Planet.com basemaps for monitoring changes in sample points.
QA/QC procedures to be applied	Sample size must be sufficient to achieve a total deforestation estimate for the project area and leakage belt which has below 20% error at the 90% confidence interval. Where there appears to be a shift in the Planet.com imagery near the edge of deforestation, Sentinel-2 imagery is used to determine whether the sample pixel is affected.
Purpose of data	Calculation of project emissions
Calculation method	Ex post version of VM0015 Table 42 in the methodological annex
Comments	

Data / parameter	$\Delta CADLK_t$, ΔCLK_t
Data unit	t CO_2e
Description	Since there are no stock changes associated with leakage prevention measures, total net carbon stock change due to leakage = total decrease in carbon stocks due to displaced deforestation at year *t*
Source of data	Areas of ex-post estimated actual deforestation within the leakage belt for each initial forest class, the leakage belt emissions factors from VM0015 Table 33, and baseline leakage emissions from VM0015 Table 37.
Description of measurement methods and procedures to be applied	The procedure for monitoring deforestation ex-post will follow VMD0055 and is described in section 7.2.1 of the methodological annex. Deforestation in the project area and leakage belt area both measured in this way,
Frequency of monitoring/recording	Annually

Value applied	Ex-Ante estimates are provided in VM0015 Table 61in the methodological annex
Monitoring equipment	Remote sensing done in QGIS using Planet.com basemaps for monitoring changes in sample points.
QA/QC procedures to be applied	Sample size must be sufficient to achieve a total deforestation estimate for the project area and leakage belt which has below 20% error at the 90% confidence interval. Where there appears to be a shift in the Planet.com imagery near the edge of deforestation, Sentinel-2 imagery is used to determine whether the sample pixel is affected.
Purpose of data	Calculation of leakage emissions
Calculation method	The estimated area for the leakage belts is combined with the emissions factors for the leakage belt from VM0015 Table 33 to create an ex-post version of VM0015 Table 37. The ex-post results are compared to the baseline results using VM0015 Table 63 to calculate $\Delta CADLK_t$. If there is a cumulative net increase in stocks in year t, then $\Delta CADLK_t$ is set to zero for the purpose of estimating leakage.
Comments	

Data / parameter	$EADLK_t$, ELK_t
Data unit	t CO_2e
Description	Since there are no GHG emissions from leakage prevention activities, total net increase in emissions due to leakage = total ex post increase in GHG emissions due to displaced forest fires at year *t*
Source of data	Areas of ex-post estimated actual deforestation within the leakage belt for each initial forest class and non-CO_2 emissions factors from VM0015 Table 41

Description of measurement methods and procedures to be applied	The procedure for monitoring deforestation ex-post will follow VMD0055 and is described in section 7.2.1 of the methodological annex. Deforestation in the project area and leakage belt area both measured in this way,
Frequency of monitoring/recording	Annually
Value applied	Ex-Ante estimates are provided in VM0015 Table 61in the methodological annex
Monitoring equipment	Remote sensing done in QGIS using Planet.com basemaps for monitoring changes in sample points.
QA/QC procedures to be applied	Sample size must be sufficient to achieve a total deforestation estimate for the project area and leakage belt which has below 20% error at the 90% confidence interval. Where there appears to be a shift in the Planet.com imagery near the edge of deforestation, Sentinel-2 imagery is used to determine whether the sample pixel is affected.
Purpose of data	Calculation of leakage emissions
Calculation method	Ex-post areas of deforestation in the leakage belt are used to create and ex-post version of VM0015 Table 42 for the leakage belt. $EADLK_t$ is the difference between the baseline and ex-post Versions.
Comments	

Data / parameter	$\Delta REDD_t$
Data unit	t CO_2e
Description	Ex post estimated net anthropogenic GHG emission reduction attributable to the AUD project activity at year *t* (t CO_2e)
Source of data	Ex-post version of VM0015 Table 64 from the methodological annex.

Description of measurement methods and procedures to be applied	Just a calculation from other monitored values.
Frequency of monitoring/recording	Annually
Value applied	Ex-Ante estimates are provided in VM0015 Table 64 in the methodological annex
Monitoring equipment	
QA/QC procedures to be applied	QA/QC procedures already applied to input data
Purpose of data	Calculation of emissions reductions
Calculation method	VM0015 Equation 19 using the values from an ex-post version of VM0015 Table 64.
Comments	

Data / parameter	ΔVCU_t
Data unit	t CO_2e
Description	Number of Verified Carbon Units at year *t* (t CO2e)
Source of data	Ex-post version of VM0015 Table 64 from the methodological annex.
Description of measurement methods and procedures to be applied	Just a calculation from other monitored values.
Frequency of monitoring/recording	Annually

Value applied	Ex-Ante estimates are provided in VM0015 Table 64 in the methodological annex
Monitoring equipment	
QA/QC procedures to be applied	QA/QC procedures already applied to input data
Purpose of data	Calculation of emissions reductions
Calculation method	VM0015 Equation 20 using the values from an ex-post version of VM0015 Table 64.
Comments	

Data / parameter	ΔVBC_t
Data unit	t CO_2e
Description	Number of buffer credits deposited in the VCS AFOLU non-permanence buffer at year *t* (t CO2e)
Source of data	Ex-post version of VM0015 Table 64 from the methodological annex.
Description of measurement methods and procedures to be applied	Just a calculation from other monitored values.
Frequency of monitoring/recording	Annually
Value applied	Ex-Ante estimates are provided in VM0015 Table 64 in the methodological annex
Monitoring equipment	
QA/QC procedures to be applied	QA/QC procedures already applied to input data

Purpose of data	Calculation of emissions reductions
Calculation method	VM0015 Equation 21 using the values from an ex-post version of VM0015 Table 64.
Comments	

Data / parameter	ΔRF_t
Data unit	%
Description	Risk factor used to calculate buffer credits in year *t* (%)
Source of data	AFOLU Non-Permanence Risk Tool
Description of measurement methods and procedures to be applied	All sources of data from the VCS Non-Permanence Risk Report will be used to measure the various risk factors. If the risk profiles are different for different portions of the project, the risk will be calculated separately for each portion of the project. Then the deductions will be applied based on the portion of VCUs generated from that part of the project. The proportion of credits generated from each part of the project will be based on the proportion of the summed risk density map values in each project area.
Frequency of monitoring/recording	Annually
Value applied	Ex-Ante estimates are provided in VM0015 Table 64 in the methodological annex based on the risk at the year of validation
Monitoring equipment	
QA/QC procedures to be applied	QA/QC procedures already applied to input data

Purpose of data	Calculation of emissions reductions
Calculation method	Calculated using the AFOLU Non-Permanence Risk Tool
Comments	

3.3.3 Monitoring Plan (VCS, 3.16, 3.20)

Theron Morgan-Brown, Reterra Limited's director of science is responsible for all GHG monitoring activities. Theron has a PhD in interdisciplinary ecology, is an expert at remote sensing and GIS, and has 14 years of REDD MRV experience. He has authored 3 validated VCS forest carbon project PDs and numerous verified VCS monitoring reports.

Monitoring of carbon stocks

Carbon stocks were assessed prior to the production of this project document as described in section 6.1 of the methodological annex. Future monitoring of both forest and post-deforestation stocks will occur at the end or beginning of each new baseline validity period, or in response to degradation events effecting more than 1 contiguous ha of the project area as detected by the monitoring of land-cover change described below. Where needed to improve overall accuracy new forest or post-deforestation stratifications will be applied.

Wilson Mugasha, PhD, a director in VCSL and a lecturer at Sokoine University, with 14 years' experience in biomass data collection, oversaw the collection of data from biomass plots during this monitoring period. He was supported in that work by a field team of mostly current and former students whom he trained and directly supervised for many plots with for quality assurance. That data is used in the update project document and was thus 'available at validation' and was used to estimate parameters in section 3.3.1. The collection and analysis of the data is described in section 6.1 of the methodological annex including the sampling approaches, target precision levels, samples sizes, sample site locations, stratification, and QA/QC procedures. The data, combined with other biomass plot data gathered prior to the monitor period was sufficient to achieve less than 10% uncertainty at the 90% confidence interval for above and below ground forest carbon stock estimates (see VM0015 Table 23 in the methodological annex). For post-deforestation biomass estimates, the target of 10% uncertainty at the 90% confidence interval was not achieved so the estimates were adjusted for uncertainty as per VM0015 (see VM0015 Table 26 in the methodological annex). The analysis of biomass data was conducted by Theron Morgan-Brown with some technical advice provided by Mugasha.

The project does not have a formal internal audit system. The built in QA/QC systems within the biomass plot survey form help prevent large errors and all the other monitoring work is performed by a single person. However, Theron did make efforts to confirm two extreme biomass values through reviewing high resolution imagery for plots and asking Mugasha to confirm with the field teams that plots were measured correctly. No non-conformities were identified.

As described in section 7.1.1 of the methodological annex, stock changes from planned timber and charcoal harvesting are expected to be insignificant, temporary, and well below 1% of total project aboveground biomass per year. The potential effects of timber and charcoal harvesting on project area carbon stocks are assessed annually using data from the VCSL CCB annual community survey. The survey captures timber volumes harvested and charcoal production income from harvesting licenses issued by project villages, which can be converted to tons of charcoal by dividing by the applicable government set price at the time. The methodology for converting survey data to AGB carbon stock impacts is described in the methodological annex in section 7.1.1 of the methodological annex using Equation 18 for timber volumes and Equation 19 for charcoal biomass.

Monitoring of land-cover change

Land-cover change monitoring is the primary ongoing monitoring activity which must be conducted at the end of each monitoring period, which under the current plan means annual monitoring. *It is the basis for estimating ex-post emissions in the project area and leakage belt.* Theron Morgan-Brown of Reterra is responsible for this activity. The *process is summarized* in section 7.2.1 of the methodological annex. In this section, the project provides details on the process and results for the first monitoring period of the new baseline validity period, which will be the basis for future monitoring periods until either switching to VM0048 or the end of the baseline validity period.

Land-use and land-cover change monitoring was conducted using point interpretation of high-resolution imagery meeting the requirements VM0015, and VMD0055, which the project expects to transition to once VM0048 activity data is available for Tanzania. As per VM0015, the minimum target precision was an estimate of deforestation with less than 20% error at the 90% confidence interval to be accepted while applying a correction for uncertainty, or less than 10% error at the 90% confidence interval to be used without any correction for uncertainty.

Ideally, the project would use the same deforestation change detection mapping approach used to map deforestation during the historical reference period since any areas detected as deforested by that approach would have a very high likelihood of being deforested. Unfortunately, JAXA annual PALSAR mosaics are not released until April or May of the following year, meaning that the project wouldn't be able to map land cover change for part of 2024 until 2025. This would create an unsuitably long delay for project monitoring and reporting. However, there is no stated requirement in VM0015 that wall to wall remote sensing must be used for ongoing land-cover change monitoring. The methodology only requires the ex-post tables of land-cover change activity data be created.

Therefore, the project used the risk density map described in section 4.2.3 of the methodological annex as the basis for the stratification of land-cover monitoring reports. The risk density map has 30 risk densities. Dinamica Ego was used to calculate the number of pixels in each of the 30 risk densities falling in the project area and leakage belt. Then by multiplying the densities by the number of pixels in each density, it was possible to calculate the projected amount of baseline deforestation in the project area and leakage belt in risk density. This analysis showed that 36.4% of deforestation was projected to occur within the highest risk density. Then the projected deforestation for the next 3 highest risk densities was 34.6% while the remaining densities would have 29% of deforestation. This seemed to offer an ideal split to create the minimum 3 strata based on relative risk of deforestation required under VMD0055. However, after some interpretation, it was realized that the 3rd strata contained too broad a range of risk densities. Therefore, it was decided to split the 3rd risk strata into 2 strata with essentially equal areas.

The ideal sample size could not be calculated in advance though it was assumed that a large sample size would be required since the proportion of forest change in each risk class would be low. Thus, the project settled on 1000 sample points for each risk class for 3000 sample points. This did not result in a deforestation uncertainty below 20% at the 90% confidence interval, so the sample sizes were expanded by 300 points, but the uncertainty was still just above 20%. At that point it was realized that splitting the last risk class into 2 strata with roughly equal areas would reduce uncertainty because the lowest risk class would have almost zero deforestation in it. Additional points were then added to the 3rd and 4th risk class to increase their sample sizes to 1000 and 900 respectively bring the total sample size to 4500 points. However, changes to the project area and leakage belt during the monitoring report revision resulted in some points falling outside the monitoring area and being excluded. Finally, as noted in the methodological deviations, one random sample point was added into a section of 316 ha of forest which was missing from the leakage belt because the risk map didn't cover the area. The final sample size was 4305 points. The point locations and details are shown in Figure 17 and Figure 18.

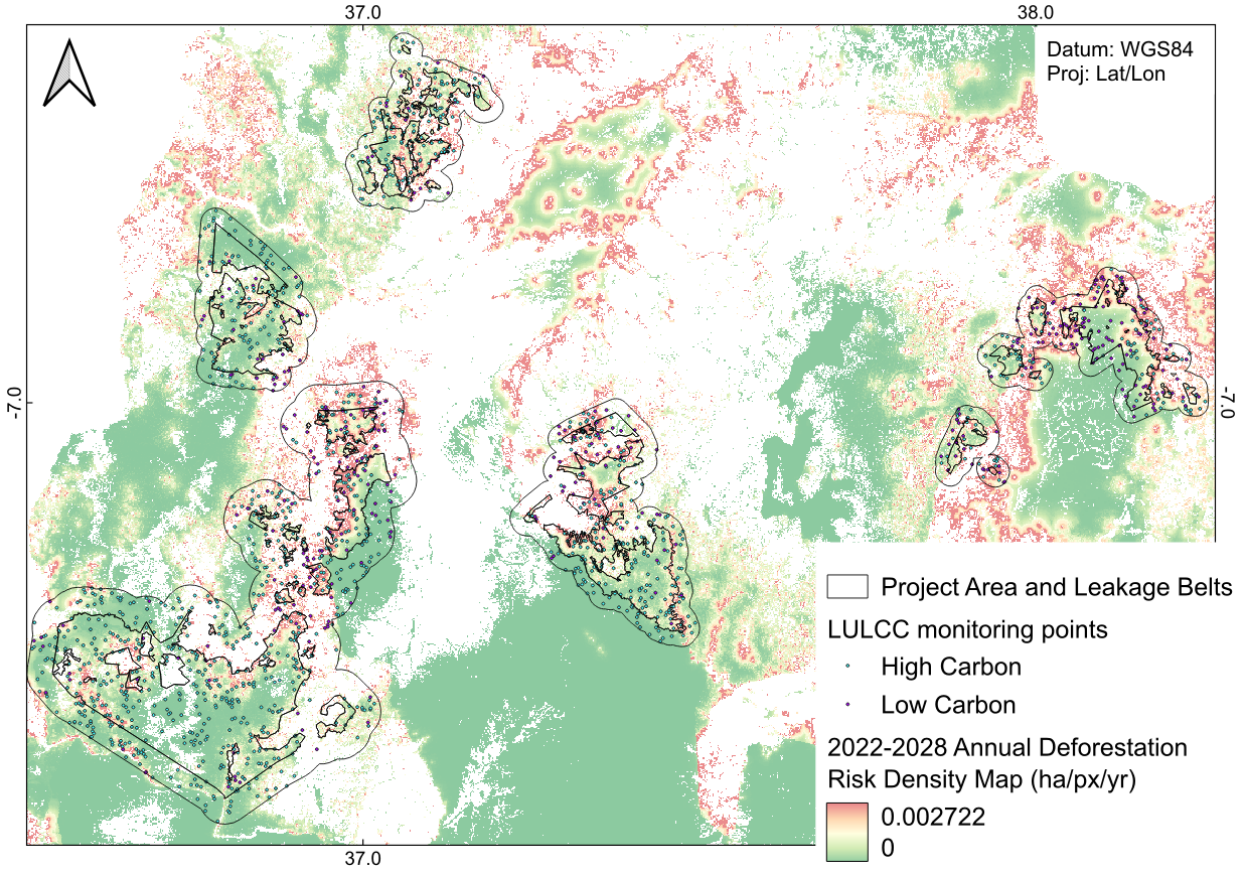


Figure 17 Location of land-cover change monitoring points in Morogoro Region

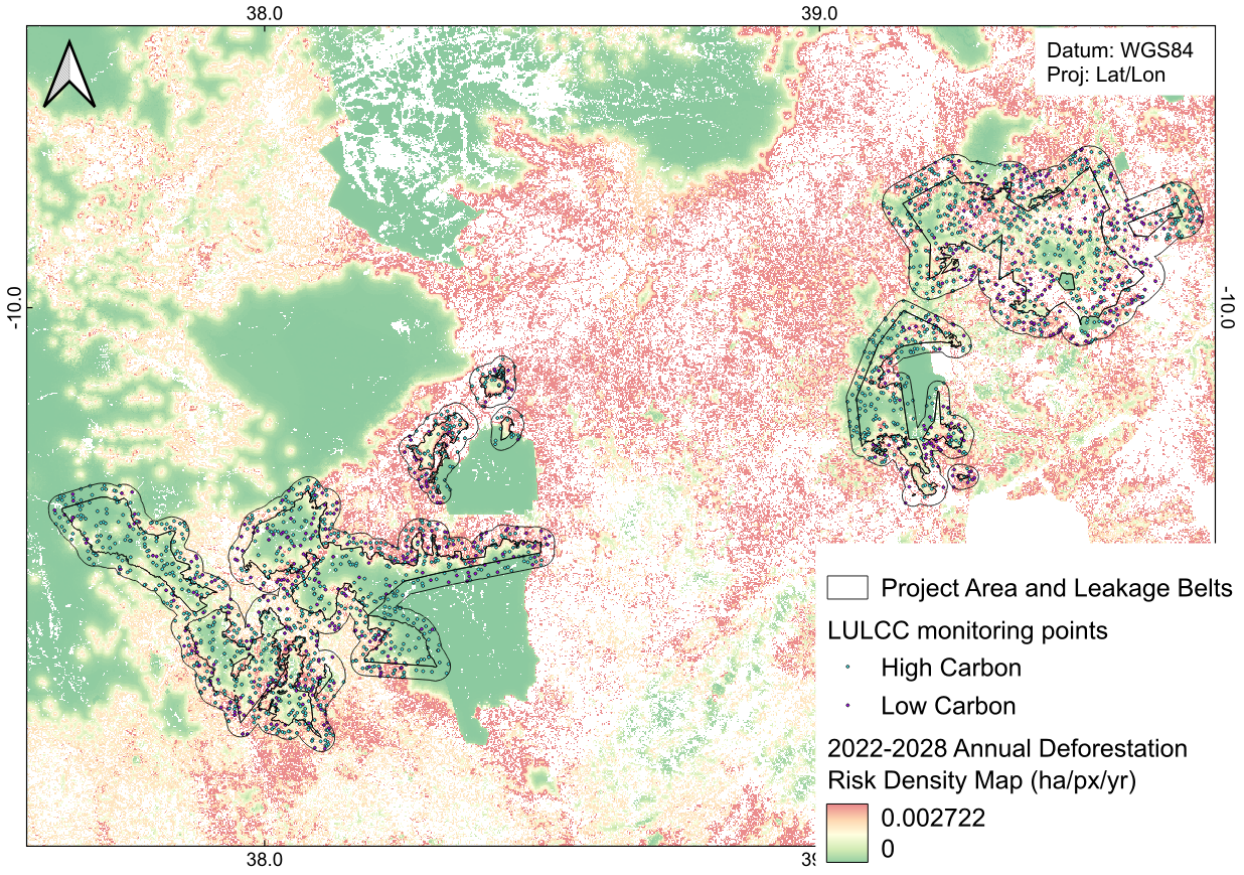


Figure 18 Location of land-cover change monitoring points in Lindi Region

The weights of each stratum used to calculate the proportion of each stratum in the project area and leakage belt and the standard errors of each change class in each strata were calculated in a python script. The script uses the risk density map, forest class map, and a masks for the project area and leakage belts to calculate a stratum map and then to count the number of pixels in each stratum. The project area mask was split into gazetted and non-gazetted project areas to facilitate the division of the stock change estimates for two different non-permanence risk reports. The results are shown in Table 3. The first two letters of the stratum code indicate whether the area is part of the leakage belt – 'LB' or part of the project area 'PA'. 'G-PA' indicates gazetted project areas where as 'PA' without the G are ungazetted project areas. The second letter represents whether the strata is part of the initial high or low carbon forest class. The final number indicates the risk density class of the stratum.

Table 3 Land-Cover Monitoring Strata Weights

Stratum	Pixel Count	Area (ha)	Weight
'LB-A-1'	669537	41,846	0.0624

'LB-A-2'	930406	58,150	0.0867
'LB-A-3'	1196517	74,782	0.1115
'LB-A-4'	1256844	78,553	0.1172
'LB-B-1'	424873	26,555	0.0396
'LB-B-2'	446263	27,891	0.0416
'LB-B-3'	319487	19,968	0.0298
'LB-B-4'	248339	15,521	0.0231
'PA-A-1'	237191	14,824	0.0221
'PA-A-2'	454248	28,391	0.0423
'PA-A-3'	1090697	68,169	0.1017
'PA-A-4'	783311	48,957	0.0730
'PA-B-1'	82688	5,168	0.0077
'PA-B-2'	128918	8,057	0.0120
'PA-B-3'	245397	15,337	0.0229
PA-B-4'	125220	7,826	0.0117
'G-PA-A-1'	161486	10,093	0.0151
'G-PA-A-2'	300709	18,794	0.0280
'G-PA-A-3'	794205	49,638	0.0740
'G-PA-A-4'	571887	35,743	0.0533
'G-PA-B-1'	43470	2,717	0.0041
G-PA-B-2'	60712	3,795	0.0057
'G-PA-B-3'	96058	6,004	0.0090
'G-PA-B-4'	59548	3,722	0.0056
Total	10,728,011	670,501	

Generation of random sampling points within the project area and leakage belt was done in QGIS using the random points within polygon tool. An initial potential sampling frame of 100,000 points was generated. Then, 12.5-meter square buffers were generated around each point and

the generate pixel centroid within polygons tool in QGIS was used to get the corresponding pixel centroids for each pixel in the risk density map overlapped by a buffer. This step was required so that square buffers could then be created around each centroid to aid in point interpretation. Then the point sampling tool in QGIS was used to determine the risk density and forest class of each centroid. Finally, the select by location tool was used to identify whether a point was within a leakage belt or project area and whether the point was with in project instance 1 and associated leakage belt, or in project instance 2 and associated leakage belts. Centroids with zero risk (indicating non-forest) were deleted. Then the sampling frame was filtered to the desired risk density for a particular strata and the random selection tool in QGIS was used to randomly select the desired number of centroids from that strata. The selected centroids were then saved in a separate file for interpretation. Then to aid in point interpretation, a separate polygon file was created using 12.5-meter square buffers around each centroid giving square polygons corresponding to the size and location of the 25-meter pixels from the risk density map.

Interpretation of each point was based on land-cover within each pixel using the same criteria used to define forest and non-forest in the forest cover benchmark maps as described in section 3.2 of the methodological annex. However, in preparation for VMD0055, the categories of degradation and regeneration were also added. Degradation was any initially forested pixel with a decrease in canopy cover during the monitoring period while regeneration was pixel which was deforested prior to the start of the monitoring (thus representing error in the 2022 FCBM), but which appeared to be reforested by the end of the monitoring period.

Since the baseline projections for each project instance were adjusted to reflect the fact that instance 2 started on February 9th, 2023 instead of at the beginning of the monitoring period (see section 4.1 of the methodological annex), the land-use and land-cover change time period considered for points in project instance 2 was from February 2023 to June 2023 instead of from April 2022 to June 2023. Any point in project instance 2 which was deforested between April 2022 and February 2023 was interpreted as non-forest persistence rather than deforestation.

Interpretation of monitoring points was carried out in QGIS by loading planet.com monthly basemaps, Sentinel-2 cloud free mosaics, and Google Earth high resolution imagery into QGIS as x,y,z layers and overlaying the pixel boundaries of each sample point (see Table 4 for interpretation layer details). This allowed the interpreter to flip between imagery of different dates and record the land-cover change as either non-forest persistence, forest persistence, deforestation, degradation, or regeneration. Dates of deforestation were determined based on planet.com monthly basemaps, with the June 2024 basemap representing the end of the monitoring period. Due to the inconsistent georeferencing of Planet.com basemaps, for quality assurance, when a pixel fell on or near a forest edge, a 2024 sentinel-2 mosaic of March – June data and/or high-resolution imagery from Google Earth imagery was used to assess whether than June planet.com basemap contained a georeferencing shift or not and the interpretation of the change up until June 2024 was adjusted accordingly. For quality assurance, since correct interpretation of areas of change is more difficult than areas of no change, after all points were

reviewed, all points marked as deforestation and degradation were reviewed a second time to ensure consistent interpretation.

Table 4 Data layers used for interpretation of LULCC in monitoring pixels

Vector	Sensor	Resolution (m)	Type	Project / Leakage Belt Coverage	Mosaic Acquisition Pixel dates		
					Min Date	Median	Max
Satellite	Sentinel-2	10	Multi-spectral	100%	~1-Mar-22	~30-Apr-22	~30-Jun-22
Satellite	Sentinel-2	10	Multi-spectral	100%	~1-Mar-23	~30-Apr-23	~30-Jun-23
Satellite	Sentinel-2	10	Multi-spectral	100%	~1-Mar-24	~30-Apr-24	~30-Jun-24
Satellite	Planetscope	4.77	Visible light	100%	~1-Mar-22	~15-Mar-22	~31-Mar-22
Satellite	Planetscope	4.77	Visible light	100%	~1-Apr-22	~15-Apr-22	~31-Apr-22
Satellite	Planetscope	4.77	Visible light	100%	~1-May-22	~15-May-22	~31-May-22
Satellite	Planetscope	4.77	Visible light	100%	~1-Jan-23	~15-Jan-23	~31-Jan-23
Satellite	Planetscope	4.77	Visible light	100%	~1-Feb-23	~14-Feb-23	~28-Feb-23
Satellite	Planetscope	4.77	Visible light	100%	~1-May-24	~15-May-24	~31-May-24
Satellite	Planetscope	4.77	Visible light	100%	~1-Jun-24	~15-Jun-24	~30-Jun-24
Satellite	Various sensors from Google Earth	0.3	Visible light	100%	2022		2024

Once the dataset was complete, a pivot table was created with the strata as rows and the land-cover change categories counts as columns (Table 5).

Table 5 Land-Cover Change Monitoring Point Counts per Stratum

SS/CHC	NFP	FP	DEF	DEG	REG	Total
LB-A-1	74	374	19	41		508
LB-A-2	46	400	25	34	2	507
LB-A-3	18	296	11	9	2	336
LB-A-4	1	368	2	1		372
LB-B-1	90	220	15	15	2	342
LB-B-2	44	172	11	6	5	238
LB-B-3	9	68	1	2	3	83
LB-B-4		58				58
PA-A-1	13	148	7	8	1	177
PA-A-2	4	218	6	7		235
PA-A-3	1	277	2	5		285
PA-A-4	1	220		1		222
PA-B-1	15	35	2	2		54
PA-B-2	7	56	1	1		65
PA-B-3		45	1			46
PA-B-4		32				32
G-PA-A-1	6	121	3	7		137
G-PA-A-2	2	161	2	6	1	172
G-PA-A-3	1	192		3		196
G-PA-A-4		151		2		153
G-PA-B-1	3	18		2		23
G-PA-B-2	3	15		4		22
G-PA-B-3		20		1		21
G-PA-B-4		21				21

Total	338	3686	108	157	16	4305

Then the points counts were converted to proportions by dividing by the total number of points in the change category and multiplying by the appropriate strata weight (Table 6).

Table 6 Land-Cover Change Categories Proportions per Stratum

SS/CHC	NFP	FP	DEF	DEG	REG	Total
LB-A-1	0.00909	0.04595	0.00233	0.00504	0.00000	0.06241
LB-A-2	0.00787	0.06842	0.00428	0.00582	0.00034	0.08673
LB-A-3	0.00597	0.09825	0.00365	0.00299	0.00066	0.11153
LB-A-4	0.00031	0.11590	0.00063	0.00031	0.00000	0.11716
LB-B-1	0.01042	0.02548	0.00174	0.00174	0.00023	0.03960
LB-B-2	0.00769	0.03006	0.00192	0.00105	0.00087	0.04160
LB-B-3	0.00323	0.02440	0.00036	0.00072	0.00108	0.02978
LB-B-4	0.00000	0.02315	0.00000	0.00000	0.00000	0.02315
PA-A-1	0.00162	0.01849	0.00087	0.00100	0.00012	0.02211
PA-A-2	0.00072	0.03928	0.00108	0.00126	0.00000	0.04234
PA-A-3	0.00036	0.09881	0.00071	0.00178	0.00000	0.10167
PA-A-4	0.00033	0.07236	0.00000	0.00033	0.00000	0.07302
PA-B-1	0.00214	0.00500	0.00029	0.00029	0.00000	0.00771
PA-B-2	0.00129	0.01035	0.00018	0.00018	0.00000	0.01202
PA-B-3	0.00000	0.02238	0.00050	0.00000	0.00000	0.02287
PA-B-4	0.00000	0.01167	0.00000	0.00000	0.00000	0.01167
G-PA-A-1	0.00066	0.01329	0.00033	0.00077	0.00000	0.01505
G-PA-A-2	0.00033	0.02624	0.00033	0.00098	0.00016	0.02803
G-PA-A-3	0.00038	0.07252	0.00000	0.00113	0.00000	0.07403
G-PA-A-4	0.00000	0.05261	0.00000	0.00070	0.00000	0.05331
G-PA-B-1	0.00053	0.00317	0.00000	0.00035	0.00000	0.00405

G-PA-B-2	0.00077	0.00386	0.00000	0.00103	0.00000	0.00566
G-PA-B-3	0.00000	0.00853	0.00000	0.00043	0.00000	0.00895
G-PA-B-4	0.00000	0.00555	0.00000	0.00000	0.00000	0.00555
Total	0.05372	0.89571	0.01920	0.02789	0.00348	

Then, the standard error of each proportion (Table 7) was calculated using equation 26 from VMD0055 and the standard error of each change category was calculated by summing the standard errors of the proportions within that change category and multiplying by the total forest area (670,501 ha) in the project area and leakage belts.

Table 7 Land-Cover Change Category proportion standard errors per Stratum

SS/CHC	NFP	FP	DEF	DEG	REG
LB-A-1	9.56E-07	1.49E-06	2.77E-07	5.70E-07	0.00E+00
LB-A-2	1.23E-06	2.48E-06	6.97E-07	9.30E-07	5.84E-08
LB-A-3	1.88E-06	3.89E-06	1.18E-06	9.68E-07	2.20E-07
LB-A-4	9.92E-08	3.94E-07	1.98E-07	9.92E-08	0.00E+00
LB-B-1	8.92E-07	1.06E-06	1.93E-07	1.93E-07	2.67E-08
LB-B-2	1.10E-06	1.46E-06	3.22E-07	1.79E-07	1.50E-07
LB-B-3	1.05E-06	1.60E-06	1.29E-07	2.54E-07	3.77E-07
LB-B-4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PA-A-1	1.89E-07	3.81E-07	1.05E-07	1.20E-07	1.56E-08
PA-A-2	1.28E-07	5.14E-07	1.91E-07	2.21E-07	0.00E+00
PA-A-3	1.27E-07	9.93E-07	2.54E-07	6.27E-07	0.00E+00
PA-A-4	1.08E-07	2.15E-07	0.00E+00	1.08E-07	0.00E+00
PA-B-1	2.25E-07	2.56E-07	4.00E-08	4.00E-08	0.00E+00
PA-B-2	2.17E-07	2.69E-07	3.42E-08	3.42E-08	0.00E+00
PA-B-3	0.00E+00	2.47E-07	2.47E-07	0.00E+00	0.00E+00
PA-B-4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G-PA-A-1	6.98E-08	1.72E-07	3.57E-08	8.08E-08	0.00E+00

G-PA-A-2	5.28E-08	2.75E-07	5.28E-08	1.55E-07	2.66E-08
G-PA-A-3	1.43E-07	5.62E-07	0.00E+00	4.24E-07	0.00E+00
G-PA-A-4	0.00E+00	2.41E-07	0.00E+00	2.41E-07	0.00E+00
G-PA-B-1	8.46E-08	1.27E-07	0.00E+00	5.93E-08	0.00E+00
G-PA-B-2	1.80E-07	3.31E-07	0.00E+00	2.27E-07	0.00E+00
G-PA-B-3	0.00E+00	1.82E-07	0.00E+00	1.82E-07	0.00E+00
G-PA-B-4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SE Proportion	0.002954	0.004140	0.001988	0.002390	0.000935
SE Area	1980.63	2775.87	1332.64	1602.61	626.83

Then the area of each change category (Table 8) within each forest type within the project area and leakage belt was calculated by multiplying the sum of the proportions of a change category within the forest type within either the leakage belt or project area. This is the same as equations 24 and 25 in VMD0055.

Table 8 Land-Cover Change Category Areas per Stratum and Percent Uncertainty

SS/CC	NFP	FP	DEF	DEG	REG
LB-A	15589	220274	7303	9491	675
LB-B	14310	69119	2694	2349	1463
PA-A	2032	153503	1790	2932	84
PA-B	2303	33122	649	315	0
G-PA-A	914	110407	440	2398	109
G-PA-B	872	14153	0	1212	0
Total	36019	600578	12875	18698	2331
U%	9.04%	0.76%	17.03%	14.10%	44.24%

Finally, the overall percent uncertainty of each change category (Table 8) was calculated using equation 28 from VMD0055. The equation calculates the percent uncertainty based on the half-width of a two-sided 90% confidence interval. The percent uncertainty for the deforestation change category was 17.03%, which is below the 20% maximum allowable uncertainty for

activity data under VM0015, but more than 10% maximum allowed to avoid applying an uncertainty inflation factor.

Therefore, the uncertainty inflation factor was calculated using VMD0055 equation 29, which yielded 0.045. Then the uncertainty inflated deforestation figures for deforestation in each forest class in the leakage belt and project area were calculated by multiplying the deforestation estimates by 1 + the inflation factor. These uncertainty adjusted deforestation figures are then reported in ex post versions of VM0015 Table 14 and 15 in the monitoring report for the project area and leakage belt respectively.

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

The monitoring plan will be publicized online as part of this project document, shared with the Designated National Focal Point and uploaded to the VERRA registry. Monitoring reports will also be submitted to the Designated National Focal Point and uploaded to the VERRA registry for public review prior to each verification. A summary of the monitoring plan and annual report will be emailed to the executive directors and Project Focal Points of the participating Local Authorities. Additionally, the summary will be translated into Swahili, printed, and distributed to the Managing Authorities. The results of each monitoring report will be summarized, translated into Swahili, and presented at decision-making meetings of the Managing Authorities. This is a contractual obligation under Clause 14.3 of the carbon trade agreement, requiring the Project Proponent to attend annual meetings of each Managing Authorities and Managers to discuss project outcomes, present performance metrics, and report on the verified emission reductions, ensuring financial transparency.

3.4 Optional Criterion: Climate Change Adaptation Benefits

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

Between 1991 and 2020, temperature and precipitation increased across most regions of Tanzania, with further rises projected between 2040 and 2071[14]. However, changes will vary by region, following the "dry gets drier, wet gets wetter" pattern[15]. Studies have observed increasing trends in key weather parameters, including the length of the hot season, the number of hot days and nights, and annual temperature extremes, as well as overall precipitation[16].

[14] Dawido S. Magang, Moses A. Ojara, Lou Yunsheng, Philemon H. King'uza (2024), Future climate projection across Tanzania under CMIP6 with high-resolution regional climate model, Nature Portfolio 14:12741

[15] Haile, G.G. et al. 2020. Projected Impacts of Climate Change on Drought Patterns Over East Africa. Earth's Future, 8 (7), e2020EF001502.

[16] MJUMITA and FAO, (2021) Climate Risk Assessment in Kilosa, Forest and Farm Facility Program, unpublished

Between 1991 and 2020, Lindi Region recorded average minimum and maximum temperatures of 20.3°C and 30.3°C, respectively. Projections for 2040–2071 suggest that both minimum and maximum temperatures will increase by 0.14°C to 0.21°C per decade across the country, placing Lindi among the regions with the highest projected minimum and maximum temperatures, reaching 23.2°C and 31.9°C respectively.

Rainfall patterns across Tanzania have been uneven. Between 1991 and 2020 some regions experienced significant decreases in precipitation, up to 127.6 mm less per decade, while others saw slight increases of less than 4.8 mm per decade. Future projections suggest further decreases in some regions, up to 47.4 mm per decade, while others may experience modest increases of less than 15.5 mm per decade. In Morogoro Region, relatively stable precipitation, averaging 1155.2 mm annually (1991–2020), has supported agriculture, though future rainfall variability is expected to increase across the country.

The project area spans both wet and dry zones, influenced by the windward and leeward sides of mountain ranges. Northern Kilosa, Ngerengere, and Doma in Morogoro experience drier conditions, with around 600 mm of annual rainfall, while Southern and Central Kilosa, including Malolo and Kisanga, receive significantly higher rainfall, up to 2,850 mm annually[17]. In Lindi, some parts of districts like Nachingwea experience lowland and midland conditions, with drier zones receiving about 700 mm annually[18], while plateau areas such as the Rondo-Litipo-Noto-Chitoa coastal forest ecosystems receive much higher rainfall.

Rainfall has also become increasingly irregular, with shorter rainy seasons and fewer heavy precipitation events. These irregular patterns, characterized by intense rains followed by prolonged dry spells[19], contribute to poor agricultural performance. Drought frequency, intensity, and duration are expected to rise significantly in Tanzania, with regions like Lindi and Morogoro already showing signs of increasing climate variability.

The identified climate scenarios, with projected increases in temperature and precipitation following the "dry gets drier and wet gets wetter" paradigm, could significantly alter local land use in the absence of the project. With the abundance of open-access forested land and the traditional reliance on slash-and-burn agriculture, communities are likely to convert more forests into farmland. This is evident as over 24,263 hectares of forested land were removed from Village Land Forest Reserves (VLFRs) in 2024, having been cleared prior to the project's start. Additionally, more than 31,215 hectares of the remaining VLFR areas were classified as non-

[17] United Republic of Tanzania, National Bureau of Statistics (2022), Morogoro Region Social Economic Profile,

[18] The United Republic of Tanzania, President's Office Regional Administration and Local Government (2019), Lindi Region Investment Guide

[19] United Republic of Tanzania, Meteorological Agency, (2022) Statement on the Status of Tanzania Climate in 2022

forest at the project's outset, largely due to deforestation for slash-and-burn agriculture. As arable land becomes drier, the easiest strategy for smallholder farmers would be to shift farming to wetter areas to compensate for lost yields, rather than adopting intensive farming practices or switching to resilient crops like sorghum, millet, or cassava. Increased drought risks could further push farmers to expand their cultivation along valleys and riverbanks, a practice already common in the project area.

Flooding, on the other hand, would likely devastate traditional agricultural lands, forcing farmers to move to less flood-prone areas. Persistent floods might lead to the expansion of wetlands, reducing available arable land for farming and settlements, and pushing farmers to clear more upland forests. Additionally, floods could cause soil erosion and sedimentation in river systems, further degrading agricultural lands and compelling communities to clear additional forested areas to compensate for the loss of productivity.

3.4.2 Climate Change Impacts (CCB, GL1.2)

The projected increase in temperature and precipitation, along with climate variability, has significant implications on water resource management, agriculture, and infrastructure planning in both the project area and Tanzania as a whole[20].

Ideal minimum temperatures are critical for crop health and growth. When too low, they can cause frost damage to sensitive crops, reducing both yield and quality[21]. In upland agro-ecological zones like Southern Kilosa, where minimum temperatures are lower, some crops may struggle to thrive, leading to reduced agricultural yield. Conversely, higher minimum temperatures, as projected in Lindi and other lowland areas, can stress crops, impeding their growth and development[22]. Heat stress caused by elevated temperatures can reduce crop yields, affecting both their quantity and quality[23].

High maximum temperatures, which are also particularly projected for Lindi, pose an increased risk of heat stress, particularly during hot and dry periods. Excessive heat can lead to wilting, reduced photosynthesis, and, in extreme cases, crop failure, posing a serious threat to food

[20] Christoph Gornott, Fred Hattermann, Frank Wechsung (2015) Yield Gap Analysis for Tanzania – The Impacts of Climate, Management, and Socio-economic Impacts on Maize Yields, Procedia Environmental Sciences, Volume 29, 2015, Page 231

[21] Lobell, D. B., & Tebaldi, C. (2014). Getting caught with our plants down: the risks of a global crop yield slowdown from climate trends in the next two decades. *Environmental Research Letters*, *9*(7), 074003.

[22] Calzadilla, A., Rehdanz, K., Betts, R., Falloon, P., Wiltshire, A., & Tol, R. S. (2013). Climate change impacts on global agriculture. *Climatic change*, *120*, 357-374.

[23] Skendžić, S., Zovko, M., Živković, I. P., Lešić, V., & Lemić, D. (2021). The impact of climate change on agricultural insect pests. *Insects*, *12*(5), 440.

security and farmers' livelihoods[24]. Conversely, cooler maximum temperatures in some areas may limit the growth of heat-tolerant crops but could extend the growing season for crops that thrive in cooler conditions.

Changes in precipitation will also significantly impact agriculture. Decreased rainfall could result in water scarcity and drought, severely affecting crop production and food security, particularly in regions like Lindi. On the other hand, increased rainfall could cause flooding and waterlogging in lowlands and valleys, impairing crop growth and quality. These shifts in precipitation patterns may disrupt agricultural activities, reduce yields, and endanger the livelihoods of farmers[25].

Through Climate Risk Assessment using the Agricord toolkit (2021) farmers reported a significant challenge due to climate variability. They estimate approximately 90% of expected farm produce is typically lost, primarily due to drought, a shortage of nutritious pasture, destruction by farm animals, floods, pests, and diseases. These combined factors have a severe impact on food security and agricultural livelihoods. Additionally, the production of bee products has declined by an average of 50%, with output per modern beehive dropping from 24 to 12 kilograms. In the villages with sustainable charcoal production, at least 5 to 10 charcoal producers fail to meet their annual targets, losing the ability to produce between 30 to 50 bags when conditions are too dry, while about 90% of the charcoal harvesting quotas remain inaccessible during periods of heavy rains and floods.

Biodiversity in the project area might be less impacted by climate change, as it is closely tied to the forest ecosystems, which provide a more stable microclimate, particularly in the Coastal Forests and Eastern Arc Mountains. However, farmers would be compelled to move away from both drier and wetter areas, clearing more forests in midlands, valleys, riverbanks, and uplands, resulting in greater biodiversity loss and further fragmentation of the existing wildlife ecosystems. Mature natural wet forests in the project area are generally resistant to fire, but the margins of some of these forests could be vulnerable to degradation if dry season fires intensify due to rising temperatures over the dry months. This increased fire risk at forest edges could pose a threat to the integrity of these ecosystems over time.

3.4.3 Measures Needed and Designed for Adaptation (CCB, GL1.3)

The project area faces documented climate risks including increased rainfall variability, more frequent and severe drought, and shifting seasonal patterns that threaten agricultural productivity, water security, and forest ecosystem integrity. The project's climate change

[24] Christoph Gornott, Fred Hattermann, Frank Wechsung (2015) Yield Gap Analysis for Tanzania – The Impacts of Climate, Management, and Socio-economic Impacts on Maize Yields, Procedia Environmental Sciences, Volume 29, 2015, Page 231

[25] Pongratz, J., Schwingshackl, C., Bultan, S., Obermeier, W., Havermann, F., & Guo, S. (2021). Land use effects on climate: current state, recent progress, and emerging topics. *Current Climate Change Reports*, 1-22.

adaptation strategies directly address these risks through two categories of intervention: ecosystem-based adaptation embedded in project activities, and community resilience-building through carbon revenue investment.

Ecosystem-based adaptation for biodiversity

Forest protection across the project area directly supports biodiversity adaptation by maintaining habitat connectivity and buffering microclimatic conditions within and between forest patches. As climate change alters species range boundaries, the wildlife corridors maintained through project activities — linking Mikumi, Udzungwa, and Nyerere National Parks and Selous, Msanjesi, and Niassa Game Reserves — provide critical refugia and dispersal pathways that allow species to track suitable habitat. Intact forest canopy also moderates local temperature and humidity extremes, reducing thermal stress on forest-dependent species during drought events. Headwater forest protection maintains dry-season river flows on which both riparian ecosystems and downstream communities depend, directly counteracting the increased hydrological stress projected under drier climate scenarios.

Fire risk management: Increased drought frequency and longer dry seasons under projected climate scenarios elevate the risk of uncontrolled fire in miombo woodland systems. The project directly addresses this risk through systematic boundary clearing and maintenance of firebreaks around village forest reserves, reducing the likelihood of fire spreading from agricultural and pastoral areas into the forest. These activities protect forest carbon stocks and biodiversity from a climate-driven threat that is expected to intensify over the project crediting period.

Community adaptation through carbon revenues and agricultural extension

Communities in the project area face climate-driven threats to food security, water availability, and agricultural income. The project directly addresses these through two mechanisms:

Water security: Forest protection maintains catchment function and dry-season flows for the Ruvuma, Rufiji, Ruaha, Mikumi, and Ngerengere Rivers. Carbon revenues are directed by villages toward water infrastructure — piped supply, rainwater harvesting, and groundwater drilling — providing household-level water security that is resilient to seasonal rainfall variability. This combination of ecosystem-based and infrastructural water security directly addresses the projected increase in drought frequency and intensity.

Agricultural resilience: The project's agricultural extension program in the leakage belt directly targets climate vulnerability by introducing conservation tillage, drought-resistant crop varieties, crop diversification, improved water use efficiency, and integrated pest management. These practices are specifically designed to maintain yields under the more variable and extreme rainfall conditions projected for the region, reducing smallholder exposure to climate-induced crop failure. Securing premium markets for climate-smart products provides an additional income buffer against climate shocks.

Income diversification: Carbon revenue dividends reduce household dependence on climate-sensitive rain-fed agriculture and forest resource extraction, directly lowering vulnerability to climate-induced income shocks. Investment in secondary education expands livelihood options for younger community members, enabling a generational shift toward climate-resilient enterprises.

4 COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CCB, CM1.1)

The well-being of people in the districts of Kilosa, Mvomero, Morogoro Rural, Nachingwea, Mtama, and Lindi Municipality exhibits a multifaceted picture. Over 91% of households live below the World Bank's poverty threshold of $1.90 per day, and 53% subsist below the national poverty benchmark of TZS 49,320 per month, while 22% of the population lives below 50% of median income[26]. Communities rely heavily on natural resources for their livelihoods, agriculture being predominant. Environmental challenges include deforestation, mostly driven by slash-and-burn agriculture, land degradation, and climate change impacts, which have affected agricultural productivity and water availability. Forest resources are critical for fuelwood, construction materials, and non-timber forest products.

Social cohesion is generally strong, with extended family systems and traditional community-based support networks playing vital roles, especially for women. However, there are issues related to access to education and healthcare, mostly driven by poor infrastructure and distance especially for families located within or adjacent to the forests, far from the villages center, but this, varies across the villages.

The village land use plans indicate that the economy in the project area is over 90% agrarian, with subsistence farming of maize being the mainstay. Cashew and sesame are the dominant cash crops in Lindi, but more diversity including horticultural crops exists in Morogoro. Poor productivity characterized by poor agronomic practices, problem animals, limited access to markets and financial services hampers economic prosperity in the project villages. Healthcare access is limited, with varying quality of services. Common health issues include malaria, respiratory infections, and waterborne diseases. Traditional medicine is often used alongside conventional healthcare.

[26] A recent socio-economic impact assessment (2024) (unpublished) carried out by the Forestry and Value Chain Program (FORVAC) in Lindi and Ruvuma regions (covered Ruangwa, Liwale, Nachingwea and Tunduru districts which are within the project area)

The communities in the project area predominantly speak Swahili and consist of diverse ethnic groups, each with unique cultural practices and traditions. In Morogoro Rural, the Luguru people practice mixed farming and have a strong sense of community, with clan-based social structures. The Kaguru and Sagara people of Kilosa are Bantu-speaking, known for their rich cultural heritage and traditional agricultural practices, including slash-and-burn agriculture. They maintain strong clan systems but connection to their land currently follows statutory village governance structures. The Gogo of Kilosa are pastoralists and farmers, with a rich heritage of music and dance. The Hehe in Kilosa and Mvomero are historically known for their resistance to colonial rule, with strong traditional leadership and subsistence farming. The Yao people of Nachingwea, predominantly Muslim, are known for their historical role in trade and practice farming. The Ndendeule in Nachingwea are agriculturalists with a strong tradition of community cooperation and resource sharing. The Zaramo and Mwera in Lindi Municipality are characterized by an urbanized lifestyle, small-scale trade, business activities, and a matrilineal social structure.

During the pre-independent era, traditional elders used to hold significant authority, with customary laws guiding resource use, maintaining cultural heritage, social order, and conflict resolution. The Local Government Act cap. 287 has established statutory organs which include the Village Councils that are popularly elected, and accountable to the Village General Assembly, as corporate bodies with legislative functions. There are also civil servants placed in Regional, District, Ward and Village levels which serve as technical advisors, liaisons, mediators, coordinators and watchdogs to the village's councils.

Village Councils serve as a legal institution in the community and hold a strong statutory role in socio-economic development. Community-based organizations, savings and credit groups, and cooperative societies are common. Practices related to land use, farming, and resource management are deeply rooted in tradition. There is a strong connection to the land, with specific sites holding historical, cultural, or spiritual significance. Relationships with natural resources are governed by customary rules and practices that promote sustainable use and conservation.

Wealth distribution varies, with a significant portion of the population living in poverty. Economic activities differ by region, with some areas focusing on cash crops while others rely on subsistence farming. Gender roles are traditionally defined, with men often involved in cash crop farming and decision-making, while women engage in subsistence farming, household chores, and caregiving. Women's participation in community leadership is growing but still limited. The population is predominantly young, with high birth rates. Youth unemployment and underemployment are pressing issues. Elders are respected and hold advisory roles in the community.

Over the past decades, there has been significant deforestation and land degradation, driven by agricultural expansion and unsustainable logging practices. The introduction of the new Forest Policy in 1998 and the Forest Act (Cap 323 of the laws of Tanzania) of 2002 has facilitated the establishment of Village Land Forest Reserves, supported primarily by the Tanzania Forest Conservation Group (TFCG), MJUMITA and MCDI. These reserves encompass over 350,000

hectares within the project area. The introduction of cash crops and market-oriented agriculture, and infrastructure development, especially in Lindi, has changed traditional farming practices, leading to economic opportunities and challenges. Migration patterns, driven by the search for better opportunities, have altered community demographics. Urbanization has led to the growth of Lindi and Mikumi towns, impacting traditional rural lifestyles, and land tenure systems. There have been improvements in healthcare infrastructure and services, though challenges remain. Vaccination programs and efforts to combat malaria have had positive impacts. Access to education has improved, with more schools being built and greater emphasis on primary education. However, secondary and higher education access remains limited.

4.1.2 Interactions between Communities and Community Groups (VCS, 3.19; CCB, CM1.1)

The Maasai community, residing in Mlilingwa, Diguzi, Matuli, and Lulongwe villages in Morogoro District, is the only distinct group traditionally interacting with the project area. At the project's outset, these villages had already designated grazing zones with restrictions on tree clearing. Following a presentation of the project model to village councils and general assemblies, it was confirmed that grazing, as a land use, aligns with both conservation and the REDD project. Although grazing was traditionally restricted in Village Land Forest Reserves (VLFRs), enforcement had been inconsistent and largely ineffective. As a result, each village's forest management plan was updated to permit grazing in the VLFRs, provided it does not involve tree clearing, thereby designating grazing areas as potential project zones.

4.1.3 High Conservation Values (CCB, CM1.2)

The tables below highlight the High Conservation Values (HCVs) in the project zone, including areas providing critical ecosystem services, essential resources for community livelihoods, and those integral to the cultural identity and well-being of local communities.

High Conservation Value	Areas that provide critical ecosystem services: The project forests serve as headwater catchments and dry-season flow regulators for major river systems including the Ruvuma, Rufiji, Ruaha, Mikumi, and Ngerengere Rivers, which supply water to downstream communities, irrigated agriculture, and hydroelectric generation. The project forests also function as wildlife corridors connecting Mikumi, Udzungwa, and Nyerere National Parks and Selous, Msanjesi, and Niassa Game Reserves, sustaining biodiversity and the tourism economy on which surrounding communities depend.
Qualifying Attribute	These forests provide water catchment, flow regulation, and corridor connectivity that directly underpin community water security, agricultural productivity, and tourism-based livelihoods across the project landscape.

Focal Area	Village forest reserves protecting headwaters for rivers, high biodiversity forests, and buffer areas around and corridors connecting national protected areas (see Figure 4, Figure 5, and Figure 6).

High Conservation Value	Areas fundamental for the livelihoods of communities: Many villages earn money from sustainable harvesting of timber and charcoal in village forest reserves. Village councils issue annual harvesting permits within defined allowable cut limits, providing revenues that fund conservation enforcement and community development as well as employment for timber cutters and charcoal makers. More broadly, all communities rely on their village forest reserves for medicinal plants and non-timber forest products which continue to be accessible under the forest management plans. Many villages with Miombo woodlands, which produce a substantial amount of grass in the understory, also permit grazing within their village forest reserves.
Qualifying Attribute	These forests provide material resources — timber, charcoal, medicinal plants, and grazing — as well as village government revenues that complement REDD+ earnings in supporting the economic well-being and self-governance capacity of participating villages.
Focal Area	Village land forest reserves in all participating villages (see Figure 4, Figure 5, and Figure 6).

4.1.4 Without-Project Scenario: Community (CCB, CM1.3)

Without the project, improvements in well-being and social services through forestry and agriculture, the major livelihoods in the project area, would be minimal. Villages rely solely on sustainable timber and charcoal for income from their Village Land Forest Reserves (VLFRs). A baseline survey in 60 communities (2022 and 2023) found that over the past three years, 20 villages earned nothing from their VLFRs, while the remaining 41 villages earned an average of only $3,700 per year. Besides, this income is unstable due to market factors. A study conducted in Kilosa (2022) by the Tanzania Forest Conservation Group (TFCG) on the sustainable charcoal model found low demand for sustainable charcoal, leading some trained producers to pursue other economic activities. Additionally, a 2021 survey on certified timber in Kilwa found that villages harvested less than 5% of the annual allowable amount on average[27]. Consequently,

[27] https://www.sciencedirect.com/science/article/abs/pii/S0305750X21001030

revenue for development projects and forest management activities would continue to be inadequate without this project.

Thus, without the project, communities would lack mechanisms and motivation to stop expanding farms into reserved village forest lands, leading to continued slash-and-burn agriculture and further forest depletion. Illegal and unsustainable wood utilization would persist, causing significant forest degradation and disrupting the communities' forest resource base. Farm expansion inside forest reserves would increase the risk of crop destruction by problem animals and further impoverish the communities. Unpredictable climatic factors would further jeopardize farming income within the reserve, with no assurance of earning a minimum of $4.106 per deforested hectare, (the opportunity cost to carbon trade) which the project is determined to offer. Poor agronomic practices would continue, reducing land productivity and disrupting natural hydrological systems, causing water scarcity for both domestic use and irrigation.

Villages would lack essential revenue for funding social development projects. Consequently, young people would face a shortage of educational infrastructure, preventing them from attending secondary schools and colleges, leaving them jobless and reliant on slash-and-burn agriculture. The lack of improvement in social services, such as health and water infrastructure, would continue to deprive communities of essential amenities, adversely affecting their overall well-being.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CCB, CM2.1)

The project anticipates generating impacts on the communities, with a specific focus on farmers living within the project area and the leakage belt, as outlined in the tables below.

Community group	60 rural communities comprising of 5 CBOs and 283 sub-villages with more than 145,609 people: comprising of 76,232 female and 69,377 male28
Impact(s)	$2.65 million net carbon income annually
Type of benefit/cost/risk	This is a predicted annual income because of the expected reduction in deforestation by at least 75% with-project scenario as compared to without-project scenario. This is a direct impact of the project, as the anticipated income stems from project-supported actions that will demonstrably result into

[28] From population figures in community baseline surveys

	reduced deforestation. These reductions, compared to the without-project scenario, will generate verified emission reductions, which will form the basis for issuing carbon credits and generating revenue. This is a benefit because it represents a new, performance-based income stream for communities. The funds will reward their efforts in forest protection.
Change in well-being	This income will boost local economies, opening opportunities for sustainable development projects. It could be reinvested in essential services like education, healthcare, and infrastructure, improving the overall quality of life. Depending on decisions by the village general assembly, a portion of the revenue might also be distributed among households. This could enhance financial stability, providing better access to basic needs like food, healthcare, and education. With additional income, families could invest in livelihood improvements, such as upgrading housing or adopting sustainable agricultural practices, raising their standard of living. The steady revenue stream from carbon credits will further support conservation efforts, increasing opportunities for more revenues from sustainable timber and charcoal. This will incentivize communities to preserve forests, reduce deforestation, and adopt environmentally friendly practices, thus contributing to both economic and environmental sustainability. This income distribution could also encourage greater community participation in conservation activities, reinforcing the long-term benefits of carbon income.

Community group	Population living within the project area and leakage belt
Impact(s)	An average of 1% increase in yield of their arable land per year.
Type of benefit/cost/risk	This impact is predicted, as the increase in yield is expected to occur over time due to two key factors: (1) the project's support for agricultural extension services and (2) the community's planned use of carbon revenues to invest in improved agricultural practices. While project activities and community intentions are in place, the yield improvements will materialize gradually over the implementation period and depend on the adoption and effectiveness of extension services and local investments.

	The impact is direct because it stems immediately from project-supported actions (agricultural extension services) and community decisions to allocate carbon income toward agriculture. This is a benefit because increased agricultural productivity leads to improved food security, household income, and resilience. Farmers will be able to produce more from the same land area, supporting livelihoods and reducing pressure on forests.
Change in well-being	The impact is socio-economic, as increased agricultural yield contributes to improved household food security, increased income stability, and enhanced resilience to climate and economic shocks among communities within the project area and leakage belt. The magnitude of this impact is considered significant, as even a modest average increase of 1% in agricultural yield can reduce the need for agricultural expansion beyond baseline conditions, thereby offsetting additional forest clearing above the levels predicted under the without-project scenario within the leakage belt, and supporting more sustainable and secure livelihoods.

Community group	Village Natural Resource Committee, with a total of 664 members comprising of 208 female and 456males[29].
Impact(s)	Capacity to operate cloud-based platforms, supported by reliably funded, outcome-driven forest patrols.
Type of benefit/cost/risk	This impact is actual because the participating villages have smartphones, loaded with Mergin maps, that they use to identify new deforestation, navigate to the deforested polygons, record and share patrol data. This impact is direct as it is immediately and measurably from the project's support. The project facilitated the use of Mergin Maps, which led directly to villages using smartphones to detect deforestation, navigate affected areas, and share real-time data. This is a benefit because it enhances local capacity, efficiency, and responsiveness in forest protection. Villages are better equipped to detect and respond to deforestation threats—this reduces forest loss,

[29] Villages CCB survey data 2024

	improves forest governance, and increases the effectiveness of conservation efforts.
Change in well-being	The primary change is in the knowledge gained and the time saved in conducting patrols. Additionally, the project budget will provide an annual increase of $109,800[30] for the patrol teams.

Community group	Forest boundary clearing team; 2,193 people, comprising of 2,042 male and 151 female31
Impact(s)	Additional jobs for communities during the lean season when farm workloads are lighter
Type of benefit/cost/risk	The impact is predicted one, expected to be a result of carbon credit revenues after successful CCB validation and verification of the emission reduction units. This impact is direct because the additional income results from specific project actions; that the project organizes and pays for forest boundary clearing leading directly to the actual income gain to communities. This is a benefit because it provides communities with a new income stream during a time of year when earnings are typically low due to reduced farm work.
Change in well-being	An increase of at least TZS 15,000 per day to farmers' income for each day they participate in boundary clearing work during the lean season, assuming four individuals can clear 0.74 acres per day, with a total project budget of TZS 172,000,000 per year.

Community group	Village Council, comprising of 1068 members (342 female and 726 male)32

[30] From the project's patrol budget modeling

[31] This is based on the project's experience in boundary clearing activity in 16 villages in 2023

[32] Data collected from the participating villages in 2024. The Village Council members will be sensitized on the project aspects and governance best practices on yearly basis.

Impact(s)	Improved tenure security and protection of forest resources within the village land, resulting from better understanding of community-based forest management, REDD and VCSL Model.
Type of benefit/cost/risk	This is actual impact as project villages will put more forests under threat under formal management, transforming them from open access (under state control) to communally managed resources (under village council). This impact is direct because the project provides training and facilitates the expansion of the existing VLFRs or creation of new ones. The project guides the revision of Forest Management Plans and supported the approval process. These activities immediately led to the formal recognition and management of additional community forest areas. Besides, the villages have 40-year contracts with VCSL which obligates the parties to work together to protect the forests, generate and sale VERs. This is a benefit because it gives communities formal rights and tools to sustainably manage and utilize their forests. Even without REDD+ payments, they get the legal basis to protect resources, implement bylaws, and benefit from forest products like timber, firewood, and non-timber goods under sustainable practices.
Change in well-being	Improved tenure security and better governance of VLFRs will help reduce deforestation, increase village carbon revenues, and enhance social services through more effective management of these revenues.

Community group	Youth, 12 to 25 years
Impact(s)	Improved completion rate of primary education, lower secondary education, and upper secondary education.
Type of benefit/cost/risk	This impact is predicted, as it reflects an expected future outcome based on two key actions: (1) community sensitization on the importance of education, and (2) the decision by villages to allocate carbon revenues to support education (e.g., school infrastructure, scholarships, or learning materials). These efforts aim to reduce dropout rates and improve educational attainment over time. The impact is direct because it results immediately from the projects and community's own actions; project's sensitization activities which will trigger communities' financial investments using revenues from

	VERs, aimed at improving education. These efforts target known barriers to education completion (e.g., cost, motivation, school conditions). This is a benefit because higher education completion rates among youth lead to enhanced skills, future employment opportunities, and long-term social mobility.
Change in well-being	Improved knowledge will enable more youth to pursue stable employment opportunities beyond slash-and-burn agriculture. It supports the development of human capital, contributing to broader community development and resilience.

4.2.2 Negative Community Impact Mitigation (VCS, 3.19; CCB, CM2.2)

The project does not negatively impact communities as it primarily focuses on Community-Based Forest and Wildlife Management schemes, established under Free, Prior, and Informed Consent (FPIC) principles and comprehensive Land Use Plans. Forest management bylaws and national policies explicitly prohibit farming in these reserved areas. Without the project, farmers within these reserves would risk occasional legal evictions attempts, jeopardizing their confidence to venture into long-term future agricultural investments.

However, the project advocates allowing existing farmers to retain their current plots, which is widely accepted by the Managing Authorities. The cloud-based mobile technology already in use helps swiftly detect and address new clearings, enhancing trust. Additionally, the project proposes financing the creation of cutlines and other visible boundary marks along forest reserve perimeters adjoining farms and residential areas, ensuring clear delineation of farming limits.

Agricultural extension services will be introduced to enhance productivity and promote sustainable practices over traditional slash-and-burn methods. These initiatives align with the precautionary principle, aiming to prevent new deforestation and forest degradation while supporting improved farming practices.

The project's plans for REDD payments aim to compensate communities at a rate above the opportunity cost of $4.06 per tCO2e, as determined by a 2021 survey in Lindi, with a 2.5% growth rate. Implementing a dividend model will further enhance individual benefits and contribute to the development of communal social services while ensuring revenue flow for forest protection.

4.2.3 Net Positive Community Well-Being (VCS, 3.19; CCB, CM2.3, GL1.4)

The project will provide communities with REDD income, previously unattainable through other forest- based enterprises. It is projected that 27 of the 30 project villages in Morogoro will

generate at least 10 times more annual revenue from VCSL's REDD initiative by preventing 85% of baseline deforestation, compared to their historical income from sustainable timber. According to the opportunity cost analysis, the project ensures a more consistent income stream, valued at a minimum of $4.06 per hectare of avoided deforestation, surpassing potential earnings from clearing that land for agriculture, which is increasingly undermined by climate change. Additionally, communities can maintain sustainable timber revenue by limiting harvesting to 1% of standing biomass annually, while simultaneously earning carbon credits. Reduced deforestation provides greater reliability for implementing sustainable wood enterprises.

REDD income will empower communities to improve social services, particularly education for boys and girls, equipping them with the skills and motivation to pursue reliable and sustainable livelihoods. This contrasts with the 'without-project' scenario, where over 96% of those engaged in deforestation within reserved land have not attained secondary education. Moreover, the project aims to achieve a 1% net increase in agricultural productivity by providing extension services. Increased forest cover will also help regulate local climate, lowering temperatures and enhancing rainfall, thus mitigating climate change impacts on the project communities.

4.2.4 High Conservation Values Protected (CCB, CM2.4)

The project will not introduce new restrictions on the use of the village land forest reserves, wildlife management areas, and local authority forest reserves, which are the targeted High Conservation Values (HCVs) in the project area. Instead, the project will promote the application of existing rules to enforce conservation. Additionally, the project will diversify community revenues through sustainable forestry by adding carbon credits, generated from reduced deforestation and forest degradation measured against baselines as additional source of revenue. The project will also advocate for the sustainable utilization of timber trees, limiting harvesting to no more than 1% of the standing biomass annually, as calculated through existing Sustainable Harvesting Plan methods. This approach ensures that none of the HCVs related to community well-being will be negatively affected, while supporting conservation and enhancing community livelihoods.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.1)

The Village Climate Solutions Project (VCSP) engages a diverse array of stakeholders, each playing a critical role in the project's success. These stakeholders include local authorities, regional administrations, national regulatory bodies, conservation groups, forest user groups, and national authorities managing biodiversity outside Village Lands. The project will have a positive impact on:

President's Office, Regional Administration, and Local Government Authorities (PO-RALG): This comprises of PO-RALG itself, Regional Secretariat (RS) and Local Government Authorities (LGAs).

The project is expected to yield several positive impacts on PO-RALG. First, by adhering to the Environmental Management (Control and Management of Carbon Trading) Regulations of 2022 and 2023, it fosters close collaboration with local authorities, reinforcing their roles in oversight, coordination, and technical advisory support to the village councils and Managing Authorities. The project is allocated with designated of Focal Persons from LGAs which enhances coordination, and the project's alignment with national guidelines for Village Land Forest Reserves (VLFRs) and empowers local authorities to effectively manage forest resources and wildlife conservation. Furthermore, the project will provide 10% of its gross revenues to PO-RALG, generating a significant positive financial impact. However, the requirement for comprehensive monitoring and third-party verification will compel local authorities to fulfill their responsibilities in managing and mediating conflicts, coordinating multiple stakeholders, and acting as environmental watchdogs, duties that would not consistently perform under business-as-usual scenario.

Vice President's Office (VPO): The VPO, as the Designated National Authority or National Focal Point, has its specific role outlined in regulation 9 of the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022 (GN 636 published on 28/10/2022), and regulation 7 of the Environmental Management (Control and Management of Carbon Trading) (Amendment) Regulations, 2023 (GN 721 published on 6/10/2023). The project has already paid registration fees and submitted related application documents. It will continue providing all requisite information necessary for project registration, implementation, monitoring, and reporting, in accordance with the regulations. The project will also share 8% of the carbon credit revenues with the Designated National Authority, ensuring positive financial impacts for VPO.

Tanzania Forest Conservation Group (TFCG): The Tanzania Forest Conservation Group (TFCG) has been committed to conserving Tanzania's high-biodiversity forests and promoting community-based forest management in the project areas since 1991. Most Village Land Use Plans and Village Land Forest Reserves in these areas were established with TFCG's support. The project will assist TFCG in achieving its conservation goals by reducing deforestation in its project areas. The proponent will provide funding from the anticipated profits to support TFCG in implementing its strategic plan, thereby advancing its conservation objectives.

Forest User Groups: The project is poised to provide significant benefits to forest users, including those reliant on non-timber forest products (NTFPs) and wood buyers. By promoting sustainable forest management and conservation practices, the project aims to improve the livelihoods of these stakeholders through enhanced access to forest resources and increased income from sustainable harvesting. Positive impacts include the preservation of critical ecosystems and biodiversity, which ensures the long-term availability of forest products while reducing deforestation and forest degradation. This sustainable approach is expected to enhance the economic resilience of these stakeholders. However, potential negative impacts may arise if the limitations on wood harvesting (restricted to 1% of standing biomass annually) are not effectively communicated or enforced. Stakeholders who rely on higher volumes of wood for their livelihoods may face short-term income challenges. Additionally, if monitoring and support mechanisms are insufficient, there could be tensions among stakeholders over resource access and utilization.

National Conservation-based Authorities: Tanzania Forest Service (TFS), Tanzania National Parks (TANAPA), and Tanzania Wildlife Authorities (TAWA) are national entities responsible for managing biodiversity outside Village Lands. The project areas serve as crucial buffers for these national protected areas, enhancing their conservation efforts. Additionally, the TFS has the potential to join the project as the Managing Authority for the national forest reserves within the project's geographical reference region.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.2)

To mitigate potential negative impacts on the well-being of stakeholders, the Village Climate Solutions Project (VCSP) has established a contractual obligation for villages to adhere to sustainable harvesting requirements, specifically limiting wood harvesting to 1% of standing biomass annually. VCSP will monitor compliance with this 1% harvesting limit and promptly communicate any discrepancies to the communities and relevant government authorities. This approach will ensure that villages issue harvesting permits based on the annual allowable cut, unlike the business-as-usual scenario where permits might be issued without regard for the harvesting plan, potentially leading to tensions with law enforcement. Additionally, conflict resolution protocols will be implemented to address any disputes over resource access and utilization, fostering collaboration and understanding among diverse stakeholder groups.

4.3.3 Net Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.3)

The project activities are not anticipated to have net negative impacts on stakeholders' well-being, as they are designed to promote collaboration and provide financial incentives that reward participation in accordance with carbon trade regulations while enhancing community livelihoods. By adhering to established environmental regulations and actively engaging with local authorities, the VCSP fosters a shared governance model that empowers stakeholders in decision-making processes. Allocating a portion of the project's gross revenues to local authorities and the National Focal Point ensures that financial benefits are shared, strengthening these bodies' capacity to fulfill their roles. Additionally, the focus on sustainable forest management and conservation practices is expected to improve access to forest resources for all stakeholders, ultimately enhancing their economic resilience and long-term well-being.

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 monitoring plan will focus on key stakeholders, including households within the project areas, Village Councils, Village Natural Resource Committees, schools, and other social service centers. Specific community groups such as women, youth, school-aged children, civil servants, and community leaders will be of particular interest. Including these groups will ensure a comprehensive assessment of the project's impact on different segments of the population.

Monitoring these stakeholders will provide valuable insights into community participation, financial benefits, educational access, and improvements in social services. Additionally, the project has already equipped all participating villages with smartphones, integrated into cloud-based platforms for forest patrols, and Open Data Kit (ODK), which enhances data collection efficiency and accuracy, supporting the monitoring efforts.

The key variables to be monitored will include the proportion of women and youth participating in community-based forestry, particularly their membership in the Village Council, Village Natural Resource Committees, and related leadership roles; the amount of carbon revenues paid to the villages and the proportions allocated for forest management, community development, and household dividends; the proportion of girls and boys attending secondary education; and the proportion of villages reporting improved social service delivery. These variables will be crucial for evaluating inclusiveness, financial benefits, educational progress, service delivery improvements, and the project's contribution to human development. Each variable will be selected to reflect significant aspects of community well-being and project success.

The project has designed Open Data Kit (ODK) tools for recording key activity data such as village meetings, beneficiaries of forest boundary clearing activities, and will design one for beneficiaries' revenue sharing. Forest patrol data are captured through cloud-based technology. These tools will facilitate easy availability and accessibility of data, streamlining the process of capturing and analyzing critical project activities. This technological initiative aims to improve data accuracy, transparency, and the overall effectiveness of monitoring efforts across various project components.

The types of measurements to be used in this monitoring plan will encompass both quantitative and qualitative methods. Village Council and Natural Resource Committee surveys, reviews of forest management and attendance records, and financial records and disbursement logs will provide quantitative data on participation, educational access, and carbon revenues. Qualitative insights will be obtained through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). The project's development of ODK tools will further enhance data gathering, ensuring comprehensive and accurate documentation of project activities and impacts. Sampling methods will include random sampling for meeting attendees and committee members, purposive sampling for financial document reviews, and targeted surveys for schools and households. Key informants, such as sub-village leaders, will be targeted to enumerate the number of households benefiting from social services to be developed using revenues generated by the project. This combination of measurements and sampling methods will ensure a comprehensive and representative assessment of the project's impact.

Monitoring and reporting frequencies will vary depending on the variable being measured. Participation metrics for women and youth will be monitored quarterly and annually, allowing for regular updates on inclusiveness. Carbon revenue payments, educational access, and social service delivery will be evaluated annually. This annual assessment will provide a broader overview of the project's long-term impacts. By combining quarterly and annual monitoring, the

plan will ensure timely tracking of progress and enable adaptive management to address emerging issues effectively. In summary the monitoring plan is provided in the table below.

What will be measured	Unit of measurement	Relevance/ Justification	How will it be measured	How often
Participation in community benefit-sharing decision-making meetings, disaggregated by sex (SDG 5.5)	Number and Percentages of participants (%) disaggregated by sex	Inclusive participation in benefit-sharing decisions strengthens transparency, equity, local governance, and community ownership of forest conservation and climate adaptation initiatives.	Review attendance records from village assemblies, village councils, benefit-sharing committees, disaggregated.	Every issuance and payment event
Smallholder farmers perceiving community benefit-sharing decision-making processes as inclusive and responsive, disaggregated by sex, age, disability status, and population group (SDG 16.7.2)	Percentage (%) of interviewed smallholder farmers	Assess perceptions of transparency, equity, participation, and inclusiveness in community decision-making processes related to carbon revenue allocation and management among project-supported smallholder farmers.	Extension officers will interview smallholder farmers during farm visits to assess perceptions regarding inclusiveness and responsiveness of benefit-sharing decision-making processes, disaggregated by sex, age, disability status	Every farm visit conducted after specific issuance and payment
Total revenue generated from carbon credits paid to the Managing Authorities and communities. (SDG 15 b)	USDs distributed to the Managing Authorities and communities	Comprehend the project's financial contributions to forestry, social services, and household dividends, which support investments in climate-resilient livelihoods, sustainable land management, and improved capacity to cope with climate variability.	Monitoring financial reports from Managing Authorities and the proponent’s disbursement records.	Every issuance and payment event

Proportion of carbon revenues allocated to household dividends, education, water services, health services, communal farming projects, and other social development projects. (SDG 1.4.1)	Sectoral USDs allocations by communities	Assess how carbon revenues contribute to community well-being, social service improvements, livelihood resilience, and inclusive local development linked to forest conservation and climate adaptation objectives.	Review village financial reports, benefit-sharing records, village assembly resolutions, and project disbursement records documenting allocation and expenditure of carbon revenues.	Every issuance and payment event
Participation in project-administered trainings during the monitoring period, disaggregated by sex (SDG 13.3)	Number and Percentages (%) of participants disaggregated by sex	Understand capacity development for effective forestry and the evolution towards, climate-resilient, sustainable livelihoods, beyond slash-and-burn agriculture.	Tracking the project's training records, disaggregated by sex.	Each training event
Completion rate of primary education, lower secondary education, and upper secondary education by sex (SDG 4.1.2)	Percentage (%) by education level and sex	Monitor the potential evolutionary trend towards, climate-resilient, sustainable livelihoods beyond traditional slash-and-burn agriculture.	Collect and analyze completion records of girls and boys from the project area per education level.	End of each Monitoring period after first payments to communities
Participation in vocational and tertiary education, disaggregated by sex (SDG 4.3.1)	Number and percentages of students disaggregated by sex	long-term improvements in educational attainment that strengthen human capital and support transitions toward diversified and climate-resilient livelihoods, other than the traditional slash-and-burn agriculture.	Collect and analyze enrollment records from village leaders in the project area, (data disaggregated by sex) and compare with the previous monitoring periods.	End of each Monitoring period after first payments to communities

Proportion of smallholder farmers within the project area adopting at least one climate-resilient agronomic practice promoted by the project e.g. improved seeds, crop rotation, soil conservation (SDG 2.4).	Percentage (%) of farmers	Adoption of climate-resilient agronomic practices strengthens farmers' adaptive capacity by improving productivity and resilience to climate variability, reducing livelihood vulnerability, and supporting more stable food production.	Measured through extension service records, capturing number of smallholder farmers applying at least one climate-resilient agronomic practice and the total number of smallholder farmers visited every year.	Every farm visit
Proportion of agricultural area under productive and sustainable agriculture (SDG 2.4.1)	Percentage (%) of agricultural land	Justify the reduction of deforestation and the control of leakage that could result from increased demand for agricultural land and enhance climate-resilience.	Measure the total agricultural area (ha) under at least one sustainable agricultural practice promoted by the project and express it as a percentage of the total agricultural area managed by participating farmers.	End of each Monitoring period after first payments to communities
Average crop yield per unit area for key priority crops i.e sesame, maize, and pigeon pea (SDG 2.3).	Average kg/ha	Higher crop yields indicate improved agricultural resilience to climate variability and contribute to enhanced food security and livelihood stability among smallholder farmers.	Extension officers' records by collecting: Total production (kg) for selected priority crops and area cultivated (ha)	End of each Monitoring period after first payments to communities
Proportion of visited smallholder farmers reporting no seasonal food shortages during	Percentage (%) of visited smallholder farmers.	A reduction in seasonal food shortages reflects improved agricultural productivity, livelihood stability, and adaptive capacity resulting from project-supported	Measured through extension officers' records of seasonal food shortages reported by smallholder	Every farm visit conducted after specific issuance and

the monitoring period.		climate-resilient practices and community investments.	farmers during routine farm visits	payment events.
Proportion of the population in project villages with access to basic social services at household and community levels, disaggregated by age and sex (SDG 1.4.1).	Percentage (%) of Households	Monitor, evaluate, and understand the trend of community motives to improve social services through revenue generation from forest protection, in a way that reduce vulnerability to climate-related stresses.	Village records on population with access to 1. Piped water and improved rainwater facilities 2. Health Insurance and access to related services, 3. Houses connected to electricity.	End of each Monitoring period after first payments to communities
Extent and security of community land tenure rights, measured through legally recognized land documentation and perceived tenure security among community members. (SDG 1.4.2)	Hectares of land covered by Certificates of Customary Rights of Occupancy (CCROs). % of communities perceiving land tenure as secured.	Comprehend the enhancements in land tenure security, through carbon trade revenues generated by the project, which encourage long-term investments by local communities including climate-resilient land management.	Review village land registries and records of CCROs; and assess perceived tenure security Focus Group Discussions.	End of each Monitoring period after first payments to communities
Employment generated through project-supported forest protection and governance activities, disaggregated by sex and expressed as Full-Time Equivalents (FTEs) (SDG 8.5)	Full-Time Equivalents (FTEs) Employments segregates by sex	Assess the project's contribution to local employment, household income generation, participation in forest conservation activities, and transition toward sustainable non-forest-clearing-based livelihood opportunities.	Review payment records, related to trainings, meetings, patrol implementation, and other project-supported activities, divided by National Minimum wage in forestry.	End of each monitoring period

Percentage of communities reporting maintained or improved access to essential forest-related resources and ecosystem services (SDG 15.1)	Percentages (%)	To assess community perceptions regarding the maintenance or enhancement of HCV linked to community well-being, including access to water sources, grazing areas, medicinal plants, and timber.	Focus Group Discussions conducted during CCB monitoring to assess changes in community access to and availability of essential forest-related resources and ecosystem services	End of each Monitoring period starting 2026

4.4.2 Monitoring Plan Dissemination (CCB, CM4.3)

The monitoring plan and its results will be disseminated and made publicly available on the internet through a Village Climate Solutions Limited website to be developed. This website will serve as a centralized platform where stakeholders, including communities, government entities, Non-Governmental Organizations (NGOs), and the public at large, can access detailed information about the monitoring activities. The website will feature comprehensive reports outlining the methodology, key findings, and analyses of monitored variables such as community participation in forestry, carbon revenue allocations, educational access, and social service improvements. These reports will be presented in a clear and accessible format to ensure transparency and facilitate understanding among diverse stakeholders.

In addition to the online platform, summaries of the monitoring plan and results will be communicated directly to communities and stakeholders through various means. Regular community meetings will be organized in project areas to discuss monitoring outcomes, solicit feedback, and address concerns. These meetings will serve as forums for engaging with community members, sharing summarized findings, and explaining the implications for local development and conservation efforts. Furthermore, informational leaflets, posters, and newsletters will be distributed in Swahili language to ensure broader dissemination of key findings and encourage community participation in ongoing monitoring activities.

Moreover, the project will develop a dashboard that will enable villages to view the progress of their work directly through their smart phones. This dashboard will provide real-time updates and visualizations of monitored data, allowing communities to track their contributions and achievements in forest management and other project activities. Additionally, the project will facilitate community engagement through social media platforms such as WhatsApp groups. These groups will serve as channels for sharing social monitoring results, fostering collaboration among community members and enhancing awareness of project impacts and activities.

By employing both advanced technological tools like dashboards and widespread communication channels such as community meetings and social media, the project aims to enhance transparency, accountability, and community involvement in monitoring and reporting efforts. These efforts are crucial for ensuring sustainable development outcomes and fostering meaningful engagement with stakeholders across project areas.

4.5 Optional Criterion: Exceptional Community Benefits

4.5.1 Exceptional Community Criteria (CCB, GL2.1)

Out of the 60 communities that the project has signed contracts with for developing and implementing carbon trade, 54 are Village Councils. These councils are established by sections 22 and 25 of the Local Government Act (District Authority), Cap 287, and are accountable to their communities as per section 55. They are recognized as corporate bodies according to section 26 and possess legislative powers as outlined in section 163. The villages are vested with statutory rights over village land based on the Village Land Act, CAP 114 of 1999. Additionally, Policy Statements 5 and 6 of the National Forestry Policy of 1998, along with sections 4(c)(i), 32, 33, and 35 of the Forest Act, CAP 323 of the laws of Tanzania, provide these communities the right to own Village Land Forest Reserves.

Of the 54 Village Land Forest Reserves (VLFRs), 35 are gazetted through Government Notices number 487 of 26/06/2020 and 688 of 28/08/2020, as provided by section 35(6)(b) of the Forest Act, CAP 323 of the laws of Tanzania. The remaining reserves are declared VLFRs based on sections 33 and 34 of the Forest Act. Additionally, five forests are managed by Community Based Organizations (CBOs) formed and registered in accordance with the Societies Act, Cap 337 R.E. 2020 of the laws of Tanzania. These CBOs will sign Joint Management Agreements (JMA) with Local Authorities to manage the forests based on section 16 of the Forest Act, CAP 323, and will receive benefits in the same way as Village Councils would do. Two Managing Authorities are Local Government Authorities responsible for their own forests as owners, but their primary function, as stipulated in the Local Government (District Authorities) Act, Cap 287 R.E. 2020, is to serve the communities.

In future expansion areas, the project plans to work with Authorized Associations (AAs), which are also CBOs registered specifically to manage Wildlife Management Areas (WMAs) established based on sections 31 and 32 of the Wildlife Conservation Act, CAP 283 of the Laws of Tanzania.

Given that the communities are the sole owners of almost the entire project area and are the ones who will reduce deforestation and forest degradation to generate saleable carbon credits, they will hold the majority share of the anticipated carbon revenues. They have the right to claim that their activities will generate the project's climate, community, and biodiversity benefits.

In addition, the project is in Tanzania, a country classified as having low human development according to the Human Development Index (HDI) published by the United Nations Development Program (UNDP). More specifically, the project is in the rural areas of Morogoro and Lindi, mostly

adjacent to Wildlife Protected Areas, which are often characterized by livelihood challenges caused by problem animals and climate change factors.

4.5.2 Short-term and Long-term Community Benefits (CCB, GL2.2)

The Village Climate Solutions Project (VCSP) is strategically designed to deliver both short-term and long-term net positive well-being benefits for smallholders and community members. In the short term, the project provides a new income source through REDD initiatives, allowing communities to earn over ten times their previous revenue from sustainable timber operations, with an expected average annual income of $2.65 million. The reliable income stream, valued at a minimum of $4.1 per hectare of avoided deforestation, offers greater financial stability compared to the unpredictable earnings from agricultural land clearing, which is increasingly jeopardized by climate change. By emphasizing sustainable timber harvesting, restricted to 1% of standing biomass annually, the project ensures ongoing revenue from wood products, while enabling communities to generate carbon credits.

Furthermore, REDD income will empower communities to invest in vital social services, especially education for both boys and girls. By equipping the next generation with skills and motivation for sustainable livelihoods, in long-run, the project seeks to break the cycle of poverty and low educational attainment, as over 96% of those involved in deforestation within reserved lands currently lack secondary education.

Additionally, the project aims to achieve a 1% net increase in agricultural productivity through targeted extension services, further bolstering the community's economic resilience. Increased forest cover will also help regulate the local climate, contributing to lower temperatures and improved rainfall patterns, thereby mitigating the adverse effects of climate change on community livelihoods.

Together, these outcomes illustrate that the VCSP will create substantial short-term and long-term benefits, significantly enhancing the overall well-being of smallholders and community members.

4.5.3 Community Participation Risks (CCB, GL2.3)

The project has undertaken a participatory process, conducting 54 village council and 5 Mitaa meetings with 1,610 members and village general assemblies with 5,456 community members to identify potential risks for smallholders and community members. Key concerns included the impact on existing agricultural practices and access to forest resources. Farmers who have encroached upon and cleared forests in the reserves expressed worries about potential eviction, which could lead to conflicts. Additionally, village governments and forest users were concerned about restrictions on forest harvesting if they engage in carbon trading.

To address these risks, the project is designed to provide agricultural extension services that enhance productivity within current farming plots, thereby reducing the need to clear more

forested areas. The project philosophy also allows communities with established farms inside the reserves to continue farming if they do not clear additional forests. In collaboration with Managing Authorities, the project has revised the existing forest map to eliminate heavily encroached areas while adding well-forested regions. This revision has been endorsed by village council meetings and general assemblies. Monitoring of farmers is conducted using cloud-based technology to ensure compliance, which has already identified and patrolled deforested polygons. All involved farmers have acknowledged their encroachment and committed to supporting the project.

Overall, these measures demonstrate the project's dedication to managing risks while enabling smallholders and community members to participate without compromising their livelihoods.

4.5.4 Marginalized and/or Vulnerable Community Groups (CCB, GL2.4)

The table below identifies the marginalized and vulnerable community groups the project engages with and outlines how these groups will gain net positive benefits

Community Group	Youth (12 to 25 years) from the project villages; Estimated at 51,78827,11324,675male) throughout the project's lifetime)[33]
Net positive impacts	Data collected through forest patrols show that only 4% of the people causing recent deforestation have attained secondary education or above. It also shows that over 90% of them are male, and 76-100% are older than 53 years. The project will support the Managing authorities to develop benefit sharing regulations which will emphasize that the generated carbon revenues to be invested in improving education facilities, through which youth will inevitably get benefited.
Benefit access	No barriers or risks that might prevent benefits going to youth
Negative impacts	No negative impact to beneficiaries.

Community Group	Elderly group, and people farming within the reserve and leakage belt, estimated at 7006 (3,853 female and 3,152 Male), throughout the project's lifetime[34]

[33] At least two-thirds of the participating villages will invest annually in secondary and college education, doubling the current number of 5,885 students enrolled in these institutions in six years.
[34] The project aims to provide extension services to at least 10% farmers , with a target of at least 55 women for every 100 trainees.

Net positive impacts	The opportunity cost survey conducted by the project in Lindi indicated that clearing forests for agriculture is primarily undertaken by older individuals. While village forest bylaws and national forest laws prohibit farming within reserved forest areas, the project allows existing farmers, particularly the elderly, to continue cultivating their current plots without further clearing. This practice is monitored through cloud-based patrol technology, providing greater security for these farmers compared to scenarios without the project, where they might face legal displacement. Additionally, the project prioritizes agricultural extension services that promote improved agronomic practices and enhance productivity. These initiatives are expected to positively impact the well-being of marginalized and vulnerable community groups, including elders. By supporting sustainable farming practices and productivity improvements, the project aims to generate net positive impacts on the economic stability and overall well-being of these groups. This approach not only preserves forest resources but also empowers community members, particularly the elderly, to maintain their livelihoods and enhance their quality of life within the framework of forest conservation regulations.
Benefit access	There is a risk of elite capture in identifying beneficiaries of agricultural extension services. Additionally, concerns exist that revenues generated from the project may primarily fund social services in village centers, potentially overlooking older individuals residing inside or near the forest. To mitigate these risks, the project focuses on registering and monitoring specific areas through a cloud-based platform developed for this purpose. Furthermore, the project has established a comprehensive benefit-sharing mechanism designed to advocate for equitable dividends. Beneficiaries are registered and approved at the sub-village level, ensuring marginalized groups, including older resident's dependent on forest resources, have fair access to project benefits and services. This approach addresses potential barriers and ensures that all identified vulnerable community members benefit from the project's initiatives. By actively identifying and addressing these challenges, the project aims to maximize positive impacts on the well-being of marginalized and vulnerable smallholders and community members, fostering inclusive development and sustainable resource management.

Negative impacts	To ensure that elderly smallholders are identified and supported, the project will engage village councils and general assemblies in identifying potential beneficiaries of agricultural extension services and ensuring equitable access to project benefits for elderly individuals. A robust registration and approval system will be established at the sub-village level, prioritizing residents living near or within forest areas. By formally registering beneficiaries, the project aims to prevent elite capture and ensure that resources are fairly distributed to those most in need. Additionally, smartphones will be used to track and manage project activities, including grievances. This technology will help identify any adverse impacts on elderly smallholders and take actions promptly. Continuous monitoring and adaptive management strategies will ensure equitable benefits and safeguard the well-being of elderly smallholders.

4.5.5 Net Impacts on Women (CCB, GL2.5)

The project has employed four (4) extension agents who are recent university graduates, two (2) of whom are women. As the project continues to expand, more extension agents will be employed, with a strategic focus on recruiting women. Currently, at least 30% (N=483) of the trained patrol team members using patrol technology are women. Additionally, 31% of community leaders participated in Village Council meetings and 41% of those attended village general meetings to learn about, discuss, and endorse the project were women. This preliminary involvement of women in key roles and decision-making processes demonstrates their significant influence within the project.

The project is committed to advocating for women's participation in decision-making activities, emphasizing the one-third requirement stipulated in the National Community Based Forest Management (CBFM) Guideline (2007) and section 33 (2) (b) of the National Forest Act CAP 323 of the laws of Tanzania. Social monitoring tools have been designed to track the participation of women in project activities and decision-making processes, ensuring that women's voices are heard and considered.

To ensure that the project generates net positive impacts on the well-being of women, benefit-sharing guidelines have been drafted to be customized by each participating village. These guidelines are based on experiences from the previous MJUMITA Community Forest Project (Lindi), which emphasized dividends to households. To mitigate men's control over household revenues, women were directly paid for themselves and on behalf of all dependents in the

household. This approach ensures that women have direct access to financial benefits, enhancing their economic independence and well-being.

Furthermore, the anticipated social service facilities to be funded by communities through project-generated revenues will have a significant impact on women. Improved water infrastructure will reduce the walking distance and time women spend fetching water, as this is typically a woman's role in rural Tanzania. Health infrastructure will serve women and household dependents, facilitating access to health services. Education support, particularly for girls, is also a priority. Some villages are expected to use funds to construct hostels and provide related facilities to save students, especially girls, from long walks to secondary schools. These improvements in social services will directly benefit women and contribute to their overall well-being.

4.5.6 Benefit Sharing Mechanisms (CCB, GL2.6)

In Tanzania, the cost and benefit-sharing mechanisms for carbon trade projects is primarily outlined in Regulation 34 of the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022 (GN 636 published on 28/10/2022) and Regulation 20 Amendments of 2023 (721 published on 6/10/2023). These regulations were developed in accordance with sections 75 and 230(2)(s) of the Environmental Management Act (CAP. 191 of the laws of Tanzania). The regulations specify the distribution of gross revenue from sales of carbon credits among six stakeholders as follows:

Managing Authorities; the forest owners – 51%

Project Proponent – 31%

Designated National Authority or National Focal Point – 8%

President's Office – Regional Administration and Local Government – 1%

Regional Secretariats – 1%

Local Government Authorities – 8%

Furthermore, the regulations state that the Designated National Authority or National Focal Point shall allocate three percent of its eight percent share to the National Environmental Trust Fund to support environmental conservation initiatives, including clean cooking energy and technologies.

The project will adopt these provisions. Additionally, while maintaining a minimum 51% share for the communities who are the forest owners, the project will consider opportunity costs as a primary determinant of this minimum share. When the project starts generating profit, 82% of it will be shared with the communities.

To ensure smallholders and community members fully and effectively participate in defining the decision-making process and the distribution mechanism for benefit-sharing, the project will develop benefit-sharing guidelines at the village level. This process will draw on experiences from

the MJUMITA Community Forest Project (Lindi) and involve extensive consultations with community members and local authorities' forest, planning, and legal officers to customize and enhance the benefit-sharing system.



Figure 19 A woman from Ruhoma village collects her and her children's REDD dividends in 2014.

In the MJUMITA Community Forest Project, the benefit-sharing system was based on the principle that all villagers were equal owners of the village forest reserve, entitling them to equal dividends. Each year, villages compiled household lists against residence eligibility criteria specified in their bylaws or regulations. They would then divide the money received from REDD+ projects by the number of eligible residents to calculate a per-person dividend. Village assemblies would then decide how much to allocate from these dividends for village development projects and forest protection, with the remainder paid out as dividends. This distribution process involved individual's publicly collection and signing of dividends in front of sub-village members to ensure transparency. Additionally, it was agreed in village general assemblies that women, would collect the dividends on behalf of the family dependents, because usually they bear primary responsibility these dependents.

This system was both efficient and effective, delivering funds and creating a community-wide incentive for conservation, receiving near-universal support from villagers. Transparency was ensured through public meetings and the involvement of all community members in decision-making processes.

The proponent has started to rework this system in consultation with communities, local authorities, and other stakeholders. One objective will be to determine the actual costs of reducing deforestation and forest degradation, which villages will prioritize for forest protection activities. This funding will primarily support regular forest patrols, boundary clearing, and fire management. Besides, the proponent will determine the best methods for delivering funds to communities, preferably through designated accounts approved by the respective village general assembly.

Additionally, the project aims to encourage villagers to fund development activities that have the greatest potential to create long-term change favoring forest conservation. The proponent believes that increasing secondary school attendance and completion is particularly important, as the opportunity cost study showed that deforestation for farming is primarily driven by the growth of the older and less educated population. Young people prefer to engage in business or employment rather than smallholder farming. Higher secondary school attendance rates would help facilitate this shift. The system will also promote investment in agriculture to increase productivity.

In summary, the project's benefit-sharing mechanism ensures full and effective participation of smallholders and community members in defining decision-making processes and distribution mechanisms. It guarantees transparency in project funding, costs, and benefit distribution through public meetings, community involvement, and clear guidelines.

4.5.7 Benefits, Costs, and Risks Communication (VCS, 3.18; CCB, GL2.7)

To ensure smallholders and community members fully understood the project's predicted and actual benefits, costs, and risks, a comprehensive engagement strategy was implemented. Relevant information was delivered through various channels, including village meetings, power point presentations and discussion maps, Mergin Maps, interactive discussions, and written materials. These approaches aimed to ensure that all participants grasped the project's implications and could make informed decisions.

Key Discussion Topics: Presentations by the project proponent, Village Climate Solutions Limited (VCSL), addressed critical subjects such as climate change impacts, the role of carbon dioxide, and the connection to international emission reduction efforts. The concept of carbon credits was explained in detail, focusing on how reducing deforestation and forest degradation in natural forests older than 10 years could generate saleable credits. The proponent's long-term commitments, including registering, validating, verifying, and securing markets for carbon credits, were clearly communicated. Additionally, the project's support for patrols, revising forest boundary maps, and marking boundaries was outlined, along with a commitment to benefit-sharing and future agricultural extension services to enhance productivity.

Project Area and Engagement Process: One of the key topics was the project area, specifically targeting forests at risk of deforestation. Community members were shown detailed maps during village meetings, which illustrated Village Land Forest Reserve (VLFR) boundaries, deforested areas, and consistently farmed lands. Through cloud-based platforms such as Mergin Maps, patrol teams identified deforested polygons, allowing direct engagement with community members responsible for deforestation. This facilitated discussions about adjusting boundaries, excluding heavily farmed areas, and expanding forest reserves to include areas potential for conservation and generation of carbon credits. These discussions, lasting over 12 months, provided communities with the time to assess carbon credit potential and allowed them to propose revisions to the project area based on their understanding.

Benefit-Sharing and Revenue Distribution: VCSL outlined the benefit-sharing mechanism in detail, committing to a minimum of 51% of gross carbon credit revenue for the villages, and sharing 82% of the profit once the company becomes profitable. Information on the financial aspects, as well as the sustainable harvest limit (1% of standing biomass per year), was shared in village councils and general assemblies. Written materials, including summaries of carbon trade contracts and benefit-sharing provisions, were distributed to ensure clarity.

Evidence of Understanding: To confirm the community's understanding of the project's benefits, costs, and risks, consent letters were obtained through Village Council meetings attended by 1610 members (507 females, 1,103 males, and 259 youths) and approved by village general assemblies attended by 5,456 members (2,270 females, 3,186 males, and 886 youths). In total, 60 communities endorsed the project. The active participation in these meetings, along with the revisions proposed by some communities regarding project area boundaries, demonstrated that stakeholders had a strong grasp of the project's implications.

Further evidence of comprehension came through the formal endorsements of the Forest Management Plans and Carbon Trade Contracts by village councils and general assemblies. These were approved by large numbers of community members, reflecting their confidence in the project's benefits and their understanding of the associated costs and risks.

District-Level Engagement: Additionally, similar presentations were made to District Council teams, where the project was endorsed in Full Council Meetings. This further demonstrates that information was effectively communicated at all governance levels, ensuring widespread understanding and support for the project.

4.5.8 Governance and Implementation Structures (CCB, GL2.8)

The project's governance structure will support the management of forests within the project area and leakage belt, supervision of performance-based payments, and coordination of agricultural extension services at the community level.

Forest Management Structures: For the management of Village Land Forest Reserves (VLFRs) and Local Authority Forest Reserves (LAFRs), the project will adopt the governance structures specified in Sections 33 and 30 of the National Forest Act, CAP 323. VLFRs will be managed by Village Natural Resource Committees (VNRCs), which are accountable to the Village Council and the Village General Assembly. VNRC members are elected through a democratic process, ensuring representation from all sub-villages and at least one-third female participation. The VNRC will be led by a Chairperson, Secretary, and Treasurer, elected annually by the committee members.

The VNRC also forms a patrol team, headed by a Patrol Commander, responsible for regular forest patrols and reporting to the VNRC meetings. These activities are guided by a Forest Management Plan and village bylaws, which are approved by the Local Authority Council after being reviewed or endorsed by the Village General Assembly. In the case of LAFRs, the bylaws are

approved by the Minister responsible for Local Government. VNRCs will report regularly to the Village Executive Officer, monthly to the Village Council, and quarterly to the Village General Assembly.

To ensure full compliance, the VNRCs will receive technical guidance from the District Forest Officer and will report quarterly to the District Executive Director (DED) through the Village Council. LAFRs, on the other hand, are managed by the District Forest Officer, who reports to the DED, the Council's economic and environmental committee, and the Full Council. National authorities, especially the Forest and Beekeeping Division under the Ministry of Natural Resources and Tourism, conducts regular monitoring to ensure compliance with national policies and regulations.

Agricultural Extension Services: The governance of agricultural extension services will involve collaboration between Local Authorities, village governments, the project proponent, and farmers, who may either operate individually or in groups. Local Authorities already have Agricultural Extension Officers employed at the village or ward level. Additionally, the project will hire its own extension officers, each responsible for supporting at least 12 villages, though they may cover larger areas depending on the need.

An ODK or Mergin map-based tool will be developed by the project to map potential farmers within the project area and leakage belt for participation in extension activities. Farmers will have the option to work individually or form groups to engage with the project. The project's extension officers will collaborate with government extension officers to ensure that farmers implement best agricultural practices, monitor progress, and report performance on a regular basis.

Performance-Based Payments and Cost-Benefit Sharing: The project will implement a performance-based payment system involving Local Authorities, VNRCs, Village Councils, the Village Cost-Benefit Sharing Committee, and the General Assembly. The process will begin with drafting village cost-benefit sharing guidelines, which will be reviewed by the District Planning Officer, Village Council, and approved by the Village General Assembly. Each village will establish a cost-benefit sharing committee with representatives from all sub-villages and various community groups, subject to approval by the General Assembly.

Participatory planning will be a core element of the payment system, with the District Planning Officer facilitating annual assessments of Opportunities and Obstacles to Development (O&OD) through sub-village level meetings. The results will inform the development of the village's annual implementation plan and budget, which will be reviewed by the Village Council and General Assembly before approval. The Cost-Benefit Sharing Committee will select priority development projects, to be funded by REDD revenues, from this budget and integrate forest management plans and budgets proposed by the VNRCs.

Decision-Making and Oversight: Each village will hold an annual special general meeting dedicated to the REDD project, attended by the project proponent, Local Authority representatives, and all village members. During these meetings, the proponent will present

monitoring reports, highlighting successes and challenges in reducing deforestation, verified carbon credits generated, and the resulting revenues. VNRCs will present their progress reports, plans, and budgets, while the Village Council will update the assembly on the progress of projects funded by REDD revenues. The Cost-Benefit Sharing Committee will then present the proposed priority projects for the upcoming year, subject to discussion and approval by the General Assembly. National authorities will oversee compliance with national policies and regulations in. the whole process.

Proponent and Project Governance: The proponent has an overall role in governing project monitoring, verification, issuance, and administration of payments to communities. The highest decision-making body within the proponent organization is its Board of Directors, responsible for reviewing and approving company policies, plans, and budgets. Day-to-day project operations are overseen by the Operations Director, who will also supervise the extension agents. The Finance Director will handle accounting, administration, and the supervision of benefit-sharing activities. Finally, the proponent will be reporting to the Designated National Authority as required by national regulations.

4.5.9 Smallholders/Community Members Capacity Development (CCB, GL2.9)

The project will enhance the capacity of smallholder farmers and community members to actively engage in the design, implementation, and management of climate-smart agriculture and forest management activities. To achieve this, the project will deploy one extension agent for every 12 project villages, providing them with motorcycles and fuel to ensure mobility. The primary focus will be small holder farmers farming within the project area or the leakage belt, with a target of increasing productivity by at least 1%. The Extension Agents will offer continuous support on farm inputs, conservation agriculture techniques, and strategies for mitigating crop losses from wild animals, a critical issue in the area. Farmers will also receive guidance on accessing climate adaptation financing, such as CRDB bank's Green Climate Fund supporting loan program for smallholder farmers.

In addition, youth members of the Village Natural Resource Committees (VNRCs) will be trained in the use of patrol technology, focusing on real-time identification of deforestation using cloud-based platforms. They will learn how to navigate deforestation sites and take appropriate action, while also collecting data to support project monitoring. Extension Officers will provide ongoing assistance in implementing patrol systems, resolving administrative issues within VNRCs, and ensuring the proper marking of Village Land Forest Reserve (VLFR) boundaries. This holistic approach ensures that both smallholders and local institutions are equipped with the skills and knowledge to sustainably manage agricultural productivity and forest resources within the project area.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (VCS, 3.19; CCB, B1.1)

Biodiversity within the project zone

Coastal Forest



Figure 20 Noto Plateau Coastal Forest in Muungano Village



Figure 21 Rondo Dwarf Galago from Noto Plateau (*Paragalago rondoensis)*

The coastal forests of Lindi are consistently identified as being a biodiversity conservation priority in global analyses of biologically important areas. They are part of the Coastal Forests of Eastern

Africa biodiversity hotspot according to Conservation International's hotspot analysis[35] and they are within the Southern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion according to the WWF Conservation Assessment of Terrestrial Ecoregions of Africa and Madagascar[36].

The East African coastal forests are characterized as 'a chain of relict forest and thicket patches set within savannah woodlands, wetlands and increasing areas of farmland'[35]. Most coastal forests are small and fragmented. Most of the Tanzanian coastal forests are in the 15 – 50 km2 size class. The high levels of botanical and mammalian endemism are the main reason for the area to have been given such a high priority in global analyses. Mittermeier *et al*. recognize 1750 endemic plant species from the area; and 11 endemic mammal species.

As part of REDD readiness activities, biodiversity surveys were carried out within the project area between 2008 and 2013 by the Tanzania Forest Conservation Group. The surveys focused on plants, mammals and birds. The study found 20 coastal forest endemics, 8 of which are only found in Lindi Region. Among the endemics was the Rondo Dwarf Galago, an endangered primate species (Figure 21). Another 4 species were near-endemic, being also found in The Eastern Afromontane Biodiversity Hotspot. The survey report detailing the species recorded from the project area is available on the TFCG website[37]. The report includes the results of the TFCG surveys and a literature review. In addition to endemic species, the surveys showed that the project area coastal forests are used by endangered African Savanah Elephants and vulnerable African Lions and Leopard.

Montane Forest

[35] Mittermeier, R. A., Turner, W. R., Larsen, F. W., Brooks, T. M., & Gascon, C. (2011). Global biodiversity conservation: the critical role of hotspots. In *Biodiversity hotspots: distribution and protection of conservation priority areas* (pp. 3-22). Berlin, Heidelberg: Springer Berlin Heidelberg.

[36] Burgess, N., Hales, J. A., Underwood, E., Dinerstein, E., Olson, D., Itoua, I., ... & Newman, K. (2004). *Terrestrial ecoregions of Africa and Madagascar: a conservation assessment* (pp. xxiii+-501).

[37] https://www.tfcg.org/wp-content/uploads/2018/05/TFCG-Lindi-Village-Forests-Biodiversity-Survey-Report-June-2013-FINAL.pdf



Figure 22 Abbott's Duiker (*Cephalophus spadix*) © Bowkett et al., 2014[38]

With the expansion of the project in 2023, the project area now also includes the 2300 ha Ilole forest in Kilosa district which is part of the globally recognized Eastern Afro-Montane Biodiversity hotspot[35], a collection of moist forests on separate mountains in East Africa. The Eastern Arc Mountains in Kenya and Tanzania are a particularly important part of the hotspot, being the result of uplift from at least 30 million years ago and have likely been forested ever since[39]. The combination of having been forested for such a long period of time while also being broken into a series of isolated mountain patches led to a very high rate of speciation. At least 96 vertebrate species are endemic, consisting of: 10 mammals, 19 bird, 29 reptile and 38 amphibian species[40].

Ilole forest was surveyed by a team of scientists, including staff members from the Tanzania Forest Conservation Group in 2006-2007[41]. The team identified 10 Eastern Arc Mountain endemic and 18 near endemic vertebrate species. Three of the amphibian species identified were new to science and likely restricted to Ilole or the Rubeho mountains. The IUCN status has not yet been assessed. The team also found a new population of Abbott's duiker (Figure 22), an

[38] Bowkett, A. E., Jones, T., Rovero, F., Nielsen, M. R., Davenport, T. R., Hawkins, D. M., ... & Stevens, J. R. (2014). Distribution and genetic diversity of the Endangered Abbott's duiker Cephalophus spadix in the Udzungwa Mountains, Tanzania. *Endangered Species Research*, *24*(2), 105-114.

[39] Lovett, J. C., Marchant, R., Taplin, J. A. M. E. S., & Küper, W. (2005). The oldest rainforests in Africa: stability or resilience for survival and diversity. Phylogeny and conservation, 198-229.

[40] Burgess, N., Butynski, T. M., Cordeiro, N. J., Doggart, N. H., Fjeldså, J., Howell, K. M., ... & Stuart, S. N. (2007). The biological importance of the Eastern Arc Mountains of Tanzania and Kenya. Biological conservation, 134(2), 209-231.

[41] Rovero, F., Menegon, M., Leonard, C., Perkin, A., Doggart, N., Mbilinyi, M., & Mlawila, L. (2008). A previously unsurveyed forest in the Rubeho Mountains of Tanzania reveals new species and range records. Oryx, 42, 16-17.

endangered forest dwelling antelope which had previously only been found in the neighboring Udzungwa Mountains. Signs of use by endangered African Savanah Elephants were also observed. Though relatively small, Ilole appears to be a very important forest for biodiversity conservation.

Miombo



Figure 23 African Savanah Elephant (*Loxodonta africana*) © www.tanzaniatourism.com



Figure 24 African Wild Dog (*Lycaon pictus*) © expertafrica.com

With the expansion of the project in 2023, most of the project area is now Miombo woodlands. Miombo woodlands are the most common type of forest in Tanzania and throughout much of Southern Africa. Thus, it is home to far fewer range restricted species. It is however a diverse ecosystem. For instance, the VCSL biomass plots in Miombo woodland had 160 different tree species in them. Miombo woodlands throughout the project area is also important habitat for many large mammals including the endangered African Savanah Elephant (Figure 23) and in Nachingwea district, endangered African Wild Dog (Figure 24), and vulnerable African Lion and Leopard. Several project area village forest reserves in Kilosa and Mvomero districts provide buffer areas to Mikumi National Park and are considered part of the same ecosystem[42], which also hosts Elephants, Wild Dogs, Lion, and Leopard.

Threats to biodiversity within the project zone

Habitat clearance

As is described in detail in section 2.2 of the methodological annex, deforestation for agricultural land is the single largest threat to the project area forests. The threat of habitat clearance is high in the coastal forest and Miombo sections of the project area. The threat to Ilole forest is low, but growing, with signs of agricultural encroachment first appearing in 2024. The level of threat mostly depends on proximity to past agricultural activity. Most species endemic to the project area are forest dependent, so forest clearance reduces their populations and puts them at increased risk of extinction. For other species such as elephants, project forests are used seasonally as corridors and refuge and the conversion of these areas to human use puts them in direct conflict with humans.

Habitat degradation due to logging

Much of the project area has been subjected to decades of logging that removed many of the large trees according to the results of interviews with community representatives and the project's vegetation plots. Species that have been targeted include *Milicia excelsa* and *Pterocarpus angolensis*. However, logging tends to be very selective since the most desirable timber species and size classes are uncommon in the project forests. Thus, while less controlled timber harvesting in the baseline scenario could be a habitat degrading factor in coastal and Eastern Arc forests, it is unlikely to greatly impact biodiversity.

Charcoal production

This is primarily only a threat in Morogoro, due to its closer proximity to Dar es Salaam. There, it is focused on Miombo woodlands. It can degrade habitat, though most species endemic to Miombo

[42] Mayengo, G., Bwagalilo, F., & Kalumanga, V. E. (2017). Human wildlife conflicts to communities surrounding Mikumi National Parks in Tanzania: A case of selected villages. International Journal of Environment, Agriculture and Biotechnology, 2(4), 238852.

are adapted to and may even benefit from local disturbances. For instance, elephants may benefit from the increased grass in areas disturbed by charcoal harvesting.

Fire

Fire is primarily a threat to Ilole forest, which is not fire adapted like Miombo, nor naturally fire suppressing like the coastal forest. In the case of Ilole, fires are most likely set either intentionally or unintentionally by hunters. The last large fire affecting the forest occurred in the 2021 dry season. However, with the start of illegal farming activities in the area in 2024, the risk of fire damaging the forest is likely increasing.

Hunting

In Lindi, some households illegally hunt wild animals including duikers, bushbuck and buffalo. Elephant and lion populations are also affected by illegal hunting in the area.

In Ilole forest, the 2007 survey found extensive evidence of illegal hunting. The area is still quite remote and so would not have been patrolled by village forest patrol teams in the baseline scenario. Hunting poses a particularly high threat to the Abbotts duiker population, which is vulnerable to snares, if it has not already gone extinct locally since 2007.

Species and habitat	Habitat: Coastal Forest (Chole and Noto forests in Figure 4) Rare Species: *Paragalago rondoensis, Loxodonta Africana, Panthera pardus, Bucorvus leadbeateri, Leptactina papyrophloea, Dichapetalum braunii, Terminalia apetala, Monanthotaxis trichantha, Mimusops acutifolia, Peponium leucanthum, Bauhinia loeseneriana* Project Impact: The project does not promote any activities which are expected to negatively impact habitat or habitat connectivity for rare, threatened or endangered species in Coastal Forest. Endemic, endangered and threatened Species found in the Coastal Forests are mostly forest dependent and will therefore benefit from the project's protection of existing native forests. Additionally, reduced deforestation in coastal forests will reduce conflict with elephants (*Loxodonta Africana*) and maintain habitat they use on a seasonal basis.
Species and habitat	Habitat: Montane Forest (Ilole Forest in Figure 6) Rare Species: *Paragalago orinus, Cephalophus spadix, Loxodonta Africana, Afrixalus uluguruensis, Buhoma procterae, Keetia davidii*

	Project Impact: The project does not promote any activities which are expected to negatively impact habitat or habitat connectivity for rare, threatened or endangered species in Montane Forest. Endemic, endangered and threatened species found in Montane Forests are mostly forest dependent and will therefore benefit from the project's protection of existing native forests. Additionally, reduced deforestation in montane forests will reduce conflict with elephants (*Loxodonta Africana*) and maintain habitat they use on a seasonal basis.
Species and habitat	Habitat: Miombo Woodland Rare Species: *Loxodonta Africana, Lycaon pictus, Panthera pardus, Panthera leo, Bucorvus leadbeateri* Project Impact: The project does promote any activities which are expected to negatively impact habitat or habitat connectivity for rare, threatened or endangered species in Miombo Woodland. The rare species found in Miombo Woodlands are generally not forest dependent. However, the project's forest protection activities will result in reduced conflict between these species and humans that would clear Miombo for farms in the baseline scenario. Predator species will benefit from increased game numbers compared to baseline since farm encroachment prevented by the project would have resulted in a reduction in habitat for their prey species. The project may work to help some villages expand their sustainable harvesting plans for Miombo forests to include new and expanded village forest reserves established with help from the project. However, the harvesting will be highly selective, based on species specific quotas based on forest surveys that monitor the age structure of each species ensuring adequate number of stems in younger age classes to replace harvested trees, less than the mean annual increment, and be less than uncontrolled harvesting that would have occurred in the baseline scenario (see section 7.1.1 of the methodological annex for more detail). Furthermore, the small-scale temporary impacts from selective harvesting will not negatively

	impact any of the rare species in Miombo since they are not forest dependent.
Areas needed for habitat connectivity	As a REDD project protecting natural forests, the project will enhance rather than harm habitat connectivity. Part of the project area in Nachingwea (see Msanjesi corridor in Figure 5) is the only remaining corridor of natural vegetation linking Msanjesi Game reserve to wilderness in Liwale district, which in turn links to the Nyerere National Park and the Selous Game Reserve.

5.1.2 High Conservation Values (CCB, B1.2)

High conservation value	Coastal Forests of Eastern Africa
Qualifying attribute	Part of a globally recognized biodiversity hotspot home to many rare and/or endemic species. Additionally, project surveys have shown that the coastal forests in the project area are home to the endangered Rondo Dwarf Galago (a primate) and endangered African Savanah Elephants. Literature reports and project area surveys found 3 endangered and 4 vulnerable plant species. Two of the endangered plant species are only known from the Noto plateau forests in the project area.
Focal area	The project village forest reserves Noto and Chitoa plateaus have the largest areas of this forest type within the project area.

High conservation value	Eastern Arc Mountain Forest
Qualifying attribute	Part of a globally recognized biodiversity hotspot home to many rare and/or endemic species. Additionally, project surveys have shown that montane forest in the project area is home to at least three IUCN endangered species - Abbot's duiker, African Savanah Elephant, and Keetia davidii (a plant), and at least 3 IUCN vulnerable species - Mountain Dwarf Galago (a primate), Uluguru Banana Frog, and Uluguru Forest Snake.
Focal area	The project Ilole forest within the village forest reserves of Malolo A, Kisanga, and Msimba is where most of this forest type is found within the project area.

High conservation value	Wildlife Corridors and Buffer Areas to Protected Areas
Qualifying attribute	The project area provides important buffer areas for species dispersal from major protected areas including Mikumi National Park, Ukwiva Forest Reserve, and Msanjesi Game Reserve. The project area also includes the only remaining corridor of undisturbed forest linking Msanjesi Game Reserve to wilderness in Liwale district which in turn links to Nyerere National Park, the Selous Game Reserve and Mikumi National Park.
Focal area	Significant project area buffer forests for Mikumi National Park include the village forest reserves in Sewe Kipera, Maharaka, Mhenda, Kitundweta, and Ihombwe. Kisanga, Malolo A, and Nyali village forest reserves provide significant buffer areas for Ukwiva Forest Reserve. Mtua, Chimbendenga, Mbondo, Majonanga, and Matekwe, villages forest reserves provide significant buffer areas for Msanjesi Game Reserve. Finally, the village forest reserves of Mbondo, Majonanga, Nakolonji, and Nahimba create a wildlife corridor of natural woodland linking Msanjesi Game Reserve to wilderness in Liwale district, which in turn links to Nyerere National Park and the Selous Game Reserve.

5.1.3 Without-project Scenario: Biodiversity (CCB, B1.3)

As noted by Richards and Panfil 2011[43], 'projections of changes to biodiversity are likely to be strongly correlated to expected changes in natural vegetation cover. For a REDD project, species that are forest-dependent can be expected to decline, if deforestation continues.'

The 'without project' scenario whereby forest land is converted to agriculture (see section 2.2 of the methodological annex) would lead to reductions in the populations of forest dependent species including the threatened and restricted range species that make the coastal forests, montane forests, and Miombo forests in the project area so globally important. The forest

[43] Richards, M. and S. N. Panfil 2011. Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 1 – Core Guidance for Project Proponents. Climate, Community & Biodiversity Alliance, Forest Trends, Fauna & Flora International, and Rainforest Alliance. Washington, DC.

dependent species would gradually go locally extinct and in the case of the two plant species endemic to the Noto Plateau, they would be at significant risk of going extinct in the wild.

The ecological processes that would result in this loss of the unique biodiversity values of the project forests are as follows.

Deforestation and forest degradation would reduce the area of habitat / potential habitat for forest dependent species. By transforming the forest into agricultural land and / or regenerating fallow, plant and animal species requiring forest habitat would be excluded. Based on a species / area correlation, the reduction in forest area would result in a loss of diversity. The impact would vary from species to species depending on species' tolerance to forest edge conditions.

Forest fragmentation would result in forest patches becoming too small to support viable populations of some plant and animal species. This isolation would be particularly damaging for those species unable to cross non-forest barriers such as the Rondo galago and would lead to a rapid or gradual population decline and eventually to local extinction.

Edge effects because of fragmentation would result in an increase as the proportion of forest edge to forest interior increased. Edge effects including greater vulnerability to fire, particularly for Ilole Forest, and pioneer species (alien and indigenous) would further reduce the area of habitat suitable for the threatened and restricted range species dependent on forests.

As forest area declined, and in the absence of any restrictions on hunting, pressure on remaining populations of larger mammals would increase. Populations of elephant, lion, leopard and antelope would be hardest hit. With less forest to migrate through, human wildlife conflicts involving elephants would probably increase temporarily before declining because of the collapse of the elephant migration.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (VCS, 3.19; CCB, B2.1)

As a VCS REDD project, the project area (see section 2.1.16 of this PD and section 1.1.2 of the methodological annex) consists entirely of natural forests at least 10 years old. Thus, no part of the project area has been cleared or drained of existing natural ecosystems within the previous 10 years.

Biodiversity element	HCV Forests important for biodiversity in the project area
Estimated change	Much more HCV forest remains in the with project scenario than in the baseline scenario.
Justification of change	There are only two project activities which could negatively impact forests; forest reserve boundary clearing and potentially introducing sustainable timber harvesting to new village forest

reserves that were created because of the project. Note that sustainable timber harvesting and charcoal harvesting were already present in project area forest reserves that existed prior to the project and that higher intensity charcoal and timber harvesting would have been present in all project forests in the baseline scenario.

Boundary clearing is an essential activity to improve awareness of forest reserve boundaries and to make forest protection easier. It is limited to a maximum of a 3 meters wide foot path at the edge of project areas where the boundaries are adjacent to human activities and the boundary is not already following other features such as a road, trail, river or stream. The clearing guidelines require the cutlines to pass around all trees with greater than 15cm diameter at breast height, limiting the impact on biomass to an insignificant amount (see section 9.1.1 of the methodological annex). Because the clearing is limited to small sections at the edge of forests and won't result in the destruction of any large trees, it isn't expected to have any negative impact on biodiversity since it won't pose a barrier to dispersal and larger trees which provide nesting sites and fruit will be unaffected.

Sustainable timber harvesting also has a very minimal impact on the project forests and is compatible with biodiversity conservation. The project would use the same guidelines being implemented by project area villages since before the start of the project[44]. This will have no impact on the project area carbon stocks (see section 7.1.1 of the methodological annex). Sustainable timber harvesting would only be introduced to Miombo forests, thereby avoiding the more biologically diverse and sensitive coastal and montane forests. The harvesting guidelines require harvesting to be highly selective and to avoid habit trees and exceptionally large trees. None of the high threatened species in the project area Miombo woodlands are forest dependent and thus none will be negatively impacted by selective Miombo tree harvesting.

[44] https://www.tfcg.org/wp-content/uploads/2020/08/Sustainable-Timber-Harvesting-Manual-2020-08-24.pdf



Therefore, the only significant change in the with project scenario compared to baseline will be a reduction in the loss of high conservation value forests that are important for biodiversity conservation. The project will monitor the change by using remote sensing to monitor the loss of high conservation value forests (see Figure 4, Figure 5, and Figure 6 for maps of HCV forests). The changes will then be compared to the projected losses of HCV forests calculated from the deforestation risk map (Figure 50). Benefits will be quantified in terms of hectares of deforestation prevented in HCV forests by project activities compared to the baseline scenario.

5.2.2 Mitigation Measures (VCS, 3.19; CCB, B2.3)

Mitigation of project activity related impacts

Boundary clearing impacts will be limited by ensuring that communities stick to the boundary clearing guidelines. This will be supervised by project extension officers who are responsible for tracking and paying for boundary clearing activities.

Sustainable timber harvesting impacts will be mitigated by ensuring that harvesting quota setting, and actual harvesting activities follow the timber harvesting manual developed by MJUMITA[44]. The Tanzania Forest Conservation Group will ensure that the quota setting is appropriate, while the village natural resource committees are responsible for ensuring that cutters adhere to harvesting rules.

Maintenance and enhancement of HCVs

The most important activity for the maintenance of biodiversity in the project area is to prevent the loss of forest to agriculture, which is the primary project activity. The project activities described in section 2.1.17 of the PD will prevent thousands of hectares from being converted to agriculture each year.

Additionally, once deforestation is under control, the project will support the community forest patrol teams to focus more of their effort to poaching prevention. This will include snare destruction and removal, warning poachers, and when appropriate, reporting poachers to the appropriate village and district authorities. Anti-poaching activities will be particularly important for maintaining the Abbot's duiker and elephant populations in the project area. Given that poaching was already widespread prior to the project, it is also possible that anti-poaching activities could lead to biodiversity enhancements in the form of increased populations of previously targeted species.

5.2.3 Net Positive Biodiversity Impacts (CCB, B2.2, GL1.4)

According to the current deforestation risk map (Figure 50), in the baseline scenario, the project area forests would contract by 219,699 ha over the next 42 years, a 67% reduction. The critical coastal forests on the Noto and Chitoa Plateaus would decrease by 12,000 ha, a loss of nearly 75%. The projected risk to Ilole forest is less significant, but conversion to agriculture is growing threat there with the first farms ever being detected in 2024. Fire on the other hand is already a significant threat to Ilole, which the project will work to mitigate through forest patrols during the dry season. Since most of the project area biodiversity is forest dependent, by maintaining forests in the project area, the project will have massive net positive impacts on biodiversity compared to the without-project land use scenario.

Maintaining forest cover is also important to help biodiversity adapt to climate change. The most certain projected climate impact for the project area is increasing temperatures. Given that the project area is already in a tropical climate, temperature increases will likely put greater physiological stress on project area's biodiversity. A simultaneous decrease in habitat caused by deforestation in without project-scenario will only increase the chance of local extinction of many of the project area species.

However, protecting forests will also help mitigate the local effects of climate change even within the remaining project forest patches in the baseline scenario by reducing local temperature extremes. Deforestation in the tropics leads to both local and regional temperature increases beyond the impact of increasing atmospheric CO_2[45]. Local temperature increases from deforestation can be far more than the long-term projected temperature increases in the worse climate change scenarios[46]. Thus, the without project scenario would greatly exacerbate the effects climate change and by protecting forest habitat, the project will keep local temperatures more stable and increase the resilience of the project area biodiversity.

5.2.4 High Conservation Values Protected (CCB, B2.4)

The project activities will increase habitat in HCV areas and reduce poaching compared to the without project scenario. As demonstrated in the table in section 5.2.1 of the PD, the project will not negatively impact any biodiversity values, including the HCVs. Thus, the net project impacts on biodiversity are positive.

5.2.5 Species Used (VCS, 3.19; CCB, B2.5, B2.6)

[45] Lawrence, D., Coe, M., Walker, W., Verchot, L., & Vandecar, K. (2022). The unseen effects of deforestation: biophysical effects on climate. *Frontiers in Forests and Global Change*, *5*, 756115.

[46] Zeppetello, L. R. V., Parsons, L. A., Spector, J. T., Naylor, R. L., Battisti, D. S., Masuda, Y. J., & Wolff, N. H. (2020). Large scale tropical deforestation drives extreme warming. *Environmental Research Letters*, *15*(8), 084012.

The project activities within the project area do not use any species as the activity is strictly protection of existing native forests. In the wider project zone, the project will promote the use of improved varieties of maize, beans, rice, cassava, sorghum, pigeon peas, cow peas, sesame and citrus trees in existing farm clearings. All these species were already farmed in the project zone prior to the project and thus are not being introduced. None are invasive.

5.2.6 Invasive Species (VCS, 3.19; CCB, B2.5)

There are no invasive species currently documented in the project area or zone.

5.2.7 GMO Exclusion (CCB, B2.7)

The project is not and will never use GMOs to produce greenhouse emissions reductions or removals.

5.2.8 Inputs Justification (VCS, 3.19; CCB, B2.8)

The project does not use any fertilizers, chemical pesticides, or biological control agents in its activities. It is possible that as part of the project's conservation agriculture training to improve crop yields in participating communities, it may promote the use of such inputs in existing farm clearings in the project zone. However, as of the writing of this PD, no such inputs have been identified. For any potentially beneficial inputs identified in the future, the project will first evaluate any potential adverse effects on the region's environment and community health. If there is a strong case for promoting inputs and any potential adverse effects can be mitigated, then the project could introduce the inputs as part of a training package that will also include training on the safe handling, storage and use the input. In general, however, conservation agriculture aims to minimize the use of chemical inputs.

5.2.9 Waste Products (VCS, 3.19; CCB, B2.9)

Project activities do not generate significant waste products.

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (CCB, B3.1) and Mitigation Measures (CCB, B3.2)

There are no anticipated negative impacts on biodiversity outside of the project zone because of project activities. Surrounding national protected areas already ban hunting and have far more resources than communities to enforce the bans, so there is little risk of hunting pressure leaking to national protected areas in response to increased anti-poaching efforts in village forest reserves. Displacement to unprotected areas outside the project zone is not considered a significant risk, as hunting pressure in the broader landscape is already largely unregulated in the absence of formal reserves. Project anti-poaching activities are therefore not expected to

materially increase hunting pressure in areas where it is already unconstrained by the baseline and where ongoing human encroachment continues to shrink wild animal habitat and populations.

5.3.2 Net Offsite Biodiversity Benefits (VCS, 3.19; CCB, B3.3)

There are no anticipated negative impacts on biodiversity outside of the project zone because of project activities.

5.4 Biodiversity Impact Monitoring

5.4.1 Biodiversity Monitoring Plan (CCB, B4.1, B4.2, GL1.4, GL3.4)

The project seeks to maintain the high conservation value portions of the project area identified in section 5.2.3 and the trigger species found within these areas. The high conservation value of forests that serve as buffer's to protected areas and wildlife corridors will be monitored through mapping changes occurring in the forest. Monitoring of changes in the forest areas where trigger species are found is an excellent proxy for forest dependent species which are not subject to hunting (e.g. the Rondo Galago which is only known to occur in a few coastal forest patches in Tanzania including the Noto and Chitoa plateaus). Species like Abbott's Duiker which are potentially targeted for hunting by local communities need to be monitored through direct observation in order to confirm their population status. Elephants and Wild Dogs are not forest dependent but do depend on having habitat and habitat connectivity where they will not come into contact and potential conflict with humans. Therefore, these species will also be through direct observation.

Table 9 Biodiversity Monitoring Plan

Biodiversity impact	Linked project activities	Monitoring indicator	Unit of measurement	Areas to Monitor	Monitoring Method	Frequency	Reporting Method	Responsibility
Maintain Habitat connectivity and Persistence in High Conservation Value Areas	Expansion, refinement and marking of VLFR boundaries, and forest patrols	Area of forest cover maintained within HCV areas	Hectares of forest cover maintained / lost	Noto, Chitoa, Ilole, protected area buffer forests and the wildlife corridor in Nachingwea	Remote sensing to map changes in forest cover caused by either fire or deforestation	Once per monitoring period	VCS / CCB Project monitoring report and summary reports for participating communities	Reterra
Maintain persistence of Rondo Dwarf Galago	Forest patrols	Number of confirmed Rondo Dwarf Galago vocalization or sitings per survey night	Detections per survey night	Noto	Nocturnal Audio surveys	Once per monitoring period	VCS / CCB Project monitoring report and summary reports for participating communities	Lindi extension agent with support from primate expert
Maintain presence of African Savanah Elephant	Expansion, refinement and marking of VLFR boundaries,	Number of elephants documented per patrol	Records per patrol	Noto, Chitoa, Ilole, protected area buffer forests and	Community survey records documenting elephant	Continuous during community patrols and analyzed	VCS / CCB Project monitoring report and summary	Forest patrol teams with support from extension agents and

within the project landscape	and forest patrols			the wildlife corridor in Nachingwea	sightings, dung observations, and incident reports	ones per Monitoring Period	reports for participating communities	VCSL operations manager
Maintain persistence of Abbott's Duiker in Ilole	Expansion, refinement and marking of VLFR boundaries, and forest patrols	Number sightings / dung deposits, recorded per patrol	Records per patrol	Ilole	Community patrol and survey records documenting sightings and dung observations	Continuous during community patrols and analyzed ones per Monitoring Period	VCS / CCB Project monitoring report and summary reports for participating communities	Forest patrol teams with support from extension agents and VCSL operations manager
Maintain persistence of Wild Dog within the Project's HCV landscapes	Expansion, refinement and marking of VLFR boundaries, and forest patrols	Number of sightings, spoor, vocalizations recorded per patrol	Records per patrol	Protected area buffer forests and the wildlife corridor in Nachingwea	Forest patrol sighting, spoor, and vocalization records	Continuous during community patrols and analyzed ones per Monitoring Period	VCS / CCB Project monitoring report and summary reports for participating communities	Forest patrol teams with support from extension agents and VCSL operations manager
Reduce poaching pressure on Abbott's duiker in Ilole	Patrols and community sensitization during MR presentation s	Number of snares; number of illegal hunting recorded per patrol	Records per patrol	Ilole	Forest patrol records for snares gathered/de stroyed and hunters encountered	Continuous during community patrols and analyzed ones per	VCS / CCB Project monitoring report and summary reports for	Forest patrol teams with support from extension agents and VCSL

						Monitoring Period	participating communities	operations manager

Deforestation Monitoring

This activity is part of project's wider support to forest patrol teams. It is carried out as multiple times per year. The current approach relies on hand digitizing observed change in Planet.com basemaps and Sentinel-2 multi-spectral imagery during green months and changes observed in Sentinel-1 imagery in the dry season. All the imagery is exported from Google Earth Engine and then loaded as x,y,z layers in QGIS making it easy to rapidly compare imagery from one time period to the next. The digitized areas of forest change are synced to the VCSL Mergin Map project and the relevant forest patrol teams are notified by their extension agent that they should sync their village specific Mergin Maps project to receive the new polygons and plan a patrol to visit the area. For biodiversity monitoring, hectares of disturbance will be reported separately for each HCV area and implications for the impact on trigger species detailed.

Nocturnal Audio Surveys

These will be done using a combination of a grid of audio recording devices and opportunistic nighttime recording using handheld devices during night patrols. The audio grid will be set up at least once per monitoring period by the Lindi Municipality project extension agent and the community members from Muungano village. Different densities and locations will be tried until detection can be performed reliably. The data from the audio grid and handheld devices will then be shared with a primate expert (Andrew Perkin) for analysis.

Forest Patrols

Forest patrol teams from the managing authorities in control of the high conservation value project areas will be trained to recognize the trigger species specified in Table 9, their vocalizations and their dung. As part of their regular patrol activities, they will opportunistically record sightings, vocalizations and dung for these species. If HCV areas are not visited as part of regular patrol activities, then Reterra will generate transects in Mergin Maps for the patrol teams to follow.

The forest patrol teams will use Mergin Maps to record species sighting, vocalizations, and dung records. The patrol record data will be used to report on the status of each directly monitored trigger species. The report will also breakdown the status by HCV area where relevant.

Forest patrol team data will also be used to monitor poaching levels of trigger species. Teams will record the numbers of snares and hunting camps encountered / destroyed. They will also record details of any hunters they encounter and report repeat offenders to village authorities. Additional transects will be generated in Mergin Maps for forest patrol teams to patrol in forests with HCV which are not frequently visited by forest patrol teams.

5.4.2 Biodiversity Monitoring Plan Dissemination (CCB, B4.3)

The monitoring plan will be publicized online as part of this project document, shared with the Designated National Focal Point and uploaded to the VERRA registry. Monitoring reports will also

be submitted to the Designated National Focal Point and uploaded to the VERRA registry for public review prior to each verification. A summary of the monitoring plan and annual report will be emailed to the executive directors and Project Focal Points of the participating Local Authorities. Additionally, the summary will be translated into Swahili, printed, and distributed to the Managing Authorities. The results of each monitoring report will be summarized, translated into Swahili, and presented at decision-making meetings of the Managing Authorities. This is a contractual obligation under Clause 14.3 of the carbon trade agreement, requiring the Project Proponent to attend annual meetings of each Managing Authorities and Managers to discuss project outcomes, present performance metrics, and report on the verified emission reductions, ensuring financial transparency.

5.5 Optional Criterion: Exceptional Biodiversity Benefits

5.5.1 High Biodiversity Conservation Priority Status (CCB, GL3.1)

The following table lists 8 endangered and 9 vulnerable IUCN Red List species documented to occur in the project area. Based on the presence of endangered species, the project meets the exceptional biodiversity criterion. Populations estimates are not available, but based on the habitat requirements of each species, it is very likely that 7 of the 9 species listed as vulnerable have at least 30 individuals within the project area. The other two vulnerable species are Lions and Leopards. Given their very large territorial requirements, it is less certain that up to 30 individuals of these species use the project area, though not impossible.

Scientific Name	Common Name	Status (IUCN 2024)	Comments	Recorded Project Forests	Location Record Source
Mammals					
Paragalago rondoensis	Rondo Dwarf Galago	Endangered	One of the top 25 most endangered primates. Known from 8 forest patches in Tanzania.	Noto, Chitoa	3,5,6
Paragalago orinus	Mountain Dwarf Galago	Vulnerable	A vulnerable primate. Ilole population likely exceeds 30 individuals based on communications with Andrew Perkin.	Ilole	2
Cephalophus spadix	Abbott's Duiker	Endangered	One of the rarest duiker species in the world.	Ilole	2

Loxodonta africana	African Savanah Elephant	Endangered	Also found in Mikumi NP and Msanjesi GR which are buffered by project area. Project areas may also serve as elephant corridors.	Noto, Chitoa, Proposed Ndonda WMA, Ilole	2,3,4
Lycaon pictus	African Wild Dog	Endangered	Also found in Mikumi NP and Msanjesi GR which are buffered by project area	Proposed Ndonda WMA	4
Panthera pardus	Leopard	Vulnerable	Also found in Mikumi NP and Msanjesi GR which are buffered by project area. Based on typical territory sizes, it is possible though unlikely that the project areas host 30 individuals.	Noto, Proposed Ndonda WMA	3,4
Panthera leo	Lion	Vulnerable	Also found in Mikumi NP and Msanjesi GR which are buffered by project area. Based on territory sizes, is probable that more than 30 individuals use the project area.	Noto, Proposed Ndonda WMA	3,4
Birds					
Bucorvus leadbeateri	Southern Ground-hornbill	Vulnerable	Also found in Mikumi NP and Msanjesi GR which are buffered by project area. Based on territory sizes, is probable that more than 30 individuals use the project area.	Noto, Chitoa, Ndonda WMA	7
Amphibians					
Afrixalus uluguruensis	Uluguru Banana Frog	Vulnerable	Based on habitat requirements, it is likely Ilole population exceeds 30 individuals.	Ilole	2
Reptiles					

Buhoma procterae	Uluguru Forest Snake	Vulnerable	Based on habitat requirements, it is likely Ilole population exceeds 30 individuals.	Ilole	2
Plants					
Leptactina papyrophloea		Endangered	Other than the project area record, only known from two locations in Tanzania and Northern Mozambique.	Kiwawa	3
Dichapetalum braunii		Vulnerable	Given the size of the suitable habitat in the project area, it is likely to exceed 30 individuals.	Ruhoma and Muungano	3
Terminalia apetala		Endangered		Ruhoma and Mkanga 1	3
Monanthotaxis trichantha		Vulnerable	Range extends to lowland Nguru and Usambara Mountains. Given the size of the suitable habitat in the project area, it is likely to exceed 30 individuals.	Ruhoma and Mkanga 1	3
Mimusops acutifolia		Vulnerable	Known from Noto and Rondo forests, Lake Lutamba, Litipo Forest Reserve, and possibly East Usambaras. Given the size of the suitable habitat in the project area, it is likely to exceed 30 individuals.	Mkombamosi and Likonde	3
Peponium leucanthum		Vulnerable	Given the size of the suitable habitat in the project area, it is likely to exceed 30 individuals.	Mkanga 1	3
Bauhinia loeseneriana		Endangered	Endemic to coastal forests in Tanzania, known from only four sites.	Mkanga 1	3

Keetia davidii		Endangered	Only known from two forests	Ilole	1

Sources:

1. Cheek, M., & Bridson, D. (2019). Three new threatened Keetia species (Rubiaceae-Vanguerieae), from the forests of the Eastern Arc Mountains, Tanzania. Gard Bull Singapore, 71, 155-169.
2. Doggart, N., C. Leonard, A. Perkin, M. Menegon and F. Rovero (2008). The vertebrate biodiversity and forest condition of the Rubeho Mountains. TFCG Technical Paper No xx. DSM, Tz. 1 - 79 pp.
3. https://www.tfcg.org/wp-content/uploads/2018/05/TFCG-Lindi-Village-Forests-Biodiversity-Survey-Report-June-2013-FINAL.pdf
4. Unpublished 2013 Management Plan for the Proposed Ndonda WMA from WWF
5. Unpublished 2024 Noto Biodiversity Survey Conducted by Andrew Perkin
6. Mittermeier, R.A., Reuter, K.E., Rylands, A.B., Jerusalinsky, L., Schwitzer, C., Strier, K.B., Ratsimbazafy, J. and Humle, T. (eds.), 2022. Primates in Peril: The World's 25 Most Endangered Primates 2022–2023. IUCN SSC Primate Specialist Group, International Primatological Society, Re:wild, Washington, DC. 163pp.
7. Seen on the edges of the project area forests in Ruhoma and Makumba villages by project staff members and in 7 project village forest reserves in Nachingwea district by members of the biomass plot assessment team. Likely uses other parts of the project area as well.

5.5.2 Trigger Species Population Trends (CCB, GL3.2, GL3.3)

Trigger species	*Paragalago rondoensis*
Population trend at start of project	Decreasing
Without-project scenario	Species is completely forest dependent and thus population would be decreasing in the without-project scenario as the forests on the Noto and Chitoa plateaus are cleared for agriculture.

With-project scenario	The species is not subjected to hunting and will benefit directly from the project's core protection activities: VLFR boundary expansion and marking, community forest patrols, and remote-sensing-based deforestation monitoring. These activities collectively prevent agricultural encroachment into the coastal forests of the Noto and Chitoa plateaus, which represent the primary threat to this species. By maintaining forest cover, the project will stabilize the population compared to the without-project scenario. Exact population estimates are difficult given the species' cryptic nocturnal behaviour and variable calling frequency, but nocturnal audio surveys conducted at least once per monitoring period will track detection rates over time.

Trigger species	*Cephalophus spadix*
Population trend at start of project	Decreasing
Without-project scenario	Species is completely forest dependent and thus the population would be decreasing in the without-project scenario as the forests on the Ilole plateaus are burned by intentional or accidental fires or cleared for agriculture. Without-project scenario populations area also affected by hunting.
With-project scenario	Based on the size of the Ilole forest and habitat requirements, it is estimated that there could be as many as 50 individuals[47]. The project maintains and enhances population status through two complementary activities: (1) VLFR boundary marking, forest patrols, and fire prevention in Ilole, which protect the forest habitat this species depends on; and (2) active anti-poaching measures including snare removal, hunter deterrence, and

[47] Doggart, N., C. Leonard, A. Perkin, M. Menegon and F. Rovero (2008). The vertebrate biodiversity and forest condition of the Rubeho Mountains. TFCG Technical Paper No xx. DSM, Tz. 1 - 79 pp.

	community sensitization during monitoring report presentations, which directly reduce the primary threat of hunting. With sustained anti-poaching effort, population numbers may increase compared to the pre-project baseline.

Trigger species	*Loxodonta africana*
Population trend at start of project	Likely Decreasing
Without-project scenario	Habitat clearing in the project area in the with-out project scenario increases conflict between humans and elephants, which in turn can lead to elephant killing and or cause elephants to move elsewhere. Current population levels everywhere in the country are lower than natural due to poaching, so habitat availability itself is probably not a population limiting factor. Elephants are also subject to increased poaching in the with-out project scenario, due to greater levels of support from communities when there are more conflicts.
With-project scenario	It is estimated that 20 to 100 elephants use the Noto-Chitoa plateaus seasonally[48]. Populations in the Miombo portions of the project area and Ilole Forest are not yet assessed. The project maintains elephant population status through VLFR boundary marking and community forest patrols, which prevent the conversion of project forests to agriculture. This reduces both direct habitat loss and human-elephant conflict — the principal driver of elephant mortality in the project area. By keeping forest corridors intact, particularly the Msanjesi-Liwale corridor in Nachingwea, the project also supports landscape-scale elephant movement between Msanjesi Game Reserve, Nyerere National Park, and the Selous ecosystem, which should contribute to population stablitiy.

[48] https://www.tfcg.org/wp-content/uploads/2018/05/TFCG-Lindi-Village-Forests-Biodiversity-Survey-Report-June-2013-FINAL.pdf

Trigger species	*Lycaon pictus*
Population trend at start of project	Likely Decreasing
Without-project scenario	In the without-project scenario, wild dog populations would decrease due to reductions in their prey caused by reductions in suitable habitat for their prey when natural areas in the project area are converted to agriculture or their prey are hunted by humans. Conflict with humans encroaching into the project area would also increase in the without-project scenario potentially leading to Wild Dogs being shot, snared, or poisoned.
With-project scenario	A recent camera trap study of the Selous-Nyerere landscape (Parsais et al., 2025) — the first systematic survey since the 1990s — estimated a wild dog density of 2.14 ± 0.45 adults and yearlings per 100 km² in Selous Game Reserve and Nyerere National Park, confirming the landscape as one of Africa's largest remaining wild dog populations. The project area in Nachingwea includes the only remaining woodland corridor linking Msanjesi Game Reserve to wilderness areas in Liwale district, which in turn connects to Nyerere National Park and the broader Selous-Niassa population. By preventing conversion of this corridor and adjacent Miombo woodland to agriculture through VLFR boundary marking and forest patrols, the project maintains the habitat connectivity on which dispersing wild dogs depend. Reduced human encroachment also lowers the risk of wild dogs being killed in response to livestock conflict. The project therefore contributes to the conservation / stabilization of a globally significant wild dog population by protecting a critical dispersal corridor at the northern edge of the Selous-Nyerere landscape.

APPENDIX 1: STAKEHOLDER DESCRIPTION TABLE

The table below provides details of the project stakeholders and links to Section 2.3.2 of the Project Description.

Stakeholder	Rights, interest, and overall relevance to the project
Communities or Village General Assembly	Description: There are 54 villages owning Village Land Forest Reserves (VLFRs) which are already working on the project. There is potential for expansion into more than 50 additional villages by the second quarter of 2025. The project has collected baseline information from 54 villages, which consist of 277 sub-villages. These sub-villages are home to 36,827 households, with an average household size of 4 people and a ratio of at least 91 males for every 100 females. About 62% of the sub-villages, comprising 54% of the households and 47% of the population, are located adjacent to the Village Land Forest Reserves (the project area) which constitute the leakage belt. It is estimated that at least 48% of the population consists of adults who make up the working force of the villages and are eligible to attend village general meetings to make decisions, as outlined in sections 24 and 103 of the Local Government Act (District Authorities), CAP 287. Rights and Interests: They Own, manage, and benefit from Village Land Forest Reserves (VLFRs). This means they protect the VLFRs; obtain a reasonable share of revenues from carbon credits; influence decisions regarding forest management and carbon credit revenues; and support the development of social services in the village. They have rights to Free Prior Informed Consent about establishment and management of VLFRs and entering carbon contract agreements. They have rights to make decisions related to VLFRs and revenues generated through sustainable forest enterprises. Overall Relevance: Communities are crucial as they directly own, manage and benefit from the VLFRs, making their participation vital for the project's success and sustainability. Through the village general assembly, they make decisions on allocation of land for forestry, and approve the plan, budgets, elect the

	village forest management institutions, endorse policies and regulations related to the VLFR and benefit sharing. Besides, they are responsible for deforestation caused by slash-and-burn agriculture.
Village Councils (VC)	Description: There are Village Councils in each village, comprising 15 to 25 popularly elected members serving five-year terms. The councils are established as corporate bodies in accordance with sections 25 and 26, making decisions through quarterly meetings in accordance with sections 104, 105, and 106 of the Local Government Act (District Authorities), CAP 287. Rights: As corporate bodies with perpetual succession, official seals, and legal capabilities, they are the custodians of the village land and the VLFR as outlined in section 32 of the Forest Act CAP 323 of the laws of Tanzania, thus entitled to enter contracts after obtaining approval of the Village General Assembly. They have rights to manage and oversee VLFRs per National Forest Act regulations, approved forest management plans, and bylaws. They also share rights with communities to FPIC for VLFR establishment and management and to enter carbon contract agreements. Interests: Their main interest is to generate revenues for financing community development projects. They are also interested in reducing deforestation and forest degradation. Overall Relevance: Village Councils are responsible for the oversight and management of VLFRs, protecting the VLFR boundaries, avoiding deforestation and forest degradation, and ensuring that community development and conservation goals are met, which aligns with the project's objectives.
Village Natural Resource Committees (VNRCs)	Description: The Village Natural Resources Committee (VNRC) is established in accordance with Section 33 (1)(d) and (2) of the Forest Act CAP 323 of the laws of Tanzania, and the national guidelines for community-based forest management (2007). The formation of a VNRC is an inclusive process, starting with a Sub-village meeting and concluding in the Village General Assembly. At least 33% of the members must be women. Their responsibilities are outlined in the Forest Management Plan (FMP). Rights: VNRCs have the right to collect and retain their share of forest revenue for implementing forest management activities as outlined in the FMPs.

	Interests: VNRCs are committed to the protection of forests as stipulated by the Forest Management Plans (FMPs) and bylaws. Overall Relevance: VNRCs form the patrol team that implements VCSL's patrol technology. They are responsible for the day-to-day activities aimed at reducing deforestation and forest degradation.
Local Government Authorities (LGAs)	Description: LGAs are statutory bodies established under section 12 of the Local Government (District Authorities) Act, Cap. 287 of the Laws of Tanzania R.E. 2020. Their day-to-day operational activities are executed by the Council Management Team (CMT), and policy, strategies, annual, and quarterly plans are reviewed and approved by the popularly elected councilors. Usually, councilors are elected from each ward, which is made up of a village. The project is currently operating in 7 LGAs: Lindi Municipality, Mikumi Township, Nachingwea, Mtama, Morogoro, Mvomero, and Kilosa District Councils. It has potential to expand to 8 other LGAs: Kilwa, Ruangwa, Tunduru, Liwale, Rufiji, Ulanga, Malinyi, and Kilolo District Councils in 2025. Rights: Like Village Councils, LGAs are corporate bodies with perpetual succession, official seals, and legal capabilities. LGAs have rights to own and manage Local Authorities Forest Reserves (LAFRs) in accordance with section 4(b) of the Forest Act, CAP 323 of the laws of Tanzania. Interests: LGAs are interested in resolving conflicts, reducing deforestation and forest degradation in both VLFRs and LAFRs, obtaining a share of carbon revenues, and promoting community development. Overall Relevance: LGAs have the power to approve village bylaws necessary for VLFR management. They serve as technical advisors, liaisons, mediators, coordinators, and watchdogs to the village councils. Local Authorities play a pivotal role in managing forest reserves and ensuring sustainable development, making them essential partners in project implementation and regulatory compliance.
Authorized Associations and other Community-Based Organizations (CBOs)	Description: CBOs are registered under the Societies Act, Cap. 337 R.E. 2020 of the laws of Tanzania, and their operations are guided by their constitution. Once established, they become corporate bodies capable of owning properties. Section 4(d) of the Forest Act CAP 323 of the laws of Tanzania, entitles them to own Community Forest Reserves. According to section 16 of the Forest Act, they can sign Joint

	Management Agreements (JMAs) with other forest owners. The proponent has facilitated the establishment of five CBOs: NONA, KUMIRU, MTENA, JUHIMI, and JUHIMM-Msimba, which will sign JMAs with Local Authority Forest Reserves to manage forests historically under villages. Rights: CBOs have the right to receive benefits from the forest reserves they manage jointly with LGAs. They also share rights with communities and VCs to FPIC for VLFR establishment and management and to enter carbon contract agreements. According to Section 32 (7) of the Wildlife Conservation Act CAP 283, Authorized Association (AA), Managing Wildlife Management Areas (WMAs) have the right to negotiate and sign agreement with potential investors, provided that, representatives of the Director and District Council are involved in the negotiation and signing of such agreements. Interests: To sign JMAs with LGAs and receive equivalent benefits to what village councils receive from the VLFRs. AA are interested in reducing deforestation and benefiting from carbon trade. Overall Relevance: CBOs are key to promoting community empowerment and sustainable management practices, aligning with the project's goals of enhancing local capacities and ensuring resource sustainability. Like communities, they are responsible for deforestation caused by slash-and-burn agriculture.
Regional Secretariats (RS) and President's Office Regional Administration and Local Governments (PO-RALG)	Description: Regional Secretariats (RS) and President's Office Regional Administration and Local Governments (PO-RALG) are national institutions responsible for policies and coordination of LGAs and Village Governments. Rights: They have the rights to oversee regional and national development and environmental management. Interests: They are interested in regional and national economic growth and compliance with carbon trading regulations and related policies. They also seek a share of project revenues to support regional administration and national efforts on carbon trade. Overall Relevance: RS and PO-RALG coordinate with the proponent and managing authorities to ensure regulatory compliance and regional and national cooperation.

Vice President's Office, Division of Environment (VPO-DoE)	Description: The VPO-DoE serves as the Designated National Authority or National Focal Point. The role is detailed in regulations 9 of the Environmental Management (Control and Management of Carbon Trading) Regulations, 2022 (GN 636 published on 28/10/2022), and regulation 7 of the Environmental Management (Control and Management of Carbon Trading) (Amendment) Regulations, 2023 (GN 721 published on 6/10/2023). Rights: They have the right to regulate and oversee carbon trading activities at the national level. Interests: They are interested in national environmental sustainability and compliance with national regulations and international agreements. They also seek a share of carbon credit revenues to support regulatory oversight and national environmental initiatives. Overall Relevance: The VPO-DoE's regulatory oversight ensures that national environmental standards are met, supporting the project's objectives.
Tanzania Forest Conservation Group (TFCG) and other conservation-based NGOs	Description: TFCG and other NGOs are active in community-based forest management and biodiversity conservation. They have a vested interest in sustainable practices and community welfare. Rights: Conservation-based employment opportunities and sustainable resource management. Interests: TFCG is a project stakeholder with involvement in operational activities and uses the project to raise funds for sustainable conservation of high biodiversity hotspots in the Eastern Arc Mountain and Coastal Forests. Overall Relevance: TFCG's expertise and involvement in forest management and conservation are invaluable to the project's implementation and success, ensuring sustainable practices and community welfare.
University of Dar es Salaam	Description: The University of Dar es Salaam (UDSM), Tanzania, is a public university incorporated as per the Universities Act no 7 of 2005 and the University of Dar es Salaam Charter of 2007) located in Mlimani area of Dar es Salaam Tanzania. UDSM possesses a 172-hectare forest block situated within the historic Nandambi Village Land Forest Reserve (VLFR), which is potential for REDD project.

	Rights: UDSM has a right to protect its forest block and enter carbon trade contracts as a Managing Authority. Interests: UDSM is interested in developing practical expertise in climate change mitigation and adaptation that aligns with efforts in biodiversity conservation and community development. VCSL's REDD+ project areas, encompassing those in and around the UDSM block in Nandambi, present an ideal platform as an outreach learning zone to achieve these objectives. Overall Relevance: UDSM has signed a Memorandum of Understanding (MoU) with TFCG, to collaborate in areas of climate change mitigation and adaptation programs. VCSL and UDSM are ideal institutions to formally establish a strategic and long-term collaboration to jointly undertake activities of common interest. These activities include: (a) To provide educational platforms on climate change mitigation and adaptation for UDSM community within the VCSL's REDD+ project area. (b) To facilitate VCSL to engage with Nandambi community in Lindi to mitigate deforestation and forest degradation for generating sellable carbon within UDSM block in Nandambi and beyond.
Forest User Groups	Description: The project will significantly benefit forest users, including those reliant on non-timber forest products (NTFPs) and wood buyers. By promoting sustainable forest management and conservation practices, the project aims to enhance the livelihoods of these stakeholders through improved access to forest resources and increased income from sustainable harvesting. Rights: Sustainable utilization of forest resources; wood harvesting limited to 1% of standing biomass annually. Interests: Ensuring sustainable utilization is not compromised. Overall Relevance: These groups are essential for promoting sustainable practices, preserving ecosystems, and ensuring the long-term availability of forest products while reducing deforestation and forest degradation.

APPENDIX 2: PROJECT ACTIVITIES AND THEORY OF CHANGE TABLE

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (short term)	Outcomes (medium term)	Impacts (long term)	
Adjusting and re-marking Village Land & Local Authority Forest Reserve Boundaries.	Map of the project area with visible physical boundaries.	Reduced encroachments in the project area	Reduced deforestation and forest degradation in the project area.	The adjusted and marked forest boundaries are easier to protect for reducing deforestation and forest degradation in the project area.
Facilitate review of Forest Management Plans (FMPs).	Approved Forest Management Plans.	Structured and regulated conservation practices.	Reduced deforestation and forest degradation.	The FMPs are the guiding tools for ensuring inclusive managing the forests in the project area.
Facilitate revive and/ or restructuring of Managing Authorities	Functional formal Forest Managing Authorities	Inclusive governance of community forest resources	Reduced deforestation and forest degradation in the project area.	Functional Managing Authorities operate inclusively to protect the forests in the project area.
Develop and implement cloud-based forest patrol technology	New deforestation identified and patrolled	New forest clearing and illegal logging prevented	Reduced deforestation and forest degradation in the project area.	The technology enhances proactive patrols, effectively deterring deforestation and forest degradation over the long term

Facilitate expansion or creation of new Community Forest Reserves	Area under community- based formal forestry increase	Better regulated forestry within the project's reference region	Reduced deforestation and forest degradation	Forests that would have been legally cleared within the project's geographical reference area will be placed under a formal management regime.
Facilitate gazettement of Village Land Forest Reserves through boundary mapping, preparation of required documentation, and support to village, district, and ministerial approval processes.	Gazettement application documents for Village Land Forest Reserves prepared and submitted to the Ministry of Natural Resources and Tourism.	The Ministry of Natural Resources and Tourism publishes gazettement orders for all Village Land Forest Reserves under the project in the Government Gazette.	Strengthened long-term protection and tenure security of Village Land Forest Reserves under the project.	Legal gazettement reduces the risk of non-permanence of carbon stocks associated with issued Verified Carbon Units (VCUs).
Baselines surveys, training Managing Authorities on carbon trade, Meetings to obtain consents on carbon trade.	Free Prior Informed Consent obtained (carbon trade contract signed	Functional carbon trade agreements the project area	Generation of carbon revenues is essential for both forestry and improved well-being in the project area.	Consents are essential for registering the project, implements actions that reduces deforestation and forest degradations, and generate and sale carbon credits.
Facilitate development and implementation of community benefit-sharing regulations.	Community benefit-sharing regulations developed, approved, and operational.	Transparent and equitable allocation of carbon revenues in the project area.	Improved community well-being and strengthened local governance of forest resources.	Transparent and equitable benefit-sharing strengthens community incentives and trust, enhancing participation in forest protection and contributing to reduced deforestation and forest degradation.

Mobilize and support village governance structures to allocate a community-determined proportion of carbon revenues to priority social services, including education, water facilities, health services, and other related development priorities, and to follow up on implementation of the prioritized investments.	Village benefit-sharing committees, village councils, and village assemblies allocate carbon revenues and implement investments in priority social services, including education, safely managed domestic water facilities, health services, and other related community priorities.	Improved access to and quality of education, water, health, and related social services in the project area, contributing to improved community well-being and resilience.	Present and future generations in the project area attain improved access to education, health, water, and livelihood opportunities, contributing to improved community well-being, reduced dependence on slash-and-burn agriculture, and reduced pressure on forest resources.	Improved social services, community well-being, livelihood resilience, and non-forest-clearing-based economic activities contribute to reduced pressure on forest resources and support long-term forest conservation objectives.
Provide smallholder farm extension services through training meetings, farm visits, and demonstration plots, and facilitate farmers' use of carbon revenues to access appropriate agricultural inputs.	Small holder farmers trained, demonstration plots established, and appropriate agricultural inputs accessed through use of carbon revenues.	Increased adoption of improved agronomic practices among smallholder farmers within the project area.	Higher farm productivity per unit area, improved resilience, and enhanced well-being of communities in the project area.	Higher farm productivity reduces the need for agricultural expansion into forest areas, contributing to reduced deforestation and forest degradation.
Monitoring, Evaluation, Learning, Validation,	Monitoring reports, carbon stock assessments,	Verified emission reductions and issued and sold in carbon	Sustainable financing for forest conservation and	Monitoring, validation, verification, and marketing ensure the credibility of reported emission reductions, enable

Verification and Marketing	validation and verification reports completed; Verified Emission Reductions (VERs) issued and marketed to potential buyers.	markets, generating carbon revenues for participating communities.	community development contributes to long-term reductions in deforestation and forest degradation while improving community well-being.	issuance and sale of carbon credits, and generate the financial resources needed to sustain forest conservation and community development activities.

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	Corruptions in the use of money from carbon trade	Mismanagement of funds intended for community development projects, may lead to non-preforming project and disincentivize communities to protect the forests	Implement effective monitoring and audit systems in collaboration with local authorities and promote a dividend model in benefit-sharing mechanisms to ensure transparency and accountability.
	Corruption in relation to forest reserve management	Misallocation of resources, illegal logging, and exploitation of forest resources, undermining conservation efforts, diminishing biodiversity	Implement effective monitoring and audit systems with local authorities and adopt a dividend model in benefit-sharing mechanisms to improve accountability.

Risks to stakeholder participation	Low attendance of communities in the decision-making meetings	Undermines representation, legitimacy, and trust, leading to ineffective policies in addressing deforestation and fostering community development	Promote a dividend model in benefit sharing to incentivize participation in meetings, encourage sub-village level meetings to increase accessibility for majority participation.
Working conditions	Injuries during patrols (e.g., from dangerous animals).	VNRCs may hesitate to participate in patrols, potentially leading to increased deforestation	Enhance safety protocols during patrols, provide comprehensive training on wildlife encounter management, equip patrols with necessary safety gear and communication devices.
	VNRC turn over	can erode the collective skills and knowledge provided. The loss of the knowledge base for implementing the project's philosophy may undermine the consistency of forest patrols, jeopardizing efforts to protect the forests from degradation and deforestation risks.	The patrol technology is easily transferable, and the project plans to train community youth as potential future VNRC members, ensuring continuity during elections. Mechanisms for VNRC election which ensure at least half of the existing members are re-elected in the new committee have been incorporated in the revised Forest management Plans.
Safety of women and girls	Potential gender-based violence especially where patrols are conducted far from village center.	Demotivates the participation of women and girls in forest patrols, undermining inclusivity in forestry and related project activities.	implement gender-sensitive patrol protocols and establish secure reporting mechanisms for any incidents. Promote girl-centered educational priorities within benefit-sharing models

Safety of minority and marginalized groups, including children	Elderly individuals living within or near the forest may face humiliation from patrol teams or be excluded from decision-making processes.	Undermine community trust, disrupt local knowledge sharing, and lead to ineffective forest management, ultimately harming ecosystem health and biodiversity.	Promote educational and community-based patrol actions over police-based approaches, while avoiding evictions and humiliation of those living in or near the forest.
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	No risk identified	The project doesn't involve activities that generate or discharge pollutants	
Discrimination	Women, youth, and the elderly, might be excluded from decision-making on benefits, or participation in forest patrols and boundary clearing activities.	Inequitable access to resources and participation in forest management, weaken community cohesion, ineffective conservation efforts,	Promote gender-sensitive policies and practices, conduct regular gender equality monitoring, collect data on grievances and provide feedback for continuous improvement. Promote youth and girl-centered educational priorities within benefit-sharing models
Sexual harassment	Possibility of women and girls being disproportionately involved in forest patrols, leading to unwanted advances, verbal abuse, physical intimidation, and	Diminished participation and trust among women girls, ultimately undermining community engagement in conservation efforts and jeopardizing efforts to reduce deforestation and forest degradation	Implement comprehensive training on gender sensitivity and harassment prevention for all participants, establish a clear reporting mechanism for incidents, and create a safe and supportive environment that encourages the participation of women and girls in all project activities, Promote girl-centered

	coercion by other participants or individuals in remote areas.		educational priorities within benefit-sharing models
Equal pay for equal work	Potential for elite capture in forest patrol and boundary clearing jobs	Unequal distribution of benefits, undermining community trust and engagement	Directly engage with beneficiaries in project implementation instead of relying on intermediaries and ensure transparency in hiring and payment processes.
Gender equity in labor and work	Shortage of women employed by the project	Shortage of diverse perspectives in decision-making and perpetuate gender inequalities within the community.	Implement targeted recruitment strategies for women, create supportive environments that encourage women's participation and career advancement, provide training and leadership opportunities.
Forced labor[1]	No risk identified	The project's actions do not trigger forced labor.	
Child labor	No risk identified	The project's actions do not trigger child labor.	
Human trafficking	No risk identified	The project's actions do not trigger human trafficking	
Recognition of, respect of, and promotion of the rights to IPs, LCs and customary rights holders	Disputes over village boundaries.	Delay or hinder forest patrols, allowing some farmers to continue clearing land in adjacent villages.	Promote compliance to Land use plans and promote Joint Management Agreements where parties involved in a conflict fail to agree on ownership of a certain part of potential project area.

	Legislative changes that may restrict direct access to REDD revenues for communities.	Demoralize communities from continuing with conservation efforts, hence potentially trigger deforestation and forest degradation.	Ensure compliance with national legislation and provide communities with clear facts and figures to analyze, understand, and protect their forest rights and responsibilities.
	Municipalization of regions containing Village Land Forest Reserves.	Demoralize communities from continuing with conservation efforts, hence potentially trigger deforestation and forest degradation.	Promote land titling for communities, establish community-based organizations, advocate for joint management agreements for local authority forest reserves to empower local communities.
Preserving and protecting cultural heritage	Internal conflicts within communities regarding forest access rights.	Illegal and unsuitable use of forest products may occur among communities that feel their rights have been undermined by project activities, leading to further degradation of forest resources and create tensions between the project and residents.	Promote sustainable use by limiting annual biomass harvesting to a maximum of 1% and ensure that the Forest Management Plans recognize and provide for the customary rights of local communities.
Protecting and preserving property rights, customary rights, or protecting legal or customary tenure/access rights to territories, property, and resources,	Private sectors purchase forested land within project areas for conversion to other land uses.	Continued deforestation and forest degradation leading to habitat destruction, loss of biodiversity, and disruption of ecosystem services, loss of tenure security	Raise community awareness about incorporating into forest reserves the forested areas designated for other land uses that align with conservation efforts, and promote community ownership and land titling

including collective and/or conflicting rights			
	Forest clearing by residents of adjacent villages.	Continued deforestation and forest degradation leading to habitat destruction, loss of biodiversity, and disruption of ecosystem services, loss of tenure security	Facilitate conflict resolution processes and develop Joint Management Agreements that incentivizes adjacent communities to actively protect the forests.
Impacts on biodiversity and ecosystems	Increased human-wildlife conflict due to expanded forest cover and enhancement efforts.	Threaten community safety and agricultural efforts through crop destruction.	Provide training to farmers on techniques to prevent crop losses from wild animals and encourage the adoption of more permanent agricultural practices in fields located further from the forests.
	Boundary clearing	Loss of forest cover	Avoid intensive boundary clearing, refrain from cutting trees with a DBH larger than 15 cm
Soil degradation and soil erosion	Boundary clearing may trigger soil erosion and soil degradation in the cleared areas.	Increase in edge effects along forest boundaries, lead to spread of invasive species compromising ecosystem stability	Avoid intensive burning during boundary clearing, use mulch to prevent soil erosion, refrain from cutting trees with a DBH larger than 15 cm, and combine boundary clearing with early burning to reduce fuel loads and prevent severe fires
Water consumption and stress	No risk identified	The project activities are not directly related to consumption of water	

Habitats (and areas needed for habitat connectivity) for rare, threatened, and endangered species	Residents living within or near forests can inadvertently cause fires, or intentionally cause forest clearing	Deforestation and disrupt habitat connectivity, threatening biodiversity, and ecosystem stability	Provide regular training to residents living in and around the forest and implement effective forest condition monitoring through cloud-based platforms for real-time tracking, helping to deter any potential intentions of forest clearing.
Areas needed for habitat connectivity	Boundary clearing may disconnect ecosystems or habitats.	Fragmentation disrupts wildlife movement, impairs ecological processes, isolates species populations, and weakens ecosystem resilience and functionality.	Avoid intensive boundary clearing, refrain from cutting trees with a diameter at breast height (DBH) larger than 15 cm and combine boundary clearing with early burning to reduce fuel loads and mitigate the risk of severe fires.
Invasive species	No risk identified	The project is not going to implement action which trigger prevalence of invasive species	
Ecosystem conversion	No risk identified	The project is not going to implement action which trigger prevalence of invasive species	
[Additional risk identified]	REDD revenues may fall short of community expectations.	Unmet expectations can reduce motivation to engage in conservation efforts, leading to diminished actions against deforestation and degradation.	Implement effective market monitoring and negotiation skills, ensure compliance with standards to produce higher-quality carbon credits that attract premium prices, and promote diversification of forest enterprises to

			provide communities with income from non-carbon sources.

[1] 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.

APPENDIX 4: COMMERCIALLY SENSITIVE INFORMATION

Use the table below to describe the commercially sensitive information included in the project description to be excluded in the public version.

Section	Information	Justification

APPENDIX 5: PROJECT AREA POLYGON DETAILS

fid	Region	District	Owner	Forest Manager	Polygon Area (ha)	Status	Area of intersected forested pixels (ha)	Government Notice No.
44	Morogoro	Kilosa	Chabima	Chabima	718.48	Gazetted Village Land Forest Reserve	662.75	GN 688
45	Morogoro	Kilosa	Chabima	Chabima	4516.12	Gazetted Village Land Forest Reserve	4241.81	GN 688
60	Morogoro	Kilosa	Chabima	Chabima	4349.17	Gazetted Village Land Forest Reserve	3539.19	GN 688
156	Morogoro	Kilosa	Chabima	Chabima	28.15	Declared Village Land Forest Reserve	27.13	
157	Morogoro	Kilosa	Chabima	Chabima	14.08	Declared Village Land Forest Reserve	13.81	
158	Morogoro	Kilosa	Chabima	Chabima	107.27	Declared Village Land Forest Reserve	106.69	
159	Morogoro	Kilosa	Chabima	Chabima	287.3	Declared Village Land Forest Reserve	281.13	
160	Morogoro	Kilosa	Chabima	Chabima	98.89	Declared Village Land Forest Reserve	98.56	
161	Morogoro	Kilosa	Chabima	Chabima	34.62	Declared Village Land Forest Reserve	34.63	
162	Morogoro	Kilosa	Chabima	Chabima	2.9	Declared Village Land Forest Reserve	2.88	

163	Morogoro	Kilosa	Chabima	Chabima	0.81	Declared Village Land Forest Reserve	0.75	
500	Morogoro	Kilosa	Chabima	Chabima	33.77	Declared Village Land Forest Reserve	33.69	
501	Morogoro	Kilosa	Chabima	Chabima	51.09	Declared Village Land Forest Reserve	50.75	
502	Morogoro	Kilosa	Chabima	Chabima	63.87	Declared Village Land Forest Reserve	62.38	
503	Morogoro	Kilosa	Chabima	Chabima	119.06	Declared Village Land Forest Reserve	118.25	
504	Morogoro	Kilosa	Chabima	Chabima	2.11	Declared Village Land Forest Reserve	2.19	
505	Morogoro	Kilosa	Chabima	Chabima	7.83	Declared Village Land Forest Reserve	7.56	
506	Morogoro	Kilosa	Chabima	Chabima	26.48	Declared Village Land Forest Reserve	26.38	
507	Morogoro	Kilosa	Chabima	Chabima	17.99	Declared Village Land Forest Reserve	18.13	
168	Lindi	Nachingwea	Chimbendenga	Chimbendenga	5123.04	Declared Village Land Forest Reserve	4931.31	
248	Lindi	Nachingwea	Chimbendenga	Chimbendenga	362.34	Declared Village Land Forest Reserve	360.13	
249	Lindi	Nachingwea	Chimbendenga	Chimbendenga	410.73	Declared Village Land Forest Reserve	378.50	
250	Lindi	Nachingwea	Chimbendenga	Chimbendenga	164.52	Declared Village Land Forest Reserve	164.06	

251	Lindi	Nachingwea	Chimbendenga	Chimbendenga	46.54	Declared Village Land Forest Reserve	46.56	
244	Lindi	Mtama	Chiwerere	Chiwerere	1005.14	Declared Village Land Forest Reserve	970.06	
245	Lindi	Mtama	Chiwerere	Chiwerere	13.8	Declared Village Land Forest Reserve	13.94	
32	Morogoro	Morogoro	Diguzi	Diguzi	2458.23	Gazetted Village Land Forest Reserve	2335.13	GN 688
33	Morogoro	Morogoro	Diguzi	Diguzi	53.19	Gazetted Village Land Forest Reserve	51.63	GN 688
289	Morogoro	Morogoro	Diguzi	Diguzi	3207.01	Declared Village Land Forest Reserve	3151.88	
83	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	2382.05	Gazetted Village Land Forest Reserve	2225.81	GN 688
85	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	9.61	Gazetted Village Land Forest Reserve	8.31	GN 688
125	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	0.86	Declared Village Land Forest Reserve	0.63	
126	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	33.46	Declared Village Land Forest Reserve	32.69	
127	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	4.4	Declared Village Land Forest Reserve	4.31	
128	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	13.26	Declared Village Land Forest Reserve	13.31	
133	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	7.42	Declared Village Land Forest Reserve	7.38	

134	Morogoro	Kilosa	Dodoma Isanga	Dodoma Isanga	7.67	Declared Village Land Forest Reserve	7.63	
79	Morogoro	Kilosa	Gongwe	Gongwe	530.59	Gazetted Village Land Forest Reserve	514.00	GN 688
82	Morogoro	Kilosa	Gongwe	Gongwe	2098.79	Gazetted Village Land Forest Reserve	1876.75	GN 688
217	Morogoro	Kilosa	Gongwe	Gongwe	2.85	Declared Village Land Forest Reserve	2.50	
218	Morogoro	Kilosa	Gongwe	Gongwe	31.55	Declared Village Land Forest Reserve	26.19	
219	Morogoro	Kilosa	Gongwe	Gongwe	6.11	Declared Village Land Forest Reserve	5.56	
220	Morogoro	Kilosa	Gongwe	Gongwe	9.59	Declared Village Land Forest Reserve	9.63	
221	Morogoro	Kilosa	Gongwe	Gongwe	2.93	Declared Village Land Forest Reserve	2.75	
222	Morogoro	Kilosa	Gongwe	Gongwe	12.32	Declared Village Land Forest Reserve	12.19	
223	Morogoro	Kilosa	Gongwe	Gongwe	3	Declared Village Land Forest Reserve	3.13	
224	Morogoro	Kilosa	Gongwe	Gongwe	4.8	Declared Village Land Forest Reserve	4.94	
225	Morogoro	Kilosa	Gongwe	Gongwe	1.32	Declared Village Land Forest Reserve	1.31	
24	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	1045.15	Gazetted Village Land Forest Reserve	879.81	GN 688

28	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	4715.81	Gazetted Village Land Forest Reserve	3955.31	GN 688
89	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	363.28	Gazetted Village Land Forest Reserve	252.75	GN 688
91	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	64.04	Gazetted Village Land Forest Reserve	46.25	GN 688
92	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	31.61	Gazetted Village Land Forest Reserve	25.25	GN 688
94	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	183.47	Gazetted Village Land Forest Reserve	106.25	GN 688
98	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	102.43	Gazetted Village Land Forest Reserve	93.44	GN 688
145	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	51.12	CBO Managed Township Land	50.19	
146	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	45.75	CBO Managed Township Land	44.44	
147	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	33.41	CBO Managed Township Land	33.44	
148	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	4.79	CBO Managed Township Land	1.69	
257	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	15.36	CBO Managed Township Land	15.19	
258	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	1.04	CBO Managed Township Land	0.94	
259	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	14.19	CBO Managed Township Land	11.75	
260	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	0.68	CBO Managed Township Land	0.31	
266	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	31.29	CBO Managed Township Land	25.00	
267	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	1.54	CBO Managed Township Land	1.50	

268	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	88.32	CBO Managed Township Land	87.69	
269	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	6.07	CBO Managed Township Land	6.00	
270	Morogoro	Kilosa	Mikumi Township	JUHIMI - CBO	8.31	CBO Managed Township Land	8.06	
25	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	4564.86	Gazetted Village Land Forest Reserve	4034.88	GN 688
26	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	11772.9	Gazetted Village Land Forest Reserve	10906.13	GN 688
27	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	7128.83	Gazetted Village Land Forest Reserve	6050.50	GN 688
58	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	454.56	Gazetted Village Land Forest Reserve	148.38	GN 688
59	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	1127.48	Gazetted Village Land Forest Reserve	908.88	GN 688
96	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	24.92	Gazetted Village Land Forest Reserve	22.63	GN 688
164	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	66.72	CBO Managed Township Land	65.19	
165	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	66.27	CBO Managed Township Land	61.06	
254	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	1571.05	CBO Managed Township Land	1517.25	
255	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	143.23	CBO Managed Township Land	113.44	
256	Morogoro	Kilosa	Mikumi Township	JUHIMM - CBO	71.01	CBO Managed Township Land	57.94	
108	Lindi	Nachingwea	Kiegei A	Kiegei A	1826.35	Declared Village Land Forest Reserve	1493.00	

166	Lindi	Nachingwea	Kiegei B	Kiegei B	18320.67	Declared Village Land Forest Reserve	17775.81	
84	Morogoro	Mvomero	Kihondo	Kihondo	2186	Gazetted Village Land Forest Reserve	1982.25	GN 688
118	Morogoro	Mvomero	Kihondo	Kihondo	1.97	Declared Village Land Forest Reserve	1.88	
119	Morogoro	Mvomero	Kihondo	Kihondo	4.04	Declared Village Land Forest Reserve	4.13	
120	Morogoro	Mvomero	Kihondo	Kihondo	4.37	Declared Village Land Forest Reserve	4.19	
121	Morogoro	Mvomero	Kihondo	Kihondo	0.94	Declared Village Land Forest Reserve	0.88	
122	Morogoro	Mvomero	Kihondo	Kihondo	4.49	Declared Village Land Forest Reserve	4.50	
123	Morogoro	Mvomero	Kihondo	Kihondo	2.83	Declared Village Land Forest Reserve	2.94	
124	Morogoro	Mvomero	Kihondo	Kihondo	3.25	Declared Village Land Forest Reserve	2.81	
170	Lindi	Nachingwea	Kilimarondo	Kilimarondo	3613.83	Declared Village Land Forest Reserve	3515.38	
247	Lindi	Nachingwea	Kilimarondo	Kilimarondo	2044.86	Declared Village Land Forest Reserve	1993.00	
298	Lindi	Nachingwea	Kilimarondo	Kilimarondo	9965.51	Declared Village Land Forest Reserve	9140.88	
55	Lindi	Lindi Municipality	Kinyope	Kinyope	1331.61	Gazetted Village Land Forest Reserve	1165.31	GN 487

459	Lindi	Lindi Municipality	Kinyope	Kinyope	207.31	Declared Village Land Forest Reserve	199.94	
460	Lindi	Lindi Municipality	Kinyope	Kinyope	1.75	Declared Village Land Forest Reserve	1.38	
461	Lindi	Lindi Municipality	Kinyope	Kinyope	3.63	Declared Village Land Forest Reserve	3.63	
462	Lindi	Lindi Municipality	Kinyope	Kinyope	27.54	Declared Village Land Forest Reserve	22.06	
463	Lindi	Lindi Municipality	Kinyope	Kinyope	14.64	Declared Village Land Forest Reserve	14.00	
469	Lindi		Kinyope	Kinyope	3390.06	Village Land	906.75	
93	Morogoro	Kilosa	Kisanga	Kisanga	93.89	Gazetted Village Land Forest Reserve	50.44	GN 688
95	Morogoro	Kilosa	Kisanga	Kisanga	9826.96	Gazetted Village Land Forest Reserve	7297.00	GN 688
135	Morogoro	Kilosa	Kisanga	Kisanga	37.78	Declared Village Land Forest Reserve	37.88	
136	Morogoro	Kilosa	Kisanga	Kisanga	18.94	Declared Village Land Forest Reserve	18.19	
137	Morogoro	Kilosa	Kisanga	Kisanga	6.73	Declared Village Land Forest Reserve	3.94	
138	Morogoro	Kilosa	Kisanga	Kisanga	3.54	Declared Village Land Forest Reserve	1.50	
139	Morogoro	Kilosa	Kisanga	Kisanga	64.85	Declared Village Land Forest Reserve	40.81	
140	Morogoro	Kilosa	Kisanga	Kisanga	5.76	Declared Village Land Forest Reserve	4.88	

141	Morogoro	Kilosa	Kisanga	Kisanga	2.78	Declared Village Land Forest Reserve	2.75	
142	Morogoro	Kilosa	Kisanga	Kisanga	7.35	Declared Village Land Forest Reserve	7.25	
143	Morogoro	Kilosa	Kisanga	Kisanga	19.57	Declared Village Land Forest Reserve	18.06	
144	Morogoro	Kilosa	Kisanga	Kisanga	145.78	Declared Village Land Forest Reserve	139.06	
4	Morogoro	Kilosa	Kisongwe	Kisongwe	849.01	Gazetted Village Land Forest Reserve	793.44	GN 688
74	Morogoro	Kilosa	Kisongwe	Kisongwe	2501.84	Gazetted Village Land Forest Reserve	2391.44	GN 688
75	Morogoro	Kilosa	Kisongwe	Kisongwe	4.17	Gazetted Village Land Forest Reserve	4.00	GN 688
192	Morogoro	Kilosa	Kisongwe	Kisongwe	29.27	Declared Village Land Forest Reserve	29.44	
193	Morogoro	Kilosa	Kisongwe	Kisongwe	37.98	Declared Village Land Forest Reserve	38.06	
194	Morogoro	Kilosa	Kisongwe	Kisongwe	54.41	Declared Village Land Forest Reserve	54.56	
195	Morogoro	Kilosa	Kisongwe	Kisongwe	20.21	Declared Village Land Forest Reserve	19.88	
196	Morogoro	Kilosa	Kisongwe	Kisongwe	5.83	Declared Village Land Forest Reserve	5.69	
197	Morogoro	Kilosa	Kisongwe	Kisongwe	2.18	Declared Village Land Forest Reserve	2.25	

198	Morogoro	Kilosa	Kisongwe	Kisongwe	0.9	Declared Village Land Forest Reserve	0.94	
199	Morogoro	Kilosa	Kisongwe	Kisongwe	5.39	Declared Village Land Forest Reserve	5.44	
200	Morogoro	Kilosa	Kisongwe	Kisongwe	0.64	Declared Village Land Forest Reserve	0.56	
310	Morogoro	Kilosa	Kisongwe	Kisongwe	1.31	Declared Village Land Forest Reserve	1.25	
311	Morogoro	Kilosa	Kisongwe	Kisongwe	4.91	Declared Village Land Forest Reserve	4.69	
312	Morogoro	Kilosa	Kisongwe	Kisongwe	8.78	Declared Village Land Forest Reserve	8.88	
313	Morogoro	Kilosa	Kisongwe	Kisongwe	1.25	Declared Village Land Forest Reserve	1.06	
314	Morogoro	Kilosa	Kisongwe	Kisongwe	7.67	Declared Village Land Forest Reserve	7.75	
315	Morogoro	Kilosa	Kisongwe	Kisongwe	1.55	Declared Village Land Forest Reserve	1.50	
316	Morogoro	Kilosa	Kisongwe	Kisongwe	2.26	Declared Village Land Forest Reserve	2.00	
62	Morogoro	Kilosa	Kitundweta	Kitundweta	192.84	Gazetted Village Land Forest Reserve	176.69	GN 688
65	Morogoro	Kilosa	Kitundweta	Kitundweta	115.05	Gazetted Village Land Forest Reserve	103.00	GN 688
66	Morogoro	Kilosa	Kitundweta	Kitundweta	67.46	Gazetted Village Land Forest Reserve	58.56	GN 688

67	Morogoro	Kilosa	Kitundweta	Kitundweta	61.45	Gazetted Village Land Forest Reserve	59.88	GN 688
68	Morogoro	Kilosa	Kitundweta	Kitundweta	61.69	Gazetted Village Land Forest Reserve	52.75	GN 688
69	Morogoro	Kilosa	Kitundweta	Kitundweta	1526.33	Gazetted Village Land Forest Reserve	1487.69	GN 688
90	Morogoro	Kilosa	Kitundweta	Kitundweta	68.63	Gazetted Village Land Forest Reserve	28.06	GN 688
172	Morogoro	Kilosa	Kitundweta	Kitundweta	227.37	Declared Village Land Forest Reserve	223.31	
173	Morogoro	Kilosa	Kitundweta	Kitundweta	5.24	Declared Village Land Forest Reserve	5.13	
174	Morogoro	Kilosa	Kitundweta	Kitundweta	10.44	Declared Village Land Forest Reserve	10.19	
175	Morogoro	Kilosa	Kitundweta	Kitundweta	1.54	Declared Village Land Forest Reserve	1.13	
176	Morogoro	Kilosa	Kitundweta	Kitundweta	2.23	Declared Village Land Forest Reserve	2.06	
177	Morogoro	Kilosa	Kitundweta	Kitundweta	2.13	Declared Village Land Forest Reserve	0.44	
303	Morogoro	district	Kitundweta	Kitundweta	17.04	Declared Village Land Forest Reserve	17.00	
49	Lindi	Lindi Municipality	Kiwawa	Kiwawa	5337.19	Gazetted Village Land Forest Reserve	5124.00	GN 487
50	Lindi	Lindi Municipality	Kiwawa	Kiwawa	2811.36	Gazetted Village Land Forest Reserve	2377.00	GN 487

387	Lindi	Lindi Municipality	Kiwawa	Kiwawa	25.03	Declared Village Land Forest Reserve	24.13	
388	Lindi	Lindi Municipality	Kiwawa	Kiwawa	15.74	Declared Village Land Forest Reserve	15.38	
389	Lindi	Lindi Municipality	Kiwawa	Kiwawa	172.3	Declared Village Land Forest Reserve	171.75	
390	Lindi	Lindi Municipality	Kiwawa	Kiwawa	210.68	Declared Village Land Forest Reserve	204.56	
391	Lindi	Lindi Municipality	Kiwawa	Kiwawa	0.7	Declared Village Land Forest Reserve	0.75	
392	Lindi	Lindi Municipality	Kiwawa	Kiwawa	4.45	Declared Village Land Forest Reserve	4.38	
393	Lindi	Lindi Municipality	Kiwawa	Kiwawa	13.53	Declared Village Land Forest Reserve	12.56	
394	Lindi	Lindi Municipality	Kiwawa	Kiwawa	1.09	Declared Village Land Forest Reserve	0.50	
395	Lindi	Lindi Municipality	Kiwawa	Kiwawa	15.99	Declared Village Land Forest Reserve	13.06	
396	Lindi	Lindi Municipality	Kiwawa	Kiwawa	0.86	Declared Village Land Forest Reserve	0.88	
397	Lindi	Lindi Municipality	Kiwawa	Kiwawa	7.97	Declared Village Land Forest Reserve	5.13	
398	Lindi	Lindi Municipality	Kiwawa	Kiwawa	73.92	Declared Village Land Forest Reserve	69.38	
399	Lindi	Lindi Municipality	Kiwawa	Kiwawa	26.86	Declared Village Land Forest Reserve	26.50	

400	Lindi	Lindi Municipality	Kiwawa	Kiwawa	3.76	Declared Village Land Forest Reserve	3.44	
401	Lindi	Lindi Municipality	Kiwawa	Kiwawa	15.15	Declared Village Land Forest Reserve	14.56	
402	Lindi	Lindi Municipality	Kiwawa	Kiwawa	24.25	Declared Village Land Forest Reserve	24.31	
403	Lindi	Lindi Municipality	Kiwawa	Kiwawa	1.5	Declared Village Land Forest Reserve	0.31	
404	Lindi	Lindi Municipality	Kiwawa	Kiwawa	8.83	Declared Village Land Forest Reserve	7.50	
405	Lindi	Lindi Municipality	Kiwawa	Kiwawa	5	Declared Village Land Forest Reserve	2.88	
406	Lindi	Lindi Municipality	Kiwawa	Kiwawa	221	Declared Village Land Forest Reserve	216.25	
407	Lindi	Lindi Municipality	Kiwawa	Kiwawa	1.07	Declared Village Land Forest Reserve	0.94	
408	Lindi	Lindi Municipality	Kiwawa	Kiwawa	84.61	Declared Village Land Forest Reserve	83.31	
409	Lindi	Lindi Municipality	Kiwawa	Kiwawa	16.4	Declared Village Land Forest Reserve	16.25	
497	Lindi		Kiwawa	Kiwawa	5788.96	Village Land	3248.75	
498	Lindi		Kiwawa	Kiwawa	266.46	Village Land	187.38	
499	Lindi		Kiwawa	Kiwawa	2.89	Village Land	2.88	
511	Lindi	Lindi Municipality	Lindi Municipality	KUMIRU - CBO	452.75	CBO Managed General Municipal Land	397.25	
101	Lindi	Mtama	Liganga	Liganga	4542.19	Declared Village Land Forest Reserve	4361.50	

47	Lindi	Lindi Municipality	Likwaya	Likwaya	615.23	Gazetted Village Land Forest Reserve	565.00	GN 487
435	Lindi	Lindi Municipality	Likwaya	Likwaya	3.5	Declared Village Land Forest Reserve	3.56	
436	Lindi	Lindi Municipality	Likwaya	Likwaya	4.72	Declared Village Land Forest Reserve	4.56	
437	Lindi	Lindi Municipality	Likwaya	Likwaya	0.64	Declared Village Land Forest Reserve	0.25	
438	Lindi	Lindi Municipality	Likwaya	Likwaya	0.63	Declared Village Land Forest Reserve	0.88	
496	Lindi		Likwaya	Likwaya	2556.63	Village Land	790.81	
410	Lindi	Lindi Municipality	Lindi Municipality	Lindi Municipality	1179.92	Gazetted Local Authority Land Forest Reserve	1172.25	GN 377
479	Lindi		Lindi Municipality	Lindi Municipality	3323.26	General Municipal Land	1555.88	
480	Lindi		Lindi Municipality	Lindi Municipality	34.2	General Municipal Land	9.06	
495	Lindi		Lindi Municipality	Lindi Municipality	4519.76	General Municipal Land	1688.50	
109	Lindi	Nachingwea	Lionja B	Lionja B	681.11	Declared Village Land Forest Reserve	677.44	
102	Lindi	Nachingwea	Lipuyu	Lipuyu	1207.92	Declared Village Land Forest Reserve	751.00	
5	Morogoro	Morogoro	Lulongwe	Lulongwe	58.36	Gazetted Village Land Forest Reserve	53.81	GN 688
6	Morogoro	Morogoro	Lulongwe	Lulongwe	2683.04	Gazetted Village Land Forest Reserve	2597.00	GN 688

304	Morogoro	Morogoro	Lulongwe	Lulongwe	284.75	Declared Village Land Forest Reserve	271.81	
305	Morogoro	Morogoro	Lulongwe	Lulongwe	504.8	Declared Village Land Forest Reserve	503.56	
306	Morogoro	Morogoro	Lulongwe	Lulongwe	11.24	Declared Village Land Forest Reserve	11.19	
307	Morogoro	Morogoro	Lulongwe	Lulongwe	30.05	Declared Village Land Forest Reserve	30.13	
308	Morogoro	Morogoro	Lulongwe	Lulongwe	71.52	Declared Village Land Forest Reserve	65.94	
309	Morogoro	Morogoro	Lulongwe	Lulongwe	5.68	Declared Village Land Forest Reserve	5.75	
22	Morogoro	Mvomero	Maharaka	Maharaka	4713.91	Gazetted Village Land Forest Reserve	3370.44	GN 688
78	Morogoro	Mvomero	Maharaka	Maharaka	446.66	Gazetted Village Land Forest Reserve	185.56	GN 688
301	Lindi	Nachingwea	Majonanga	Majonanga	9292.33	Declared Village Land Forest Reserve	9127.56	
353	Lindi	Nachingwea	Majonanga	Majonanga	3240.11	Declared Village Land Forest Reserve	3215.00	
12	Lindi	Lindi Municipality	Makumba	Makumba	1585.95	Gazetted Village Land Forest Reserve	1302.88	GN 487
13	Lindi	Lindi Municipality	Makumba	Makumba	232.64	Gazetted Village Land Forest Reserve	163.94	GN 487
17	Lindi	Lindi Municipality	Makumba	Makumba	304.17	Gazetted Village Land Forest Reserve	246.31	GN 487

18	Lindi	Lindi Municipality	Makumba	Makumba	183.58	Gazetted Village Land Forest Reserve	173.13	GN 487
38	Lindi		Makumba	Makumba	4.22	Village Land	0.06	
39	Lindi		Makumba	Makumba	14.31	Village Land	2.19	
40	Lindi		Makumba	Makumba	21.44	Village Land	3.19	
41	Lindi		Makumba	Makumba	156	Village Land	44.94	
354	Lindi	Lindi Municipality	Makumba	Makumba	1.77	Declared Village Land Forest Reserve	1.13	
355	Lindi	Lindi Municipality	Makumba	Makumba	14.24	Declared Village Land Forest Reserve	6.50	
356	Lindi	Lindi Municipality	Makumba	Makumba	0.94	Declared Village Land Forest Reserve	0.81	
357	Lindi	Lindi Municipality	Makumba	Makumba	0.94	Declared Village Land Forest Reserve	0.69	
358	Lindi	Lindi Municipality	Makumba	Makumba	5.27	Declared Village Land Forest Reserve	4.81	
359	Lindi	Lindi Municipality	Makumba	Makumba	1	Declared Village Land Forest Reserve	0.31	
360	Lindi	Lindi Municipality	Makumba	Makumba	19.98	Declared Village Land Forest Reserve	13.56	
361	Lindi	Lindi Municipality	Makumba	Makumba	28.57	Declared Village Land Forest Reserve	28.31	
362	Lindi	Lindi Municipality	Makumba	Makumba	1.39	Declared Village Land Forest Reserve	1.44	
363	Lindi	Lindi Municipality	Makumba	Makumba	1.82	Declared Village Land Forest Reserve	1.69	

364	Lindi	Lindi Municipality	Makumba	Makumba	3.63	Declared Village Land Forest Reserve	3.75	
485	Lindi		Makumba	Makumba	82.22	Village Land	25.13	
486	Lindi		Makumba	Makumba	1755.51	Village Land	728.25	
155	Morogoro	Kilosa	Malolo A	Malolo A	27216.02	Declared Village Land Forest Reserve	21965.50	
107	Lindi	Nachingwea	Matekwe	Matekwe	7629	Declared Village Land Forest Reserve	7166.81	
296	Lindi	Nachingwea	Matekwe	Matekwe	4.03	Declared Village Land Forest Reserve	4.06	
297	Lindi	Nachingwea	Matekwe	Matekwe	216.14	Declared Village Land Forest Reserve	214.56	
299	Lindi	Nachingwea	Matekwe	Matekwe	5512.47	Declared Village Land Forest Reserve	5362.81	
302	Lindi	Nachingwea	Matekwe	Matekwe	736.93	Declared Village Land Forest Reserve	547.75	
9	Morogoro	Morogoro	Matuli	Matuli	28.6	Gazetted Village Land Forest Reserve	24.50	GN 688
10	Morogoro	Morogoro	Matuli	Matuli	1022.76	Gazetted Village Land Forest Reserve	940.81	GN 688
11	Morogoro	Morogoro	Matuli	Matuli	135.2	Gazetted Village Land Forest Reserve	83.88	GN 688
31	Morogoro	Morogoro	Matuli	Matuli	380.62	Gazetted Village Land Forest Reserve	260.56	GN 688
321	Morogoro	Morogoro	Matuli	Matuli	175.54	Declared Village Land Forest Reserve	171.50	

322	Morogoro	Morogoro	Matuli	Matuli	1.68	Declared Village Land Forest Reserve	1.44	
323	Morogoro	Morogoro	Matuli	Matuli	107	Declared Village Land Forest Reserve	94.81	
61	Morogoro	Kilosa	Mbamba	Mbamba	807.27	Gazetted Village Land Forest Reserve	799.44	GN 688
63	Morogoro	Kilosa	Mbamba	Mbamba	656.58	Gazetted Village Land Forest Reserve	586.50	GN 688
64	Morogoro	Kilosa	Mbamba	Mbamba	40.94	Gazetted Village Land Forest Reserve	41.06	GN 688
178	Morogoro	Kilosa	Mbamba	Mbamba	5.51	Declared Village Land Forest Reserve	5.69	
179	Morogoro	Kilosa	Mbamba	Mbamba	9.42	Declared Village Land Forest Reserve	9.44	
180	Morogoro	Kilosa	Mbamba	Mbamba	2.44	Declared Village Land Forest Reserve	2.44	
181	Morogoro	Kilosa	Mbamba	Mbamba	5.13	Declared Village Land Forest Reserve	5.25	
182	Morogoro	Kilosa	Mbamba	Mbamba	4.52	Declared Village Land Forest Reserve	4.38	
183	Morogoro	Kilosa	Mbamba	Mbamba	2.48	Declared Village Land Forest Reserve	2.56	
184	Morogoro	Kilosa	Mbamba	Mbamba	8.14	Declared Village Land Forest Reserve	8.13	
185	Morogoro	Kilosa	Mbamba	Mbamba	12.67	Declared Village Land Forest Reserve	12.75	

186	Morogoro	Kilosa	Mbamba	Mbamba	23.68	Declared Village Land Forest Reserve	23.75	
187	Morogoro	Kilosa	Mbamba	Mbamba	2.52	Declared Village Land Forest Reserve	2.50	
188	Morogoro	Kilosa	Mbamba	Mbamba	40.85	Declared Village Land Forest Reserve	20.94	
189	Morogoro	Kilosa	Mbamba	Mbamba	27.09	Declared Village Land Forest Reserve	26.88	
190	Morogoro	Kilosa	Mbamba	Mbamba	21.48	Declared Village Land Forest Reserve	21.56	
191	Morogoro	Kilosa	Mbamba	Mbamba	8.14	Declared Village Land Forest Reserve	0.00	
167	Lindi	Nachingwea	Mbondo	Mbondo	2831.08	Declared Village Land Forest Reserve	2720.13	
300	Lindi	Nachingwea	Mbondo	Mbondo	6784.74	Declared Village Land Forest Reserve	6628.75	
1	Morogoro	Kilosa	Mhenda	Mhenda	14.77	Gazetted Village Land Forest Reserve	14.56	GN 688
23	Morogoro	Kilosa	Mhenda	Mhenda	5669.25	Gazetted Village Land Forest Reserve	5230.63	GN 688
97	Morogoro	Kilosa	Mhenda	Mhenda	37.99	Gazetted Village Land Forest Reserve	37.81	GN 688
149	Morogoro	Kilosa	Mhenda	Mhenda	103.61	Declared Village Land Forest Reserve	101.56	
150	Morogoro	Kilosa	Mhenda	Mhenda	51.85	Declared Village Land Forest Reserve	51.19	

230	Morogoro	Kilosa	Mhenda	Mhenda	653.93	Declared Village Land Forest Reserve	647.81	
231	Morogoro	Kilosa	Mhenda	Mhenda	31.22	Declared Village Land Forest Reserve	27.94	
232	Morogoro	Kilosa	Mhenda	Mhenda	38.01	Declared Village Land Forest Reserve	38.06	
261	Morogoro	Kilosa	Mhenda	Mhenda	12.72	Declared Village Land Forest Reserve	11.88	
262	Morogoro	Kilosa	Mhenda	Mhenda	1.6	Declared Village Land Forest Reserve	1.63	
263	Morogoro	Kilosa	Mhenda	Mhenda	1.65	Declared Village Land Forest Reserve	1.81	
264	Morogoro	Kilosa	Mhenda	Mhenda	18.09	Declared Village Land Forest Reserve	17.94	
99	Lindi	Mtama	Mihima	Mihima	3129.9	Gazetted Village Land Forest Reserve	3093.06	GN 487
151	Lindi	Mtama	Mihima	Mihima	7171.35	Declared Village Land Forest Reserve	7059.50	
153	Lindi	Mtama	Mihima	Mihima	139.97	Declared Village Land Forest Reserve	137.06	
154	Lindi	Mtama	Mihima	Mihima	27.83	Declared Village Land Forest Reserve	26.81	
42	Lindi		Milola Magharibi	Milola Magharibi	125.27	Gazetted Village Land Forest Reserve	104.81	GN 487
43	Lindi		Milola Magharibi	Milola Magharibi	1042.68	Gazetted Village Land Forest Reserve	960.00	GN 487

57	Lindi		Milola Magharibi	Milola Magharibi	135.16	Gazetted Village Land Forest Reserve	131.31	GN 487
441	Lindi		Milola Magharibi	Milola Magharibi	24.11	Declared Village Land Forest Reserve	22.44	
472	Lindi		Milola Magharibi	Milola Magharibi	2104.3	Village Land	1195.88	
473	Lindi		Milola Magharibi	Milola Magharibi	3.14	Village Land	3.19	
474	Lindi		Milola Magharibi	Milola Magharibi	27.18	Village Land	12.00	
475	Lindi		Milola Magharibi	Milola Magharibi	2.08	Village Land	1.25	
476	Lindi		Milola Magharibi	Milola Magharibi	1.86	Village Land	1.88	
490	Lindi		Milola Magharibi	Milola Magharibi	14.63	Declared Village Land Forest Reserve	7.19	
491	Lindi		Milola Magharibi	Milola Magharibi	27.58	Declared Village Land Forest Reserve	20.50	
492	Lindi		Milola Magharibi	Milola Magharibi	59.2	Declared Village Land Forest Reserve	58.75	
508	Lindi		Milola Magharibi	Milola Magharibi	419.16	Declared Village Land Forest Reserve	315.75	
509	Lindi		Milola Magharibi	Milola Magharibi	2.46	Declared Village Land Forest Reserve	2.19	
510	Lindi		Milola Magharibi	Milola Magharibi	2.81	Declared Village Land Forest Reserve	2.88	
7	Morogoro	Mvomero	Misengele	Misengele	395.26	Gazetted Village Land Forest Reserve	391.31	GN 688
16	Morogoro	Mvomero	Misengele	Misengele	3810.07	Gazetted Village Land Forest Reserve	3726.44	GN 688

229	Morogoro	Mvomero	Misengele	Misengele	57.85	Declared Village Land Forest Reserve	54.13	
343	Morogoro	Mvomero	Misengele	Misengele	1.88	Declared Village Land Forest Reserve	1.88	
344	Morogoro	Mvomero	Misengele	Misengele	7.42	Declared Village Land Forest Reserve	7.38	
345	Morogoro	Mvomero	Misengele	Misengele	4.85	Declared Village Land Forest Reserve	4.69	
346	Morogoro	Mvomero	Misengele	Misengele	4.72	Declared Village Land Forest Reserve	4.69	
347	Morogoro	Mvomero	Misengele	Misengele	18.19	Declared Village Land Forest Reserve	18.19	
348	Morogoro	Mvomero	Misengele	Misengele	36.65	Declared Village Land Forest Reserve	35.19	
349	Morogoro	Mvomero	Misengele	Misengele	151.82	Declared Village Land Forest Reserve	151.19	
350	Morogoro	Mvomero	Misengele	Misengele	29.46	Declared Village Land Forest Reserve	28.88	
351	Morogoro	Mvomero	Misengele	Misengele	115.31	Declared Village Land Forest Reserve	111.69	
352	Morogoro	Mvomero	Misengele	Misengele	3.16	Declared Village Land Forest Reserve	3.44	
46	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	3110.71	Gazetted Village Land Forest Reserve	3005.13	GN 487
48	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	101.85	Gazetted Village Land Forest Reserve	88.56	GN 487

411	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	4.7	Declared Village Land Forest Reserve	3.88	
412	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	3.68	Declared Village Land Forest Reserve	3.31	
413	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	2.02	Declared Village Land Forest Reserve	2.19	
414	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.7	Declared Village Land Forest Reserve	0.75	
415	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.97	Declared Village Land Forest Reserve	0.81	
416	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	6.95	Declared Village Land Forest Reserve	7.00	
417	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	12.02	Declared Village Land Forest Reserve	11.88	
418	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.81	Declared Village Land Forest Reserve	0.75	
419	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	3.28	Declared Village Land Forest Reserve	3.38	
420	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	9.79	Declared Village Land Forest Reserve	9.81	
421	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.74	Declared Village Land Forest Reserve	0.75	
422	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	12.19	Declared Village Land Forest Reserve	12.19	
423	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	1.01	Declared Village Land Forest Reserve	0.75	

424	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.96	Declared Village Land Forest Reserve	0.38	
425	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	28.97	Declared Village Land Forest Reserve	29.00	
426	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	6.66	Declared Village Land Forest Reserve	6.13	
427	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	1.4	Declared Village Land Forest Reserve	1.50	
428	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.95	Declared Village Land Forest Reserve	0.94	
429	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	1.03	Declared Village Land Forest Reserve	0.69	
430	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	3.91	Declared Village Land Forest Reserve	3.75	
431	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	1.01	Declared Village Land Forest Reserve	0.94	
432	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	1.74	Declared Village Land Forest Reserve	1.69	
433	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	2.97	Declared Village Land Forest Reserve	3.13	
434	Lindi	Lindi Municipality	Mkombamosi	Mkombamosi	0.87	Declared Village Land Forest Reserve	0.81	
470	Lindi		Mkombamosi	Mkombamosi	2807.21	Village Land	1090.13	
471	Lindi		Mkombamosi	Mkombamosi	349.51	Village Land	274.31	
29	Morogoro	Morogoro	Mlilingwa	Mlilingwa	448.35	Gazetted Village Land Forest Reserve	392.31	GN 688

30	Morogoro	Morogoro	Mlilingwa	Mlilingwa	986.66	Gazetted Village Land Forest Reserve	957.81	GN 688
35	Morogoro	Morogoro	Mlilingwa	Mlilingwa	148.76	Gazetted Village Land Forest Reserve	125.50	GN 688
36	Morogoro	Morogoro	Mlilingwa	Mlilingwa	970.82	Gazetted Village Land Forest Reserve	968.06	GN 688
275	Morogoro	Morogoro	Mlilingwa	Mlilingwa	40.46	Declared Village Land Forest Reserve	38.13	
276	Morogoro	Morogoro	Mlilingwa	Mlilingwa	443.9	Declared Village Land Forest Reserve	437.06	
277	Morogoro	Morogoro	Mlilingwa	Mlilingwa	20.06	Declared Village Land Forest Reserve	19.81	
278	Morogoro	Morogoro	Mlilingwa	Mlilingwa	8	Declared Village Land Forest Reserve	7.94	
279	Morogoro	Morogoro	Mlilingwa	Mlilingwa	3.02	Declared Village Land Forest Reserve	3.00	
280	Morogoro	Morogoro	Mlilingwa	Mlilingwa	11.53	Declared Village Land Forest Reserve	11.56	
281	Morogoro	Morogoro	Mlilingwa	Mlilingwa	31.74	Declared Village Land Forest Reserve	31.81	
282	Morogoro	Morogoro	Mlilingwa	Mlilingwa	52.06	Declared Village Land Forest Reserve	49.25	
283	Morogoro	Morogoro	Mlilingwa	Mlilingwa	6.39	Declared Village Land Forest Reserve	6.31	
284	Morogoro	Morogoro	Mlilingwa	Mlilingwa	9.81	Declared Village Land Forest Reserve	8.88	

285	Morogoro	Morogoro	Mlilingwa	Mlilingwa	3.37	Declared Village Land Forest Reserve	3.44	
286	Morogoro	Morogoro	Mlilingwa	Mlilingwa	2.77	Declared Village Land Forest Reserve	2.75	
287	Morogoro	Morogoro	Mlilingwa	Mlilingwa	1695.69	Declared Village Land Forest Reserve	1559.81	
288	Morogoro	Morogoro	Mlilingwa	Mlilingwa	111.24	Declared Village Land Forest Reserve	111.50	
439	Lindi	Lindi Municipality	Mputwa	Mputwa	363.89	Declared Village Land Forest Reserve	318.38	
440	Lindi	Lindi Municipality	Mputwa	Mputwa	3244	Declared Village Land Forest Reserve	2869.69	
76	Morogoro	Mvomero	Msongozi	Msongozi	2916.45	Gazetted Village Land Forest Reserve	2565.19	GN 688
77	Morogoro	Mvomero	Msongozi	Msongozi	1561.96	Gazetted Village Land Forest Reserve	808.56	GN 688
81	Morogoro	Mvomero	Msongozi	Msongozi	198.12	Gazetted Village Land Forest Reserve	83.94	GN 688
226	Morogoro	Mvomero	Msongozi	Msongozi	257.78	Declared Village Land Forest Reserve	234.06	
227	Morogoro	Mvomero	Msongozi	Msongozi	16.6	Declared Village Land Forest Reserve	14.00	
228	Morogoro	Mvomero	Msongozi	Msongozi	20.84	Declared Village Land Forest Reserve	15.56	
464	Lindi	Lindi Municipality	Lindi Municipality	MTENA - CBO	601.33	CBO Managed General Municipal Land	538.63	

171	Lindi	Nachingwea	Mtua	Mtua	3587.36	Declared Village Land Forest Reserve	3519.00	
14	Lindi	Lindi Municipality	Muungano	Muungano	493.03	Gazetted Village Land Forest Reserve	445.00	GN 487
15	Lindi	Lindi Municipality	Muungano	Muungano	3285.01	Gazetted Village Land Forest Reserve	3118.94	GN 487
365	Lindi	Lindi Municipality	Muungano	Muungano	178.59	Declared Village Land Forest Reserve	111.50	
366	Lindi	Lindi Municipality	Muungano	Muungano	396.64	Declared Village Land Forest Reserve	275.13	
367	Lindi	Lindi Municipality	Muungano	Muungano	0.83	Declared Village Land Forest Reserve	1.00	
368	Lindi	Lindi Municipality	Muungano	Muungano	0.86	Declared Village Land Forest Reserve	0.75	
369	Lindi	Lindi Municipality	Muungano	Muungano	0.51	Declared Village Land Forest Reserve	0.50	
370	Lindi	Lindi Municipality	Muungano	Muungano	4.97	Declared Village Land Forest Reserve	4.94	
371	Lindi	Lindi Municipality	Muungano	Muungano	72.69	Declared Village Land Forest Reserve	72.56	
372	Lindi	Lindi Municipality	Muungano	Muungano	24.97	Declared Village Land Forest Reserve	23.88	
373	Lindi	Lindi Municipality	Muungano	Muungano	10.73	Declared Village Land Forest Reserve	10.75	
374	Lindi	Lindi Municipality	Muungano	Muungano	24.49	Declared Village Land Forest Reserve	24.25	

375	Lindi	Lindi Municipality	Muungano	Muungano	2.8	Declared Village Land Forest Reserve	2.38	
376	Lindi	Lindi Municipality	Muungano	Muungano	1.37	Declared Village Land Forest Reserve	1.38	
377	Lindi	Lindi Municipality	Muungano	Muungano	86.57	Declared Village Land Forest Reserve	72.50	
378	Lindi	Lindi Municipality	Muungano	Muungano	16.14	Declared Village Land Forest Reserve	16.19	
379	Lindi	Lindi Municipality	Muungano	Muungano	10.7	Declared Village Land Forest Reserve	10.63	
380	Lindi	Lindi Municipality	Muungano	Muungano	10.66	Declared Village Land Forest Reserve	6.13	
381	Lindi	Lindi Municipality	Muungano	Muungano	2.89	Declared Village Land Forest Reserve	2.63	
382	Lindi	Lindi Municipality	Muungano	Muungano	158.05	Declared Village Land Forest Reserve	134.88	
383	Lindi	Lindi Municipality	Muungano	Muungano	3.62	Declared Village Land Forest Reserve	3.63	
384	Lindi	Lindi Municipality	Muungano	Muungano	0.97	Declared Village Land Forest Reserve	1.19	
385	Lindi	Lindi Municipality	Muungano	Muungano	4.91	Declared Village Land Forest Reserve	4.56	
386	Lindi	Lindi Municipality	Muungano	Muungano	6.99	Declared Village Land Forest Reserve	5.94	
493	Lindi		Muungano	Muungano	5057.06	Village Land	2477.88	
494	Lindi		Muungano	Muungano	632.15	Village Land	389.94	

317	Lindi	Mtama	Muungano II	Muungano II	78.66	Declared Village Land Forest Reserve	75.63	
318	Lindi	Mtama	Muungano II	Muungano II	167.54	Declared Village Land Forest Reserve	164.69	
319	Lindi	Mtama	Muungano II	Muungano II	129.55	Declared Village Land Forest Reserve	128.94	
320	Lindi	Mtama	Muungano II	Muungano II	31.61	Declared Village Land Forest Reserve	30.44	
103	Lindi	Nachingwea	Nahimba	Nahimba	4780.49	Declared Village Land Forest Reserve	4620.38	
246	Lindi	Nachingwea	Nakalonji	Nakalonji	3002.14	Declared Village Land Forest Reserve	2793.63	
106	Lindi	Nachingwea	Namatunu	Namatunu	11433.48	Declared Village Land Forest Reserve	10817.56	
169	Lindi	Nachingwea	Namatunu	Namatunu	4152.68	Declared Village Land Forest Reserve	3964.81	
265	Lindi	Nachingwea	Namatunu	Namatunu	285.7	Declared Village Land Forest Reserve	222.25	
487	Lindi		Namkongo	Namkongo	581.09	Declared Village Land Forest Reserve	574.44	
488	Lindi		Namkongo	Namkongo	604.42	Declared Village Land Forest Reserve	604.56	
489	Lindi		Namkongo	Namkongo	4728.91	Declared Village Land Forest Reserve	4265.00	
104	Lindi	Nachingwea	Nanjihi	Nanjihi	4668.55	Declared Village Land Forest Reserve	4511.44	

252	Lindi	Nachingwea	Nanjihi	Nanjihi	44.04	Declared Village Land Forest Reserve	44.06	
253	Lindi	Nachingwea	Nanjihi	Nanjihi	27.5	Declared Village Land Forest Reserve	27.38	
152	Lindi	Mtama	Nndawa	Nndawa	2860.58	Declared Village Land Forest Reserve	2598.00	
105	Lindi	Nachingwea	Ngunichile	Ngunichile	1724.1	Declared Village Land Forest Reserve	1696.31	
465	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	54.73	CBO Managed General Municipal Land	52.31	
466	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	101.03	CBO Managed General Municipal Land	100.81	
467	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	1067.5	CBO Managed General Municipal Land	1023.81	
468	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	1530.56	CBO Managed General Municipal Land	1494.31	
481	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	6.86	CBO Managed General Municipal Land	6.81	
482	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	191.02	CBO Managed General Municipal Land	189.50	
483	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	20.35	CBO Managed General Municipal Land	20.00	
484	Lindi	Lindi Municipality	Lindi Municipality	NONA - CBO	77.84	CBO Managed General Municipal Land	77.75	
512	Lindi	Lindi Municipality	USDM	NONA - CBO	173.32	CBO Managed General Municipal Land	172.19	

100	Lindi	Mtama	Ntene	Ntene	5398.65	Declared Village Land Forest Reserve	4811.75	
88	Morogoro	Kilosa	Nyali	Nyali	5636.2	Gazetted Village Land Forest Reserve	5359.94	GN 688
110	Morogoro	Kilosa	Nyali	Nyali	58.6	Declared Village Land Forest Reserve	57.63	
111	Morogoro	Kilosa	Nyali	Nyali	11.17	Declared Village Land Forest Reserve	11.31	
112	Morogoro	Kilosa	Nyali	Nyali	3.42	Declared Village Land Forest Reserve	3.38	
113	Morogoro	Kilosa	Nyali	Nyali	2.84	Declared Village Land Forest Reserve	2.75	
114	Morogoro	Kilosa	Nyali	Nyali	5.77	Declared Village Land Forest Reserve	5.56	
115	Morogoro	Kilosa	Nyali	Nyali	0.57	Declared Village Land Forest Reserve	0.56	
116	Morogoro	Kilosa	Nyali	Nyali	3.13	Declared Village Land Forest Reserve	3.19	
117	Morogoro	Kilosa	Nyali	Nyali	12.18	Declared Village Land Forest Reserve	5.50	
86	Morogoro	Kilosa	Rudewa	Rudewa	2271.67	Gazetted Village Land Forest Reserve	2158.69	GN 688
87	Morogoro	Kilosa	Rudewa	Rudewa	0.87	Gazetted Village Land Forest Reserve	0.75	GN 688
129	Morogoro	Kilosa	Rudewa	Rudewa	258.74	Declared Village Land Forest Reserve	257.81	

130	Morogoro	Kilosa	Rudewa	Rudewa	5.92	Declared Village Land Forest Reserve	5.88	
131	Morogoro	Kilosa	Rudewa	Rudewa	2.89	Declared Village Land Forest Reserve	3.06	
132	Morogoro	Kilosa	Rudewa	Rudewa	6.43	Declared Village Land Forest Reserve	6.38	
274	Morogoro	Kilosa	Rudewa	Rudewa	209.23	Declared Village Land Forest Reserve	147.06	
37	Lindi		Ruhoma	Ruhoma	1.06	Village Land	0.00	
51	Lindi	Lindi Municipality	Ruhoma	Ruhoma	94.15	Gazetted Village Land Forest Reserve	91.25	GN 487
52	Lindi	Lindi Municipality	Ruhoma	Ruhoma	371.43	Gazetted Village Land Forest Reserve	353.94	GN 487
53	Lindi	Lindi Municipality	Ruhoma	Ruhoma	2330.51	Gazetted Village Land Forest Reserve	2266.06	GN 487
54	Lindi	Lindi Municipality	Ruhoma	Ruhoma	15.43	Gazetted Village Land Forest Reserve	11.00	GN 487
56	Lindi		Ruhoma	Ruhoma	1.05	Village Land	0.19	
442	Lindi	Lindi Municipality	Ruhoma	Ruhoma	5.86	Declared Village Land Forest Reserve	3.44	
443	Lindi	Lindi Municipality	Ruhoma	Ruhoma	19.09	Declared Village Land Forest Reserve	17.94	
444	Lindi	Lindi Municipality	Ruhoma	Ruhoma	0.58	Declared Village Land Forest Reserve	0.06	
445	Lindi	Lindi Municipality	Ruhoma	Ruhoma	1.02	Declared Village Land Forest Reserve	0.81	

446	Lindi	Lindi Municipality	Ruhoma	Ruhoma	44.02	Declared Village Land Forest Reserve	40.75	
447	Lindi	Lindi Municipality	Ruhoma	Ruhoma	2.29	Declared Village Land Forest Reserve	2.25	
448	Lindi	Lindi Municipality	Ruhoma	Ruhoma	2.49	Declared Village Land Forest Reserve	0.44	
449	Lindi	Lindi Municipality	Ruhoma	Ruhoma	3.47	Declared Village Land Forest Reserve	3.50	
450	Lindi	Lindi Municipality	Ruhoma	Ruhoma	25.55	Declared Village Land Forest Reserve	20.25	
451	Lindi	Lindi Municipality	Ruhoma	Ruhoma	1.7	Declared Village Land Forest Reserve	1.50	
452	Lindi	Lindi Municipality	Ruhoma	Ruhoma	1.72	Declared Village Land Forest Reserve	1.56	
453	Lindi	Lindi Municipality	Ruhoma	Ruhoma	0.84	Declared Village Land Forest Reserve	0.75	
454	Lindi	Lindi Municipality	Ruhoma	Ruhoma	9.54	Declared Village Land Forest Reserve	9.56	
455	Lindi	Lindi Municipality	Ruhoma	Ruhoma	2.76	Declared Village Land Forest Reserve	2.75	
456	Lindi	Lindi Municipality	Ruhoma	Ruhoma	1.26	Declared Village Land Forest Reserve	1.25	
457	Lindi	Lindi Municipality	Ruhoma	Ruhoma	5.67	Declared Village Land Forest Reserve	5.38	
458	Lindi	Lindi Municipality	Ruhoma	Ruhoma	163.76	Declared Village Land Forest Reserve	102.69	
477	Lindi		Ruhoma	Ruhoma	1321.92	Village Land	500.56	

478	Lindi		Ruhoma	Ruhoma	2.64	Village Land	0.88	
8	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	8439.36	Gazetted Village Land Forest Reserve	8258.63	GN 688
324	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	24.9	Declared Village Land Forest Reserve	24.56	
325	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	75.04	Declared Village Land Forest Reserve	75.25	
326	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	1.24	Declared Village Land Forest Reserve	1.31	
327	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	26.27	Declared Village Land Forest Reserve	26.31	
328	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	145.31	Declared Village Land Forest Reserve	142.31	
329	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	182.01	Declared Village Land Forest Reserve	181.38	
330	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	31.25	Declared Village Land Forest Reserve	31.50	
331	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	11.85	Declared Village Land Forest Reserve	11.88	
332	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	20.72	Declared Village Land Forest Reserve	20.69	
333	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	11.44	Declared Village Land Forest Reserve	11.25	
334	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	65.72	Declared Village Land Forest Reserve	65.25	
335	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	3	Declared Village Land Forest Reserve	2.94	

336	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	2.17	Declared Village Land Forest Reserve	2.25	
337	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	42.5	Declared Village Land Forest Reserve	41.25	
338	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	4.69	Declared Village Land Forest Reserve	4.69	
339	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	4.92	Declared Village Land Forest Reserve	4.88	
340	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	1.23	Declared Village Land Forest Reserve	1.38	
341	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	54.37	Declared Village Land Forest Reserve	54.13	
342	Morogoro	Mvomero	Sewe Kipera	Sewe Kipera	20.65	Declared Village Land Forest Reserve	20.69	
2	Morogoro	Morogoro	Tununguo	Tununguo	1848.87	Gazetted Village Land Forest Reserve	1732.88	GN 688
3	Morogoro	Morogoro	Tununguo	Tununguo	106.97	Gazetted Village Land Forest Reserve	104.63	GN 688
290	Morogoro	Morogoro	Tununguo	Tununguo	84.75	Declared Village Land Forest Reserve	60.25	
291	Morogoro	Morogoro	Tununguo	Tununguo	29.51	Declared Village Land Forest Reserve	29.19	
292	Morogoro	Morogoro	Tununguo	Tununguo	8.06	Declared Village Land Forest Reserve	8.06	
293	Morogoro	Morogoro	Tununguo	Tununguo	161.62	Declared Village Land Forest Reserve	158.44	

294	Morogoro	Morogoro	Tununguo	Tununguo	3.55	Declared Village Land Forest Reserve	3.69	
295	Morogoro	Morogoro	Tununguo	Tununguo	1.37	Declared Village Land Forest Reserve	1.38	
19	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	17.33	Gazetted Village Land Forest Reserve	17.63	GN 688
20	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	33.62	Gazetted Village Land Forest Reserve	15.19	GN 688
21	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	2748.28	Gazetted Village Land Forest Reserve	2481.69	GN 688
233	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	2.82	Declared Village Land Forest Reserve	1.13	
234	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	167.55	Declared Village Land Forest Reserve	160.31	
235	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	3.87	Declared Village Land Forest Reserve	3.69	
236	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	0.59	Declared Village Land Forest Reserve	0.44	
237	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	0.59	Declared Village Land Forest Reserve	0.69	
238	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	1.34	Declared Village Land Forest Reserve	1.25	
239	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	28.3	Declared Village Land Forest Reserve	25.00	
240	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	5.27	Declared Village Land Forest Reserve	5.19	

241	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	5.65	Declared Village Land Forest Reserve	5.38	
242	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	4.21	Declared Village Land Forest Reserve	4.31	
243	Morogoro	Kilosa	Ulaya Mbuyuni	Ulaya Mbuyuni	3.06	Declared Village Land Forest Reserve	3.00	
34	Morogoro	Kilosa	Unone	Unone	101.99	Gazetted Village Land Forest Reserve	90.50	GN 688
70	Morogoro	Kilosa	Unone	Unone	155.45	Gazetted Village Land Forest Reserve	153.31	GN 688
71	Morogoro	Kilosa	Unone	Unone	1987.62	Gazetted Village Land Forest Reserve	1912.81	GN 688
72	Morogoro	Kilosa	Unone	Unone	98.1	Gazetted Village Land Forest Reserve	90.25	GN 688
73	Morogoro	Kilosa	Unone	Unone	222.63	Gazetted Village Land Forest Reserve	217.00	GN 688
80	Morogoro	Kilosa	Unone	Unone	360.03	Gazetted Village Land Forest Reserve	335.25	GN 688
201	Morogoro	Kilosa	Unone	Unone	12.59	Declared Village Land Forest Reserve	12.44	
202	Morogoro	Kilosa	Unone	Unone	27.94	Declared Village Land Forest Reserve	27.69	
203	Morogoro	Kilosa	Unone	Unone	10.26	Declared Village Land Forest Reserve	9.81	
204	Morogoro	Kilosa	Unone	Unone	132.47	Declared Village Land Forest Reserve	132.13	

205	Morogoro	Kilosa	Unone	Unone	2.12	Declared Village Land Forest Reserve	2.25	
206	Morogoro	Kilosa	Unone	Unone	5.82	Declared Village Land Forest Reserve	6.06	
207	Morogoro	Kilosa	Unone	Unone	71.05	Declared Village Land Forest Reserve	71.44	
208	Morogoro	Kilosa	Unone	Unone	9.11	Declared Village Land Forest Reserve	9.19	
209	Morogoro	Kilosa	Unone	Unone	63.59	Declared Village Land Forest Reserve	62.69	
210	Morogoro	Kilosa	Unone	Unone	28.63	Declared Village Land Forest Reserve	28.75	
211	Morogoro	Kilosa	Unone	Unone	28.33	Declared Village Land Forest Reserve	28.25	
212	Morogoro	Kilosa	Unone	Unone	18.83	Declared Village Land Forest Reserve	17.38	
213	Morogoro	Kilosa	Unone	Unone	11.29	Declared Village Land Forest Reserve	10.69	
214	Morogoro	Kilosa	Unone	Unone	1.1	Declared Village Land Forest Reserve	1.00	
215	Morogoro	Kilosa	Unone	Unone	0.71	Declared Village Land Forest Reserve	0.63	
216	Morogoro	Kilosa	Unone	Unone	756.94	Declared Village Land Forest Reserve	744.75	
271	Morogoro	Kilosa	Unone	Unone	57.58	Declared Village Land Forest Reserve	56.75	

272	Morogoro	Kilosa	Unone	Unone	118.27	Declared Village Land Forest Reserve	118.13	
273	Morogoro	Kilosa	Unone	Unone	102.17	Declared Village Land Forest Reserve	102.44	

APPENDIX 6: METHODOLOGICAL ANNEX

This methodological annex provides details for the methodological steps outlined in VM0015 v1.2 published on 18 December 2023. The heading and derived subheading numbering matches the step numbering from the methodology outlined in Figure 2 on page 6 of the methodology. Table numbering also matches the numbering from the methodology unless otherwise specified.

1 PROJECT BOUNDARY

1.1 Spatial Boundaries

1.1.1 Reference Region

The revised reference region for the baseline reassessment consists of 18 districts encompassing most of Southeastern Tanzania (). It is a single contiguous area and includes the project areas and leakage belts. District boundaries were derived by aggregating 2022 Tanzania ward boundaries created by the National Bureau of Statistics. The file was downloaded from: https://www.nbs.go.tz/uploads/statistics/documents/en-1714652282-TANZANIA_2022PHC_WARD_SHAPEFILES.zip

The reference region is 18,578,230 ha, equivalent to approximately 19% of Tanzania's total land area, of which 13,208,455 ha was forested at the start of the historical reference period. These figures do not include 126,684 ha of planned flooding in Lindi and Morogoro Regions as the result of the Julius Nyerere Hydropower Station for which construction started during the historical reference period. That area is excluded from the reference region as planned deforestation.

The project area is 327,234 ha of forest at the start of the baseline validity period. Thus, the reference region, being 56.8 times as large as the project area easily meets the methodology guideline of being 5 to 7 times larger than the project area in the case of projects larger than 100,000 ha.

The boundaries are unbiased consisting entirely of official administrative boundaries. The districts include the 12 districts in the two regions, Lindi and Morogoro, with the largest overlap with the project area, two districts in Mtwara region and Tunduru district which border the project area in Nachingwea. The project may also expand to these districts in the future. The reference region also includes Kibiti, Rufiji and Kilolo districts, which are all adjacent to Lindi and Morogoro regions and are districts where the project plans to expand in the future.

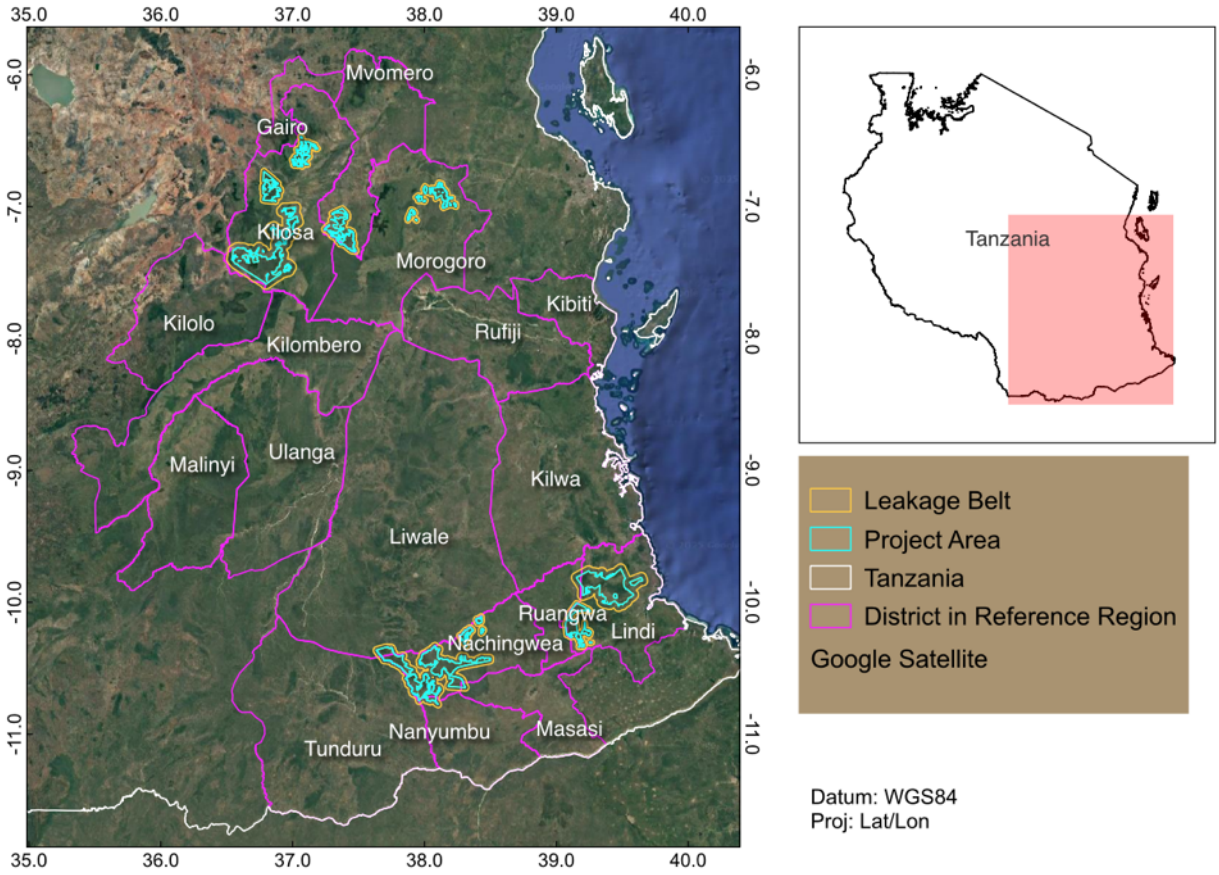


Figure 25 Reference Region Map

The reference region meets the similarity requirements with the project area as follows:

1. The reference region is a good representation of project areas during the baseline validity period. A nationwide study of deforestation in Tanzania showed large consistency in the drivers of deforestation across the country[49]. At least Eighty-nine percent of forest loss in Tanzania is driven by the expansion of agriculture, primarily small-holder agriculture. This is also true in the reference region, though there is a growing threat from larger commercial agriculture as demonstrated by what happened to two villages in Lindi Municipality which were part of the original 10 villages in the project. Thus, the inclusion of some larger scale deforestation driven by commercial agriculture in the reference region is also appropriate.

    a. Expected deforestation agents expected to encroach into the project area in the baseline scenario include small holder farmers, who are ubiquitous in Tanzania, charcoal harvesters, who are often also small holder farmers, and to a lesser extent,

[49] Doggart, N., Morgan-Brown, T., Lyimo, E., Mbilinyi, B., Meshack, C. K., Sallu, S. M., & Spracklen, D. V. (2020). Agriculture is the main driver of deforestation in Tanzania. *Environmental Research Letters*, *15*(3), 034028.

larger-scale commercial farmers. Monitoring of encroachment into the project area from 2023-2024 by village forest patrols teams showed encroachment from all these agents resulting in project area loss. Thus, all these agents exist in the reference region and clearly pose a threat to the project area.

b. Due to the absence of a comprehensive settlement point layer for Tanzania, settlement density was assessed in two ways. The first used the Global built-up surface layer available on Google Earth Engine from the Global Human Settlement Layer (GHSL) project. Processing this data to identify reliable pixels of settlement followed the steps described in section 4.2.1 of this methodological annex. There were 14.08 pixels of settlement per square kilometer of reference region in 2010 compared to 20.71 pixels of settlement per square kilometer of leakage belt in 2020 (see section 1.1.3 for details on the leakage belt). Thus, settlement density in terms of settled pixels in the reference region at the start of the historical reference period is less than the density around the project area at the baseline validity period start date. The builtup pixel density in the reference region in 2020 (20.37) was also slightly lower than the density in the leakage belt.

   To assess road densities only tertiary and above roads from OpenStreetMaps were used. This is because the mapping intensity of lesser roads is highly variable depending on location. Tertiary and above roads include tertiary, secondary, primary, and trunk roads. The roads were clipped to either the reference region or leakage belt and the density calculated. The road density in the reference region was 44 m/km^2 while the density in the leakage belt is 92.5m/km^2. Thus, the density of major roads in the area surrounding the project area is significantly higher than in the reference region.

   There are no navigable rivers in either the project area or reference region.

2. The landscape configuration and ecological conditions of the reference region and project area meat the following similarity requirements:

   a. Forest types were assessed using a 2010 Tanzania Landcover map produced by Space Intelligence and shared with the project as part of a consultancy for the Nature Conservancy. There are three main types of forest in Eastern Tanzania. The largest portion is miombo woodland followed by lowland/coastal forest and montane forest. The project area and reference region both contain all 3 of these forest types. Miombo is the most common forest type in both the project area and reference region. The core area of the original 10 project area villages is coastal forest on the Noto and Chitoa Plateaus and the Ilole forest within the Msimba, Malolo A, and Kisanga village forest reserves is montane.

   b. Elevation was assessed using the Copernicus Digital Elevation Model downloaded from Google Earth Engine and reprojected to match the pixel size and spacing of the forest

cover benchmark maps. Histogram counts were produced using Dinamica Ego. Project elevation ranged from 61 to 2067 masl, which overlaps with 95% of the range of the rest of the forested reference region at the beginning of the HRP.

c. Slope was assessed using slope calculated from Copernicus Digital Elevation Model in Google Earth Engine and reprojected to match the pixel size and spacing of the forest cover benchmark maps. Histogram counts were produced using Dinamica Ego. Project slope ranged from 0 to 68 degrees, which overlaps with 99.99% of the range of the rest of the forested reference region at the beginning of the HRP.

d. Precipitation was assessed using OpenLandMap Monthly Precipitation map available on Earth Engine. The dataset was reprojected to match the pixel size and spacing of the forest cover benchmark maps. Histogram counts were produced using Dinamica Ego. Project annual precipitation ranged from 718 mm to 1322 mm, which overlaps with 92.5% of the range of the rest of the forested reference region at the beginning of the HRP.

e. Soil types were assessed using the dominate soil types from the FAO Digital Soil Map of the World. The vector data was rasterized and projected to have the same projection and pixel spacing as the forest cover benchmark maps. Histogram counts were produced using Dinamica Ego. The soil types in the project area exist in 86% of the forested portion of the reference region. However, the largest area of soil type not included in the project area at the time of writing this annex does exist in planned project expansion areas in Rufiji district. Once that expansion is complete, the project area will include soil types found in 91% of forested portions of the reference region.

3. The required project area and reference region socio-economic and cultural similarities are met as follows:

a. In the baseline case, the project area would predominately consist of a mixture of unprotected forests and protected forests on village land. The project area also includes some forest in local authority forest reserves and land which will be included in local authority forest reserves, but which would have been unprotected forest on general land in the absence of the project. The reference region includes all these land status types, but also includes various types of national protected areas. It is important to include national protected areas because they fall in the project leakage belts and thus must be included in the deforestation risk map. The forest in national protected areas is better protected than the project area forests in the baseline scenario, so including these forests in the reference region does not bias the reference region to include more deforestation than if these areas were excluded.

b. In the baseline case, the project area would include forest under village council authority, forest which is converted through clearing from village council to individual

household ownership, forest which would have been sold by local authorities to agricultural investors by villages or local authorities, and forest which is under the control of local authorities. All these land-tenure types are prevalent in the reference region.

c. The current land-use class in the project area is natural forest under protection. That is a common land-use throughout the reference region. The projected land-use in the project areas include conversion to small-holder farming, conversion to commercial agriculture, and conversion to non-forest due to excessive charcoal harvesting. All these use cases are prevalent in the reference region.

d. All land is Tanzania is governed by the 1999 Land Act and subsidiary regulations.

e. There is no spatially explicit data for Tanzania showing the proportion of urban and agriculturally based populations. Within districts, there are municipal and district councils, but there are municipalities which include villages (e.g., the project villages in the Lindi Municipality) and there are towns within district councils (e.g., Mikumi town in Kilosa district, which is adjacent to the project area). Thus, the council types don't clearly distinguish between urban and rural populations. Furthermore, there are agriculturally based peoples in urban areas and non-agriculturally based peoples in rural areas. The 2022 census data only provides summary metrics of urban vs rural populations which works out to approximately 65% rural. It is not clear if this is just based on splitting up populations into district and municipal wards, which would be misleading, or if it is captured by some other metric measured in the census. WorldPopulationReview.com provides what they claim are 2024 estimates of 275 Tanzanian city and towns with populations greater than 2000 people including 38 which overlap the reference region. Dividing the total population from these 38 cities and towns by the total population for the reference region from the 2022 census gives 18 percent urban. Diving the population of Mikumi town, which directly borders a portion of the project area in Kilosa district by the total population of participating project communities and Mikumi town gives 10 percent urban, which is within 10% of the proportion for the reference region.

1.1.2 Project Area

At baseline revision, the project area consists of 327,234 ha of forest persistence since 2010 within the project area polygons (Figure 26). The forest mapping was conducted as part of the reference region historical deforestation analysis as described in section 3.

There are no areas of planned deforestation within the project area and the entire project area is under the control of the project at this baseline revision. The project area includes both areas under immediate and future threat of deforestation according to the risk map created as described in section 4.

Project area polygons in kml format with the details of the ownership of each polygon have been provided to the VVB and uploaded to the project VCS registry account. The complete list of project participants and their roles is provided in section 2.1.8 of the project document. An interactive web map of the project area is also available at: https://maps.reterra.ltd/VCSL_Project_Areas/

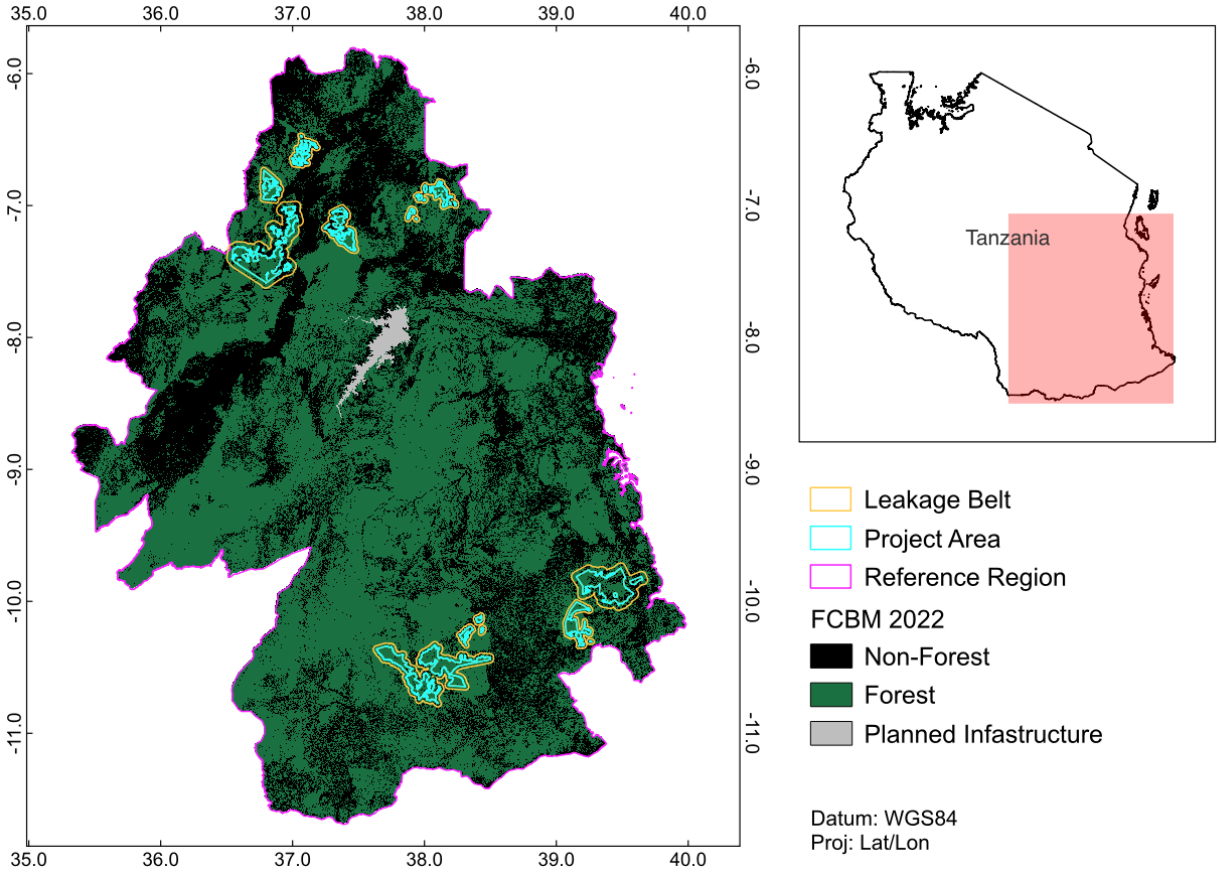


Figure 26 Project Area and Leakage Belt Map

1.1.3 Leakage Belt

The leakage belt is the land surrounding the project area that is monitored for the displacement of deforestation activities from the project area because of project activities. The leakage belt extents were revised due to the baseline revision and expanded project area. The revised leakage belts were established using a combination of requirements from VM0015 mobility analysis and VMD0055 leakage belt requirements to ensure the leakage belts will be valid after the transition to VM0048.

VMD0055 allows for a maximum leakage belt buffer of 10km around the project area, which is then reduced until the forest within the leakage belt is equivalent to the amount of forest within the project area or the leakage belt has reached the minimum buffer of 2km. This calculation is done separately for each discreet project area parcel separated by more than 4km. During the leakage belt calculations, parcels that were separated by more than 4km, but which required leakage belt buffers which would

overlap were subsequently combined for the purposes of calculating the leakage belt buffer. The minimum required buffer for each parcel or group of parcels was calculated using numpy functions in python using a distance from project area parcels group map and the 2022 FCBM as a mask to identify the distance percentile containing the same number of forested pixels as the project parcels in the group. The identified parcel risk buffers ranged from the required minimum of 2000 meters to 4175 meters. The leakage buffer around Malolo A village in Kilosa district ended up extending slightly outside the reference region. The area was mapped as part of the buffer area around the reference region, which indicated that there were 169 ha of forest in the portion of the leakage buffer extending beyond the reference region. Since the area was not part of the reference region, it was not assigned a deforestation density and thus will be conservatively assumed to have zero risk and will be monitored as part of the project leakage belt. The total forest within the identified required buffers was 343,267 ha or approximately 4.9% more than in the project area.

In terms of the requirements of VM0015 mobility analysis, distance from the project area functions as the facilitation criterion, because deforestation agents who were going to deforest in the project area would find it easier to shift their activities into forests that are closer to the project area compared to forests farther away. Then, the risk maps produced in section 4 were used to assess constraints on activity mobility. The risk maps are produced by creating spatial maps of different factors and then training a model based on historical patterns of deforestation and persistence and thus meet the requirements for mobility mapping. See section 4.2.1 for the maps of each factor. The final risk map model included distance to recent deforestation, soil cation exchange capacity, distance to major roads, national protected areas with clear boundaries, slope, and topographic position index. Each one of these variables can be interpreted as a deforestation constraint. For instance, deforestation is much less likely to occur in a national protected area with clear boundaries, which is clearly reflected in the final risk map. Deforestation is also unlikely to occur in very sandy soils with poor cation exchange capacity because the soil is not suitable for rainfed agriculture without fertilizer, which is the main kind of agriculture in Tanzania, the reference region, and around the project areas. By totally up the projected annual density of deforestation in the project area vs leakage belts, it was therefore possible to establish if the leakage belts had forests that were not only accessible from the project area, but also unconstrained for conversion. The total annual deforestation projected in the leakage belts was 7035 ha while the projected deforestation in the project area is 5268 ha. Therefore, during the baseline validity period, the leakage belts hold more than enough forest to accommodate 100% of the deforestation projected in the project area and the average accessibility/conversion suitability of forest in the leakage belt is higher than in the project area.

1.1.4 Leakage Management Zones

The primary leakage management activity for the project is agricultural extension services aimed at improving yields from areas already deforested by communities participating in the project. This will include farms existing within the project area polygons as well as the leakage belt polygons in 2022. According to the 2022 forest cover benchmark map, there are approximately 209,577 ha of non-forest

in the leakage belt and 48,781 ha of non-forest in the project area polygon. Most of these non-forest areas are active or fallow farms where leakage management activities can be undertaken.

1.1.5 Forest

For the purposes of this project, the forest definition follows the FAO definition of lands of more than 0.5 hectares, with a tree canopy cover of more than 10 percent, which are not primarily under agricultural or urban land use. Trees should be able to reach a minimum height of 5 meters in situ. The Tanzanian definition is similar except that it includes trees which may grow to reach 3 meters in-situ. The FAO definition is more conservative and much easier to consistently map with remote sensing techniques. A study published in 2023 of long-term land-use trajectories in Tanzania found that most deforestation on village land is permanent[50]. This was also supported by an unpublished 2021 survey of farmers in Lindi region, where shifting cultivation is common[51]. That study found that the average fallow length has declined to just 4 years, which is sufficient time for significant canopy up to 3 meters to develop from coppicing and root suckers, but not enough time for significant biomass recovery.

The forest cover benchmark maps produce in section 3 have pixels which are 0.0625 ha and have 8-pixel orthogonal sieves applied to them so that the minimum landcover parcel is 0.5 ha and thus met the 1 ha minimum mapping unit requirement of the methodology.

1.2 Temporal Boundaries

1.2.1 Start and End Dates of the Historical Reference Period

This methodological annex is for a revised baseline. The start date for the original project historical reference period was 25-May-2001, and the end date 21-April-2012, corresponding with the start date of the project. Version 1.2 of VM0015 states that the start of the HRP should not be more than 10 years prior to the start date of the project but is silent on the length of the HRP to be used for baseline revision. The VCS Methodology Requirements v4.4, which are the most recent at the time of writing this annex, state that historical factors from at least the previous 10 years must be used to project the future location of deforestation, implying that longer timeframes can be used. The revised baseline uses a 12-year historical reference period from 2010 to 2022. A longer historical reference period was necessary because the PALSAR radar backscatter mosaics which are critical for producing accurate land-cover maps in Tanzania do not cover 2012. There isn't an exact start date because the PALSAR imagery used to map the historical reference period is a mosaic of imagery in strips acquired from May 1, 2010, to September 23, 2010, with a pixel-based average of July 7, 2010.

[50] Doggart, N., Mugasha, W. A., Mpiri, A., Morgan-Brown, T., Sallu, S. M., & Spracklen, D. V. (2023). Agricultural fallows are the main driver of natural forest regeneration in Tanzania. *Environmental Research Letters*, *18*(5), 054008.

[51] Morgan-Brown, T. (2021) Lindi Opportunity Cost Study. Unpublished study report shared with VVB.

The end dates of the historical reference period correspond to the 2022 PALSAR II radar backscatter mosaics used in the final change step. The dates of the 2022 PALSAR II strips in the mosaic range from July 27, 2022, to Nov 11, 2022, with a pixel-based average of September 4, 2022.

1.2.2 Start Date of the AUD Project Activity Crediting Period

This a grouped project with two instances. The start date of the first project instance was 21-April-2012 and the start date for the parcels in the second instance is Feb 9th, 2023, which is the date of the first on the ground patrols supported by the project in the new instance. The initial crediting period was to be 30 years, but this has been extended by an additional 20 years in new contracts with the participating forest owners. Version 4.7 of the VCS standard requires a minimum of 20-year crediting periods for AFOLU projects which can be renewed for a maximum of 100 years. The standard also sets a minimum of 40 years for AFOLU project longevity. In the baseline case, the project areas would still have some forests in 40 years, so it was reasonable to extend the crediting to cover the entire longevity period.

1.2.3 Start and End Dates of the Baseline Validity Periods

The initial baseline validity period was from April 21, 2012, to April 20, 2022.

As per version 4.7 of the VCS standard, the new baseline validity period will be for 6 years from April 21, 2022, to April 20, 2028. However, the project expects to transition to VM0048 before that subject to availability of VM0048 baseline data from Verra.

1.2.4 Monitoring Period

As per the methodology and VCS standard, the minimum monitoring period is one year, and the maximum duration is the baseline validity period.

1.3 Carbon Pools

The greenhouse gasses included or excluded from the project boundary area shown in VM0015 Table 2.

VM0015 Table 2 Carbon Pools Included in or Excluded from the Boundary of the Proposed AUD Project Activity

Carbon pools	Included / Excluded	Justification
Above-ground biomass	Tree: Included	The largest carbon pool subject to change
	Non-tree: Excluded	The only perennial crops in the baseline final land-cover are tree crops and are thus captured in the tree

		pools. The project area is not suitable for sugarcane plantations and pigeon peas are cleared and replanted each season.
Below-ground biomass	Included	This is a significant carbon pool subject to change
Dead wood	Excluded	The carbon stocks in the standing dead tree pool are higher on average in the baseline scenario due to residual unfelled ringbarked trees left in the first 1-2 years after deforestation. However, subsequent burning, cutting, and termite activity remove these residual trees leaving a stock in this pool comparable to the project scenario. The difference between the long-term average post deforestation stock in this pool and average stock in the project forest classes weighted by projected baseline deforestation is 1.98t CO_2e/ha, which is 1.2% of the average emissions factor weighted by projected baseline deforestation. Thus, excluding this pool will not lead to significant overestimate of GHG reductions. Lying dead wood was measured in a subset of forest and post-deforestation biomass plots. The volume of lying dead wood in the forest plots was higher than in the post-deforestation plots, so excluding that pool is conservative.
Harvested wood products	Excluded	Most of the biomass cleared in the baseline scenario is simply burned on site as part of farm preparation. A minority (less than 10%) is turned into charcoal, but that does not translate into a long-lived wood product. An even smaller amount (less than 1%) is turned into timber. The level of timber extraction in both the baseline and project scenario is low because only a minority of tree species are considered suitable for timber and only a minority of those trees are large enough to produce timber. Finally, there isn't likely to be a significantly difference between scenarios as sustainable timber harvesting is allowed in the project scenario. Thus, excluding this pool does not lead to an overestimation of net GHG emissions reductions.

Litter	Excluded	Most of the project area is Miombo woodland, which is subject to periodic burning, so this pool is temporary even in the project case.
Soil Organic Carbon	Excluded	The predominate land-use change in the baseline scenario is conversion from forest to cropland, which results in reductions in soil organic carbon. Excluding SOC is conservative for now, though the project may decide to include SOC when it transitions to VM0048.

1.4 Sources of GHG Emissions

VM0015 Table 3 Sources and GHG to be Included in or Excluded from the Boundary of the Proposed AUD Project Activity

Sources	Gas	Included/Excluded	Justification
Biomass burning	CO_2	Excluded	Counted as carbon stock change
	CH_4	Included	Slash-and-burn is the method of forest clearance in the baseline scenario
	N_2O	Included	Slash-and-burn is the method of forest clearance in the baseline scenario
Livestock emissions	CO_2	Excluded	Not a significant source as per the methodology
	CH_4	Excluded	The project activities have no effect on livestock numbers or emissions and therefore they are excluded as insignificant
	N_2O	Excluded	The project activities have no effect on livestock numbers or emissions and therefore they are excluded as insignificant

2 BASELINE SCENARIO

2.1 Determination of the most plausible baseline scenario

As per the methodology and VCS standard, the additionality of the project is assessed using the most recent version (3.0) of VT0001 Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities. This assessment is updated for the baseline revision and expanded project area, though largely remains the same because the conditions have not changed much in the 10 years since the project start.

The tool requires four steps to be applied:

a) Step 1. Identification of alternative land use scenarios to the AFOLU project activity

b) Step 2. Investment analysis to determine that the proposed activity is not the most economically or financially attractive of the identified land use scenarios; or

c) Step 3. Barrier analysis; and

d) Step 4. Common practice analysis

Step 1. Identification of alternative land use scenarios to the proposed VCS AFOLU project activity

In this step, alternative land use scenarios to the proposed VCS AFOLU project activities that could be the baseline scenario are identified through the following sub-steps:

Sub-step 1a. Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity.

Four credible alternative land use scenarios have been identified in line with the guidelines presented in the tool.

1. Continued conversion of communally owned village forest land to small-scale agriculture, primarily for annual cash or subsistence crops. This has been observed within the previous 10 years affecting forest areas within the project area polygons and leakage belt polygons. It is the dominate driver of deforestation for the entire country.

2. Changing villages to township or municipal status ceases the village council's role as Managing Authority. Without active efforts to secure effective cooperation between the Local Authority (Municipal Council) and communities, management of the village land forest reserve becomes ineffective, potentially resulting in the conversion of forests to agricultural use. This is a new threat which was not present during the initial historical reference period, but which is demonstrated most clearly through the experience of Nandambi and Mkanga 1 villages, which in the absence of continued support from the REDD project were converted to municipal land

by the Lindi Municipality and had portions of what had been their village forest reserves sold to local investors for agriculture between 2018 and 2022.

3. Conservation resulting from an NGO raising the funds necessary to implement all the proposed project activities, including CBFM, from sources not related to carbon markets.

4. Conservation resulting from the conversion of village land to a new national protected area such as a national park, nature reserve, forest reserve, or game reserve.

Scenario 1 and 2 is the continuation of the pre-project (or business as usual) land uses seen within the project area and reference region within the past 10 years. See section 2.2 of this methodological annex for more details of these scenarios. Scenarios 3 and 4 require external sources of funding to support conservation activities. An example of scenario 3 is the creation of 10 village forest reserves now part of the Village Climate Solutions project in Mvomero and Morogoro rural districts with support from the Transforming Tanzania's Charcoal Sector project. Sustainable charcoal production was the primary motivation for the creation of the forest reserves, not carbon finance. The work was funded by the Swiss Development Corporation[52], but ended in 2023. For scenario 4, while Tanzania has created many new national protected areas in the past 10 years, we could not find examples of where the protected area was created by converting village land to a national protected area.

Outcome of sub-step 1a: Scenarios 1, 2, and 3 are credible scenarios with examples that have occurred within the previous 10 years.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations

Scenario 1: Prior to the project, none of the villages in the initial project instance had established village forest reserves or conducted land-use planning. Thus, conversion of forest to small holder agriculture was legal, except in the case of conversion of forest land to agriculture within 30 meters of a stream and farming on extremely steep slopes (hazard lands), which are illegal land-uses under the 2002 Forest Act and 1999 Land Act respectively. However, there is not a single documented case of these acts being enforced in the participating project villages prior to the start of the project and numerous examples of farmers clearing in stream valleys and on hazard lands.

The second project instance consists of a mixture of village and local-authority forest reserves predating the project, new village forest reserves created specifically for the project, and village forest reserve expansions created specifically for the project. Through establishing new villages forest reserves and encouraging expansion of existing village forest reserves, an additional 97,918 ha were placed into village forest reserves because of the project activities. As was the case with the original project instance, conversion of forests in the new village forest reserves and village forest reserve

[52] https://www.tfcg.org/what-we-do/develop/coforest/

expansions created for the project would have been legal in the baseline scenario because they would not be in village forest reserves in the baseline scenario. It should also be noted that 7 Kilosa district village forest reserves now part of the project covering 82,659 ha were established as part of a different prospective REDD project developed by the Tanzania Forest Conservation Group and MJUMITA during the same period that these organizations developed the first instance of this project. That project failed to produce a project document and in the absence of continued donor funding and a clear market for REDD credits in 2015, was unable to progress to registration. These villages have been supported by TFCG and MJUMITA since 2015 with donor funding from two different projects which ended in 2023.

Conversion of existing village forest reserves or local authority reserves to small holder farming through informal processes is illegal but is commonplace in the absence of substantial funding for forest protection.

Scenario 2: Changing Village Governments to township or municipal status ends the Village Council's role as the Managing Authority over the Village Land Forest Reserve. This does not automatically convert Village Land Forest Reserves into general land unless legalized through a Government Notice. Converting gazetted Village Land Forest Reserves to general land requires approval from the Ministry of Forestry and Beekeeping, which is possible but more difficult due to the need for public consultations and multiple endorsements from local level. Thus, scenario 2 is legal, but really only a threat to parts of the project area in ungazetted village forest reserves. Supporting the gazettement of more Village Forest Reserves in the project will be a key strategy employed by the project to enhance permanence.

Scenario 3: The 2002 Forest Act allows for the conservation activities in scenario 3 to be established.

Therefore, for a substantial portion of the project area, all the scenarios are compatible with applicable laws and regulations in the baseline scenario. However, there is also a portion of the project area where scenario 1 would not be consistent with the applicable laws and regulations. In such cases, VT0001 requires that non-compliance with those legal requirements be prevalent in at least 30% of the smallest administrative unit that encompass the project area for the land-use to be considered plausible.

The additionality of protecting forests within 30 meters of streams outside of village forest reserves is only claimed in the case of the original project instance. The lack of enforcement of this law was assessed during the initial project validation using Lindi Region. To access the prevalence of deforestation along streams, some reasonable sampling had to be done as there is no map of all the streams in Lindi Region. Therefore, the analysis of deforestation within 30 m of a stream was limited to major streams, for which a GIS shapefile was available. This is reasonable because if this rule is not enforced along major water ways, it is even more likely that the rule is not enforced for minor water ways. Additionally, not all the Region is inhabited, so it is difficult to access the enforcement of a rule where there is no threat. Instead, the sampling was done at the scale of wards. There are 119 wards in Lindi Region and 61 of them overlap a major stream. High resolution imagery available from Google Earth was used to locate agricultural within 30 meters of major streams. If a farm was found, then the

search shifted to a new ward. The search was not systematic and did not cover all the wards. Once enough clearings were detected to demonstrate that the law regarding cultivation near streams is not enforced across most of the region, the search stopped. The search revealed agricultural clearings within 30 meters of a major stream in 32 wards with a combined area equal to 50% of the region. Examples of agricultural encroachment in streams were found in all 6 of the region's districts. Shapefiles of the locations of agricultural encroachment in waterways, ward and district boundaries were shared with the validation body.

In the case of the lack of enforcement of rules in existing village and local authority forest reserves, given that the new project instance spans multiple regions, the smallest administrative unit covering the entire project area would be the entire country. There is no national dataset of village and local authority forest reserves, so assessment at the national level would be impossible. Instead, the project looked at protection of village and local authority forest reserves within 11 of the 18 districts making up the reference region using village and local authority forest reserve boundaries collected by the Tanzania Forest Conservation Group and Mpingo Conservation and Development Initiative. In total, there were 127 villages with forest reserves covering 824,678 ha in the dataset which had been created prior to 2022 and most prior to 2016. The reserves were checked for deforestation using the 2016-2022 reference region land-cover change analysis described in section 3. Ninety-three percent of the reserves had at least 0.5 ha of deforestation during that period and 43% had at least 50 ha of deforestation, indicating that lack of enforcement is widespread. One village in Kilwa district, Nanjirinji A, lost 6,646 ha of forest in its village forest reserve during that period and 8166 ha between 2010 and 2016. The reserve was established in 2012. Another village in Liwale district, Ngumbu, lost 7,481 ha of forest between 2010 and 2016 and 2530 ha between 2016 and 2022 which translated into a total loss of 74% of its village forest reserve during the 12-year period. Lack of enforcement was also prevalent within the village forest reserves in the 55 villages in the dataset that later joined the VCSL project. 98% lost at least 0.5 ha and 56% lost at least 50 ha between 2016 and 2022.

Outcome of sub-step 1b: Scenarios 1, 2 and 3 are consistent with enforced mandatory applicable laws and regulations.

Sub-step 1c. Selection of the baseline scenarios

Scenario 1 and 2, which are the continuation of the land-use trends of the 10 years prior around, and even in, the project area are the most plausible alternative land use scenarios in the absence of this REDD project. While some of the land-use conversions are illegal under national Tanzanian law, these laws were in place during the 10 years prior to the project and the historical deforestation analysis demonstrates that they were not enforced. To justify the selection of Scenario 1 and 2 as the baseline scenario, the relative likelihood of each scenario is briefly considered.

Scenario 1: Continued conversion of communally owned village forest land to small holder agriculture, primarily for annual cash or subsistence crops.

A large portion of the land in the project area prior to the establishment of the project instances was de facto open access village land. Village residents in the project area and in the rest of the reference region were free to clear as much forest as they were able to establish their farms. Furthermore, only through clearing forests could residents obtain customary ownership over the land since they could not simply claim forested land as their own. Farmers in the participating project villages and in the wider reference region frequently clear new farms from the forest to avoid pests and weeds, and access more fertile soil. Due to the lack of capital and knowledge, farmers in the region do not engage in intensive forms of agriculture and are unlikely to come to adopt them in the future in the absence of the project.

The underlying drivers of deforestation are population growth and improved market access, both of which are likely to continue in the future. See 2.2.2 of this methodological annex for a complete description of the drivers of deforestation in the region and a justification of their likely future trajectories.

Scenario 2: Changing Village Governments to township or municipal status ceases the Village Council's role as Managing Authority over the Village Land Forest Reserve, potentially resulting in the conversion of forests to agricultural. This is legal but rare, having occurred only twice in the past 20 years within the project area. It typically requires multiple consultative meetings and approvals from local to national levels.

Scenario 3: Conservation resulting from an NGO raising the funds necessary to implement all the proposed project activities from sources not related to carbon markets. This scenario is unlikely due to barriers described in Step 3.

Scenario 4: Conservation resulting from the establishment of a new national protected area. This scenario is unlikely due to barriers described in Step 3.

Step 3. Barrier analysis

Following Step 1, VT0001 allows for either conducting an investment analysis or a barrier analysis. We elected for a barrier analysis. The analysis is used to establish whether the type of proposed project activity faces barriers that:

Prevent the implementation of this type of proposed project activity without the revenue from the sale of GHG credits; and

Do not prevent the implementation of at least one of the alternative land use scenarios.

Sub-step 3a. Identify barriers that would prevent the implementation of the type of proposed project activity.

a) Investment barriers

Donor funding can be obtained to pay for establishing village and local authority forest reserves. However, as demonstrated in sub-step 1b, establishment does not automatically lead to long term

protection. Donor funded projects are by design, not long term. The hope of community based-forest management in Tanzania has always been that villages will be able to obtain sufficient income from sustainable forest use to pay for and incentivize forest conservation in the long term. That hope has not materialized. The project village forest reserves in Morogoro region that were not established as part of a REDD project have been supported by the Tanzania Forest Conservation Group and MJUMITA since 2015 as part of two multi-million-dollar projects funded by the Swiss Development Corporation aimed at promoting sustainable charcoal and timber. The last phase of the project ended in 2023, but direct support to most village in Morogoro region villages ended in 2019.

However, even during the period of donor funding, the project struggled with political opposition to the concept of sustainable charcoal[53]. This opposition resulted in frequent charcoal bans in the project districts, which only affect legal charcoal, and regulations aimed at undermining the project[54]. For instance, new regulations require villages to charge the same royalties on their charcoal as the Tanzania Forest Service (TFS) is supposed to charge on charcoal coming from general land. TFS charcoal check points ensure that villages strictly adhere to this policy and since in reality, most charcoal from general lands evades paying royalties, villages are at a competitive disadvantage and have struggled to find buyers ever since. In 2022, the last full year of the project, the total income for 30 villages active in sustainably timber production was $92,465[55], or $3,082 per village, which is simply not sufficient finance to fund and incentivize the protection of 140,000 ha of forest under high pressure for conversion. By comparison, 27 of these 30 villages will earn a minimum of 10 times as much annually from this REDD project if they can prevent 85% of baseline deforestation.

Villages focusing on sustainable timber are also forced to charge the same royalties as national government. This, combined with the withdrawal of the company Sound and Fair, which previously purchased FSC certified hardwoods from Lindi Region, has also made it difficult to find buyers. Nanjirinji A for instance is part of an FSC group certification scheme supported by the Mpingo Conservation and Development Initiative. As recent as 2017, the village was earning as much as $90,000 a year from sustainable timber sales. However, it then lost 6,646 ha (10%) of its forest reserve between 2016-2022 due to small holder agricultural encroachment.

Furthermore, revenue from sustainable forest use has never been used to fund activities like agricultural extension services. Short-term donor funding can be obtained for such activities, but long-term support is required to reach a substantial proportion of farmers. Thus, even villages that can earn

[53] Doggart, N., & Meshack, C. (2017). The marginalization of sustainable charcoal production in the policies of a modernizing African nation. *Frontiers in Environmental Science*, *5*, 27.

[54] Mabele, M. B. (2020). The ‘war on charcoal’ and its paradoxes for Tanzania's conservation and development. *Energy Policy*, *145*, 111751.

[55] From village charcoal royalty data shared by MJUMITA

sufficient income from sustainable use to fund and incentivize forest protection will see leakage from those activities in the long run in the absence of REDD.

Thus, while scenario 3 might be credible for a 3-to-5-year donor funded project, it is not possible to secure donor funding to support all the project activities for 40 years or for sustainable forest use established by donor funding to cover all the project activities for 40 years.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios (except the proposed project activity).

The barriers described in sub-step 3a facilitate rather than hinder scenario 1. The lack of a business case for community-based forest management in the area both in terms of commercial and subsistence use means that communities would be unwilling to put as much forest aside for forest protection as they have as part of this project.

Scenario 2 is also facilitated by the identified barriers. Without long-term funding for forest protection and technical support from an NGO or similar partner, villagers are less likely to be able to block the transfer of their land to a municipality for sales to investors. This poses a threat even to village forests that have a long conservation history.

Step 4. Common practice analysis

As outlined in previous sections, community-based forest management initiatives have been implemented in various regions of Tanzania, including the project area itself, without the explicit incentive of a carbon market. However, the scope, scale, and effectiveness of these initiatives falls short of a REDD+ project. Most importantly, as described in the investment barriers section, the level of financial flows expected from REDD project activities to participating communities will be 10x those from prior forest conservation activities.

Also, typically, villages supported with donor funding to create village forest reserves without carbon finance will leave large portions of their forest outside of protection. For instance, community-based forest management has been supported by donor funded projects for over a decade in Nachingwea district with a focus on sustainable timber harvesting. When TFCG started working in Nachingwea district in 2020 under the COFOREST project with an aim to introduce sustainable charcoal harvesting, they focused on villages that didn't have existing village forest reserves assuming they would have the most interest in creating a reserve. They identified Chimbendenga and Lionja B villages as potential villages for new village forest reserves, but in the end were only able to convince Lionja B to create a reserve, which is just 681 ha of forest. Three years later, when VCSL came into Nachingwea to introduce REDD, the project was able to convince 14 villages, 11 of which already had a village forest reserve, to create and start patrolling 70,528 ha of new or expanded village forest reserves. This was 163% increase in area under village forest reserves accomplishing in months what previous donor supported work had not accomplished in over a decade. The new expanded areas also increased the baseline for those villages by 169% indicating that the expanded village forest reserves had on average

slightly higher risk than the existing reserves. The project was able to find additional forests to add to the project area in every village it engaged with in 2023 regardless of how long ago the village had established its village forest reserve. Thus, the scale of the conservation work in the project communities is working is not common practice.

Furthermore, the analysis presented in sub-step 1b shows that even though community-based forest management in the reference region had left ample forests for farmers to clear outside of village forest reserves, encroachment in village forest reserves was widespread. In part, this is because multi-decade support is not common practice with donor funded projects typically having 3-to-5-year timelines. Donors expect villages to achieve financial independence for conservation activities after the initial support to create the village forest reserves. For instance, donor supported forest conservation activities for second instance villages in Morogoro Region ended in 2019 with the end of the TTCS project. In Nachingwea, the Mpingo Conservation and Development Initiative, which had previously supported many of the project villages had no donor funding to support the villages at the time those villages joined the VCSL project. More durable solutions require multi-decade funding that can ensure that conservation and leakage avoidance activities are funded regardless of the policy and market environment for sustainable forest use. Currently this can only be accomplished with carbon finance.

2.2 Description of Baseline Scenario (Step 2): Analysis of Agents, Drivers and Underlying Causes of Deforestation and Their Likely Future Development

In February 2023, the project introduced a new forest patrol technology to forest patrol teams. The system uses Mergin Maps, which has a plugin for QGIS, a cloud server, and a mobile GIS data viewing and collection app. Using base maps from Planet.com, the project mapped all the forest disturbance that occurred within the project area and proposed project areas from May 2022 to February 2023 and synced the deforestation polygons to the cloud server. Then the project provided a smart phone to each forest patrol team and trained them how to use the Mergin Maps mobile app to navigate to the polygons of deforestation, record details about the deforestation, and survey the deforestation agents where possible. Where village forest patrols teams were inactive, or where the forest tenure had been changed from village to municipal land, the project worked with local government to re-establish forest patrol teams from households living adjacent to the project area forests.

Forest patrol teams then continued to collect new data through the monitoring period, though deforestation maps were not regularly updated during the latter half of the 2024 farming season.

In addition to the Mergin Maps data, the project conducted focus group discussions with community leaders and village natural resource committees to gather basic baseline data about the socio-economic conditions in each community.

Taken together, these datasets provided the project with comprehensive and up-to-date information on the agents, drivers, and underlying causes of deforestation within the project area itself, so there is no

need to extrapolate from the reference region, though all indications are that the project area is very similar to the reference region.

2.2.1 Identification of Deforestation Agents

As of June 2024, forest patrol teams had made 4,853 forest disturbance agent entries in the Mergin Map system. The dataset includes many duplicates, because data is recorded for each polygon and the same agent is often responsible for multiple forest disturbance polygons. Filtering the data by unique names and ages, and for complete residence length information, the dataset is reduced to 2501 entries, though duplicates remain due to differences in name spelling. However, the pattern of duplication should not systematically bias the data.

With a few exceptions, almost all the deforestation agents resided in a project community (69%) or community adjacent (27.5%) to the project area. There were only 88 records (3.5%) of a deforestation agent living farther than 10km from the project area, mostly comprising smallholder farmers from nearby villages and towns who move to the forests during farming seasons and return to their homes after harvesting. This is because most deforestation is driven by small holder agriculture and the main mode of transportation to farms is walking. Only larger scale commercial farmers have transportation means that would allow them to live farther from the project area and that type of farming is still relatively rare in the vicinity of the project areas. This conclusion is also supported by the breakdown of household transportation assets from the 2022 census for Morogoro and Lindi Regions (Table 10).

Table 10 Household transportation assets from 2022 census

Region	Bicycle	Motor Vehicle	Motorcycle / Vespa
Morogoro	24.2%	1.9%	7.8%
Lindi	29.2%	0.9%	9%

Deforestation agents can also be grouped by residence length and whether they come from a community neighboring the project area or farther away. Approximately 29% of agents had shifted their residence in the 5 years prior. However, 35% of those agents had simply shifted from a neighboring village. Due to the nature of the survey question, it likely that some of the 19% of agents that reported shifting from outside the project area in the previous 5 years also came from a neighboring village. This is because some of the reports of people coming from a different region are from project areas in Nachingwea that border Mtwara region and Tunduru district. Removing the records where that is likely to have occurred reduces the percent of agents moving to the vicinity of the project area within the past 5 years to 17%. Thus, approximately 83% of deforestation agents have resided in the vicinity of the project area for more than 5 years.

Table 11 Deforestation agent genders

Gender	Percent (total sample size = 2444 entries
Female	10%
Male	90%

Deforestation agents are overwhelmingly male (Table 11). This may be because women are less likely to be involved in the clearing process itself and more likely to work farm areas closer to home. Making new farms in the forest often requires walking substantial distances from home and it may not be practical for women, who are principally responsible for childcare, to walk such distances with young children.

Table 12 Deforestation agent ages

Quantile from youngest to oldest	Age Range
1-25%	18-35
26-50%	36-44
51-75%	45-52
76-100%	53-92

Considering that in 2022 census data for mainland Tanzania, 55% of people over the age of 18 are 35 years or younger, deforestation agents (Table 12) are significantly older than the average Tanzanian adult. However, this may in part be explained by differences in education attainment. Older generations have lower rates of educational attainment and thus have fewer options beyond farming. Another factor is that younger people are more likely to move to cities to look for work. This can be seen in Lindi in particular. In the 2012 census, there were a significant number of missing men (Figure 27) between the ages of 20 and 50 which because many men had shifted to cities to look for work. With the opening of the Mkapa bridge in 2004 and improved roads since then, Lindi has become much better connected to the country's major export cities making cash crop farming more attractive and this has reduced the demographic imbalance (Figure 28), though it is still visible.

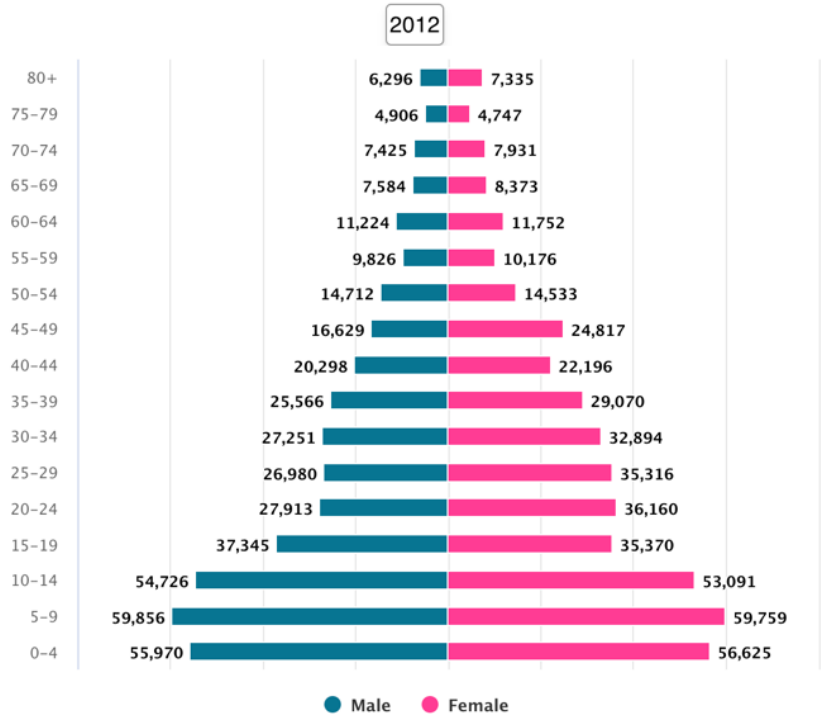


Figure 27 Lindi population pyramid 2012

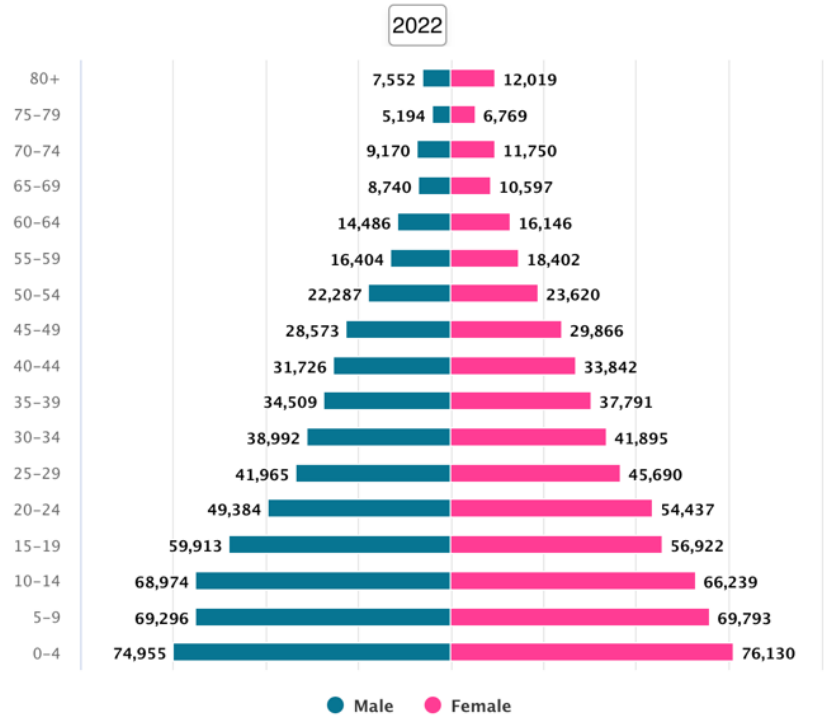


Figure 28 Lindi population pyramid 2022

Table 13 Deforestation agents by education attainment

Education Level	Percent (total sample size = 2468 entries)
None	32%
Primary	64%
Secondary	3.6%
Post-Secondary	0.4%

Considering that that the 2022 census data reports that 22% of Mainland Tanzania adults have secondary or above education, deforestation agents in the project area are significantly less educated than the average Tanzanian adult. This makes sense since people with higher levels of education are less likely to engage in other livelihood options that are not open to those with less education.

Expected changes in deforestation agents.

Tanzania has not produced updated population growth expectations based on the 2022 census but considering that the countries fertility rate is currently 4.7 births per woman and nearly half the country's population is under the age of 17 (Figure 29), high population growth rates can clearly be expected during the baseline validity period as today's youth come of age. This will also doubtlessly translate into a large growth in absolute terms of the deforestation agent population. According to the project's baseline focus group discussions, the secondary school enrollment for secondary school age children is 33.6%. This is substantially higher than before, but the number of people in the project area with less than secondary school attainment is set to increase substantially during the baseline validity period, both from local and immigrant populations.

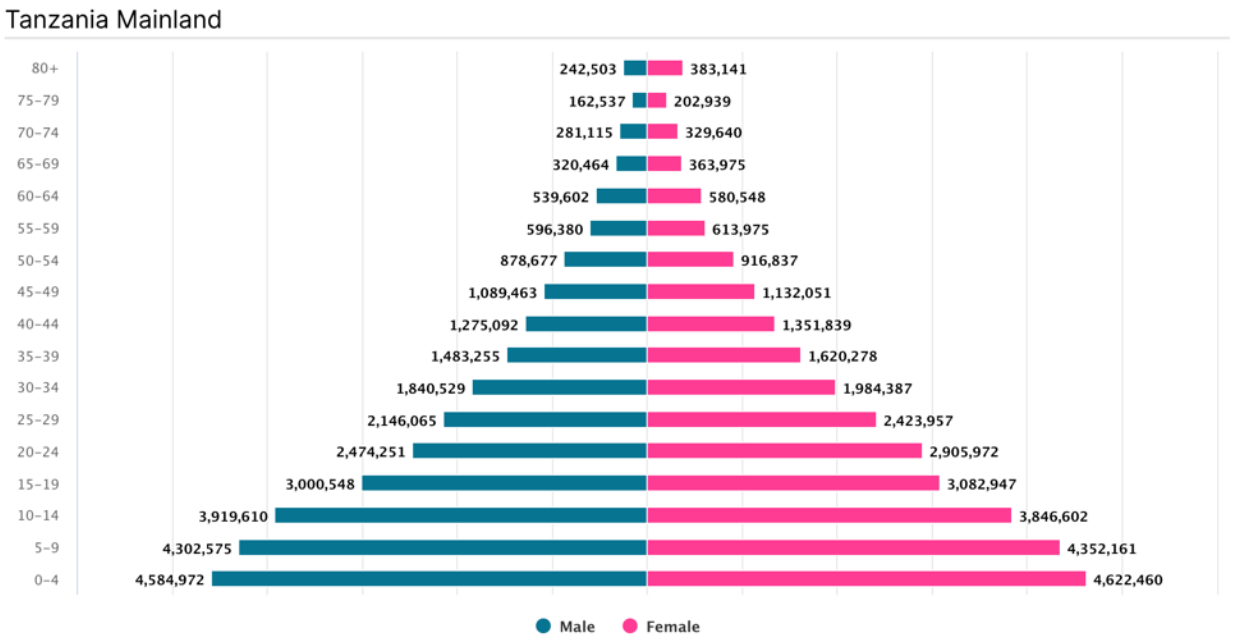


Figure 29 Tanzania Mainland 2022 Population Pyramid

2.2.2 Identification of Deforestation Drivers

Field Data

As of June 2024, the forest patrol teams had uploaded patrol data from 5273 disturbance polygons covering 4,635 acres of disturbance from polygons ranging in size from 0.01 to 24.24 acres.

Forest patrol teams recorded what they believed was the primary cause of the disturbance (Table 14), all other disturbance causes they observed (Table 15), and the crops grown if any (Table 16). There were 4010 records for farm clearings with valid crop records covering 3,843 acres.

The results from Table 14 and Table 15 make it clear that deforestation in the project area is almost exclusively driven by agriculture with most other forest disturbance activities simply being opportunistic activities carried out by farmers as part of farm clearing. Additionally, most of the other disturbance activities are technically drivers of degradation rather than deforestation since they are small scale and unlikely to lead to permanent land-cover change. Charcoal production was the primary driver of disturbance for just 2% of the area cleared. The opportunity cost study conducted in Lindi in 2021 found that the charcoal production opportunity cost was negative in most locations due to the high labor and transport costs. It appears primarily an activity reserved for forest near cities or major roads linking cities, which are becoming increasingly rare due to conversion to agriculture. In the past decade, an increasingly percentage of charcoal sold in Dar es Salaam, Tanzanian's largest charcoal market, has come the southern highlands where it is made from invasive black wattle trees that grow rapidly in fallow farms.

Table 14 Primary cause of forest disturbance in project areas from (May 2022 – May 2024)

Primary Disturbance Factor	Percent of Records	Percent of Area
Farming	91.22%	95.45%
Charcoal	3.79%	2.05%
Grazing	0.68%	0.44%
Building	0.13%	0.05%
Timber	0.19%	0.03%
Firewood	0.09%	0.04%
Fire	3.00%	1.13%
Other	0.64%	0.62%
None	0.23%	0.20%

Table 15 All causes of forest disturbance in project areas from (May 2022 - May 2024)

Disturbance Factor Present	Percent of Records	Percent of Area
Farming	91.69%	95.95%
Charcoal	5.73%	3.91%
Grazing	1.42%	1.22%
Building	2.12%	4.81%
Timber	0.57%	0.22%
Firewood	5.12%	7.27%
Fire	25.98%	24.47%
Building Poles	6.90%	11.59%
Other	1.35%	0.98%

Table 16 Crops grown in farm clearings in project area (May 2022 - May 2024)

Crop	Percent of Records	Percent of Area
Maize	48.60%	46.29%
Sesame	49.48%	55.60%
Cashew	10.27%	14.89%
Orchard	0.10%	0.02%
Peanut	3.29%	4.78%
Sunflower	8.78%	11.98%
Casava	5.64%	5.10%
Beans	4.21%	3.19%
Pigeon pea	22.29%	23.38%
Cowpea	5.26%	6.39%
Hill Rice	15.76%	14.17%
Sorghum	10.72%	9.84%
Vegetables	2.07%	3.17%

Eighty-three percent of farmed land with crop records had either Maize or Sesame or both. The most common stand-alone crop was Sesame, covering 24.44% of area. Principle food crops including maize, sorghum, casava, rice, millet, beans, banana, cowpeas, and pigeon peas were found in 75% of farms representing 79% of farm clearing by area. Principle cash crops including sesame, cashew, sunflower, pigeon pea, cowpea, peanuts, and orchard crops were found in 80% of farms representing 91% by area. Sesame, cashew, and sunflower, which are exclusively cash crops were found in 66% of farms representing 78% of farm clearing by area.

Driver variables explaining quantity of deforestation

Population Growth

The quantity of deforestation within the reference region has been steadily increasing over time (see section 4.1). The primary explanation is faster population growth, particularly the increase in the less educated population which has few livelihood options outside of farming. The growth rates for Morogoro and Lindi Regions between 2012 and 2022 were much higher than the previous 10 years (Table 17).

Some of that growth would have gone into urban areas, but the total 2024 town and city populations[56] of Morogoro and Lindi are less than the 2012-2022 change so obviously there was also substantial growth in rural populations. Nationally, the rates of attainment of secondary or higher education doubled between 2012 and 2022, but the total number of Tanzanian adults with primary or less educational attainment increased by 22%. As shown in the section on deforestation agents, 96% of project area deforestation agents fall into this group.

One of the key project activities is to increase secondary school enrollment in project communities by increasing secondary school accessibility. Over the long run, this will give more project community members more livelihood options beyond farming and thus reduce pressure on forests. Additionally, global studies suggest that increased secondary school attainment for women is associated with reduced population growth as it tends to delay the age of first pregnancy and increase women's empowerment.

Table 17 Morogoro and Lindi Region population from past 3 censuses

Region	2,002	2,012	2022	Change 2002-2012	Change 2012-2022
Morogoro	1,753,362	2,218,492	3,197,104	465,130	978,612
Lindi	787,624	864,652	1,194,028	77,028	329,376

Commodity prices

The field data on disturbance causes suggests that both subsistence food and cash crop production pose a threat to the project area, thought there appears to be increasing focus on cash crop production. An unpublished opportunity cost study of farmers who had cleared forest between 2017 and 2020 in Lindi Region found that 67% reported planting maize and only 42% reported planting sesame. A national study of deforestation from 2010-2017 found maize in 57% of farms and sesame in 20%[57]. Given the apparent shift towards cash crops, it can be expected that commodity prices will play a larger role in deforestation. However, Tanzanian farmers are flexible in the crops they grow and can

[56] Data from WorldPopulationReview.com

[57] Doggart, N., Morgan-Brown, T., Lyimo, E., Mbilinyi, B., Meshack, C. K., Sallu, S. M., & Spracklen, D. V. (2020). Agriculture is the main driver of deforestation in Tanzania. Environmental Research Letters, 15(3), 034028.

rapidly respond to market conditions, so individual commodity prices may not matter as much when they can switch to a higher price commodity.

This may in part explain the drop in the percent of farmers cultivating maize, which was identified as the primary driver of deforestation during the first baseline validity period. Maize is the most important cereal crop in Tanzania and in neighboring countries. As reported in the first methodological annex for this project, the Tanzanian government periodically institutes maize export bans. This appeared to have constrained deforestation in Lindi historically as maize cultivation was the biggest driver of deforestation and higher when maize export bans were not in place. In 2012, in response to studies conducted by USAID and the World Bank that showed export bans did not improve food security and increased rural poverty, the Tanzanian government made a commitment not to impose crop export bans in the future. However, the commitment did not last long with the government once again instituting complete bans in 2016 and 2017[58] and then setting up a ridged export licensing system still in place in 2024[59]. Thus, farmers may be switching to cash crops more and more as a strategy to avoid the uncertainty of the maize market policies.

Export volume and value data from Tridge.com suggests that the export price of sesame from Tanzania has increased in recent years after drop in price in 2020 associated with record high production levels. The sesame export value reached a record high in 2023.

Table 18 Tanzania sesame export data (2019-2022) from Tridge.com

Year	Volume (millions of kg)	Value (millions of USD)	Price per kg (USD)
2019	126.93	168.52	1.33
2020	161.46	152.46	0.94
2021	133.46	149.33	1.12
2022	120.99	143.79	1.19
2023	154.88	225.6	1.46

One of the key project activities is supporting agricultural extension services aimed at improving farm yields outside of forests, particularly for Sesame and Maize, which are the crops most associated with

[58] https://www.thecitizen.co.tz/tanzania/news/national/govt-insists-a-ban-on-maize-export-won-t-be-lifted-2594602

[59] https://www.theeastafrican.co.ke/tea/business/kenya-loses-42pc-of-tanzania-maize-imports-4597522

deforestation in the project area. Additionally, the project is exploring the possibility of linking project area farmers to commodity dealers who may be able to offer higher prices for deforestation free commodities. Most sesame grown in Tanzania is exported to China, but about 12% in 2023 was shipped to Japan, which is a G7 country. The 2019 G7 Environment Declaration on halting deforestation recognized the role of commodity supply chains in deforestation. Japan's global deforestation footprint is increasing according to a 2022 report by the Food and Land Use Coalition[60] which also found that sesame seed imports are responsible for 4% of Japan's deforestation footprint. By rewarding deforestation free sesame cultivation, one of the key drivers of deforestation could be transformed into a force for forest protection.

Driver variables explaining the location of deforestation

Accessibility and proximity to markets

The most important factor affecting the location of deforestation is accessibility. Distance to settlements and roads obviously affects accessibility, but these variables do not capture fine scale details about the location of human activity on the ground. In many countries, this can be captured by distance to forest edge, which is the benchmark model under VT0007. However, in the Tanzanian context, distance to forest edge can be misleading due to the presence of many areas of natural grasslands without any human presence. This could be overcome with land-use maps that could distinguish reliably between grasslands and agricultural lands, and natural forests and agroforestry, but it is very difficult to distinguish these land-uses with high accuracy in Tanzania.

Instead, the best way to locate human land-use in the landscape is to map deforestation. There is a very clear relationship between distance to deforestation and the location of future deforestation. An analysis of deforestation in the reference region showed the 50% of 2016-2022 deforestation occurred within 141 meters of 2010-2016 deforestation, 75% within 351 meters and 95% within 1105 meters. This kind of accessibility is constantly expanding as farmers clear the frontier and increase the fragmentation of forests. Thus, forest accessibility should continue to increase during the baseline validity period.

In contrast, for distance to settlements (see 4.2.1 for dataset details), 95% of 2016-2022 deforestation is not accounted for until 7,469 meters from 2015 settlements, while for distance to tertiary and higher-level roads, the 95% mark wasn't accounted for until 16,894 meters. Thus, distance to recent deforestation clearly gives much more spatially detailed information on the location of future deforestation. This makes sense to because most deforestation agents are accessing the forest by foot. Roads and settlements will continue to expand over time, though in the case of roads, it often seems

[60] https://www.foodandlandusecoalition.org/wp-content/uploads/2022/09/Assessing-the-G7s-international-deforestation-footprint-and-measures-to-tackle-it.pdf

that they follow people in Tanzania rather than people following roads since most frontier expansion begins with foot paths.

Another factor affecting accessibility is land tenure status. Deforestation is much more likely on village land than in reserved lands such as National Parks, Game Reserves, Forest Reserves, and Nature Reserves where it is illegal, and rule enforcement is more likely due to the greater resources of the national government. Despite covering almost 1/3 of the reference region in terms of forest, national protected areas with clear boundaries had less than 1% of deforestation from 2016-2022. It should be noted that some of this effect it due to remoteness as deforestation does occur in some protected areas that are near people. There is no expansion of national protected areas expected during the baseline validity period and there are still millions of hectares of forest outside of protected areas available for clearing in the reference region.

Favorability for farming

As farming is the primary cause of 95.45% of cleared area (Table 14), it is important to consider what factors make an area attractive for farming.

Basic topographic variables play a role including elevation, slope, and topographic position index. Elevation can affect a whole range of factors important to farmers such as rainfall, temperature, and soil types. Steep slopes are generally less preferred for agriculture because tractors and draft animals cannot be used on steep slopes. However, in the context of the project area and reference region, most deforestation is driven by farming which is done by hand and as a result, people can often be seen farming on very steep slopes, particularly in mountain areas that have higher rainfall. As a result, what can be even more important than slope is topographic position index which indicates whether a piece of land has a flat, concave, or convex shape. Farmers prefer flat and concave surfaces which will better regain soil moisture.

Soil types also play a role, but soil type maps like those of the FAO and Homogenized World Soil Database are generalized into very large polygons that disregard the much greater heterogeneity at finer scales that is necessary to predict the location of deforestation. Fortunately, Innovative Solutions for Decision Agriculture Ltd. (iSDA), has create a wide variety of soil characteristic maps for the African continent at 30-meter resolution using machine learning[61] and made them available on Google Earth Engine. Of particular interest in the Tanzanian context is the map of soil cation exchange capacity (CEC). CEC can be an indication of soil fertility, but perhaps equally important in the Tanzanian context is that higher CEC indicates higher moisture retention capacity. Almost all farming in Tanzania is rainfed, so soil moisture retention is critically important to farmers.

[61] Hengl, T., Miller, M. A., Križan, J., Shepherd, K. D., Sila, A., Kilibarda, M., ... & Crouch, J. (2021). African soil properties and nutrients mapped at 30 m spatial resolution using two-scale ensemble machine learning. *Scientific reports*, *11*(1), 6130.

2.2.3 Identification of Underlying Causes of Deforestation

The 5 main underlying causes of deforestation in the reference region are as follows:

Local and National population growth

As shown in Table 17, the populations in Lindi and Morogoro regions increased by 38% and 44% respectively between 2012 and 2022. Rural population increases contribute to demand for food production and land for food and cash crop cultivation. Urban population increases contribute to demand for food production, and forest products like charcoal. Over the long run, by increasing access to secondary education, the project may reduce local population growth by providing more young people with the skills they need to find livelihoods in urban areas and indirectly by delaying the start of childbearing for young women.

Open-access land use regime

Sixty percent of the project area forest reserves were created specifically for this REDD project or in expectation of a REDD project. Prior to that, these forests were open-access land whereby people from the participating villages and to some extent surrounding villages, were free to clear forest for farming. Under the customary land tenure system employed in these villages, clearing forest allowed households to convert forest land from open access communally owned land to individual household tenure. The only constraints on clearing forests were labor supply and demand for farm crops. By establishing village forest reserves and enhancing forest protection and boundary marking methods, the project has transformed these areas from open access to communally owned and protected areas with funding for protection.

Poor enforcement of forest management plans

Forty percent of the project area forests were in village forest or local authority reserves prior to the project. Protection of these forests was mixed prior to the project. As part of establishing the new project instance in 2023, VCSL identified over 20,034 ha of land that had either been part of a VLFR or planned Wildlife Management Area prior to the start of project activities that were removed from consideration as potential project areas due to heavy agricultural encroached. The underlying causes of poor enforcement are lack of revenue, technical capacity, failure to involve forest adjacent community members in forest protection activities, and lack of awareness[62] of forest reserves and boundaries. The project addresses these underlying issues by funding forest patrol activities directly, mapping and communicating the location of encroachment to forest patrol teams on a regular basis and establishing new forest patrol teams with members from forest adjacent communities regardless of which community the forest belongs to. The project is also improving boundary marking through boundary

[62] Forest patrol teams found that 27% of the deforestation agents they asked were not aware that they were farming inside a protected area.

clearing and will eventually have aluminum boundary markings placed at regular intervals along boundaries facing people. These boundary marking activities are standard practice for better protected national protected areas in Tanzania, but surprisingly have never been done before for village forest reserves or local authority reserves.

Farming conditions

Farmers in the project villages practice expansive agriculture with low yields rather than intensive agriculture with higher yields. This requires a lot more land that would otherwise be needed to produce the same amount of crop. Baseline focus groups discussions conducted by VCSL in each project village suggest that only 6.8% use fertilizers of any kind despite nationwide government subsidies.

Poor soils, weeds, grass, and pests also cause many farmers to shift their cultivation frequently. Maize demands relatively high soil fertility leading farmers to clear forests in search of more fertile soils. Sesame cultivation is susceptible to insect pests, which some farmers avoid by establishing clearings within forest that are isolated from other farms. Historically, when populations within the reference region villages were lower, shifting cultivation was probably sustainable and forests had sufficient time to regenerate between clearings. Today, however, fallow periods have declined substantially, almost never exceeding 10 years with an average of 4 years. Other clearings have been converted to permanent farms and due to changes in soil and fire frequency some clearings failed to regenerate at all despite being abandoned for more than 20 years after cultivation. In the absence of the project, the soil, weed and pest conditions would likely only worsen in the future as population growth would put even greater limitations on fallow lengths.

The project will partially address both underlying drivers through promoting conservation agriculture interventions that help to maintain soil fertility, prevent the buildup of weeds, and increase yields through a combination of improved seeds and labor-intensive soil moisture management techniques. Ironically, poor soils are also part of the reason for low fertilizer use in Tanzania. Increasing active carbon in the soil[63], which increases cation exchange capacity, makes fertilizers more effective. The best methods for doing this in the project context will be determined through experimentation. Potential options include reducing the use of burning to clear fallow farm biomass in favor of slashing and spreading biomass. The project may also explore the use of barrels for charcoaling fallow farm biomass which can then be added as a more permanent soil amendment to increase SOC and CEC.

The other leading explanation for the preference for expansive farming in Tanzania is the unpredictability of profits from farming. Weather and an uncertain government policy environment some crop exports may be restricted or banned play a role in this. While the project cannot impact

[63] Chamberlin, J., Jayne, T. S., & Snapp, S. (2021). The role of active soil carbon in influencing the profitability of fertilizer use: Empirical evidence from smallholder maize plots in Tanzania. Land degradation & development, 32(9), 2681-2694.

these factors, the project will explore options for crop insurance, which has been shown elsewhere in Tanzania to encourage the adoption of more intensive farming techniques[64].

Lack of alternatives to farming

Farming is the primary economic activity in the vicinity of the project areas and the primary driver of deforestation. The demographic profiles of deforestation agents, however, suggest that this type of farming and lifestyle is not preferred by younger Tanzanians with more skills and education are shifting in ever greater numbers from rural areas to urban areas. However, so far, this has only happened in relative terms. In absolute terms, rural populations who have few alternative livelihood options continue to increase. In the absence of the project, education and economic alternatives to farming would likely continue to slowly improve in the vicinity of the project areas as economies diversify and education levels improve. However, the project will accelerate this process. In addition to community level benefits aimed at improving access to education, REDD earnings paid as dividends to community members can be used to start small businesses or further improve education access. A survey of community members after the REDD test payments in the initial project instance found that 35% of households reported spending REDD dividends on entrepreneurial activities and 20% reported spending dividends on education. Additionally, all villages decided to spend some of their earnings on improving education services.

2.2.4 Analysis of chain of events leading to deforestation

In summary, in the baseline scenario, continued rural population growth, particularly growth in the number of people with less than secondary education and with few livelihood options beyond farming will lead to increased demand for agricultural land for both subsistence food and cash crop production. Continue urban population growth will also help ensure an expanding market for farm products. Variable weather, market conditions, and poor soils lead farmers to practice expansive and shifting rather than intensive agriculture practices, further expanding the total quantity of land required for farming. Most of the remaining forested land in the project areas would be under open access tenure, open to whoever had the labor necessary to clear it and convert it from communal to household ownership. Furthermore, even areas set aside for protection would be encroached at increasing rates as populations expand, donor funding for conservation ends, and the value of sustainable forest use remains uncompetitive with farming due to both ecological and policy factors.

2.2.5 Conclusion

The available evidence about the likely future deforestation trend in the reference region and project area is conclusive. While the country continues to become proportionately more urban, the countries

[64] van Dijk, M. P. (2022). Crop insurance, a frugal innovation in Tanzania, helps small maize farmers and contributes to an emerging land market. Land, 11(7), 954.

rural population exploded in the past 10 years in total terms and the population pyramid data suggests that trend will continue as nearly half of the country's population is under 18. The threat of encroachment into the project areas is directly observable and the drivers and agents are well documented from the available evidence.

3 ANALYSIS OF HISTORICAL LAND USE AND LAND COVER CHANGE

This section describes the collection and analysis of spatial data to assess the current land-cover and historical land-cover change within the reference region during the historical reference period.

3.1 Collection of Suitable Data

Historical and present land-use mapping in the reference region was conducted in Google Earth Engine using data from Landsat 5, Sentinel-2, and PALSAR I and II satellites. Land-cover mapping in Eastern Tanzania with optical data is exceptionally difficult due to extensive cloud cover throughout most times of year and strong seasonal effects on the appearance of vegetation making it difficult to distinguish land-cover types during the dry season. PALSAR I and II L-band radar satellites provide cloud free coverage that can distinguish many forests and non-forest landcover types accurately, especially during the dry season. However, L-band radar does not work well to distinguish non-forest from forest in areas with steep slopes, or dense perennial crops like sugar cane. It also can't distinguish between agroforestry and natural forests. Thus, it is most effective to use PALSAR data together with optical data when mapping land-cover.

Training and accuracy assessment data was accessed through Google Earth Engine. This included Planetscope basemaps, which are provided free under the Norway's International Climate and Forests Initiative Satellite Data Program, in the case of single year mosaics of Sentinel-2 data, and in the case of GEDI lidar height and cover metrics. Training and accuracy assessment data also came from the collection of high-resolution imagery available on Google Earth.

The complete list of data sources is presented in VM0015 Table 4.

VM0015 Table 4 Data Used for Historical LU/LC Change Analysis

Vector	Sensor	Resolution (m)	Type	Reference Region Coverage	Mosaic Acquisition Pixel dates		
					Min Date	Median	Max
Satellite	Landsat 5[a]	30	Multi-spectral	100%	7-Feb-05	5-May-08	10-Jul-10

Satellite	PALSAR I	25	L-band Backscatter	100%	7-Jul-07	8-Sep-07	14-Oct-07
Satellite	PALSAR I	25	L-band Backscatter	100%	25-Apr-08	12-May-08	31-Jul-08
Satellite	PALSAR I	25	L-band Backscatter	100%	13-Jun-09	7-Jul-09	17-Oct-09
Satellite	PALSAR I	25	L-band Backscatter	100%	1-May-10	10-Jul-10	23-Sep-10
Satellite	PALSAR II	25	L-band Backscatter	100%	30-Jan-15	26-Jul-15	23-Oct-15
Satellite	PALSAR II	25	L-band Backscatter	100%	29-Jan-16	24-Jul-16	7-Oct-16
Satellite	PALSAR II	25	L-band Backscatter	100%	10-Feb-17	30-Aug-17	25-Oct-17
Satellite	PALSAR II	25	L-band Backscatter	100%	4-Mar-18	22-Jul-18	19-Oct-18
Satellite	PALSAR II	25	L-band Backscatter	100%	26-Jul-19	9-Aug-19	1-Sep-19
Satellite	PALSAR II	25	L-band Backscatter	100%	24-Jul-20	16-Aug-20	13-Nov-20
Satellite	PALSAR II	25	L-band Backscatter	100%	28-Jul-21	25-Aug-21	12-Nov-21
Satellite	PALSAR II	25	L-band Backscatter	100%	27-Jul-22	24-Aug-22	11-Nov-22
Satellite	Planetscope[b]	4.77	Visible light	9%	~1-Jan-22	~15-Jan-22	~31-Jan-22
Satellite	Planetscope	4.77	Visible light	9%	~1-Feb-22	~14-Feb-22	~28-Feb-22
Satellite	Planetscope	4.77	Visible light	9%	~1-Mar-22	~15-Mar-22	~31-Mar-22
Satellite	Planetscope	4.77	Visible light	9%	~1-Apr-22	~15-Apr-22	~30-Apr-22
Satellite	Planetscope	4.77	Visible light	9%	~1-May-22	~15-May-22	~31-May-22
Satellite	Planetscope	4.77	Visible light	9%	~1-Jun-22	~15-Jun-22	~30-Jun-22
Satellite	Sentinel-2	10	Multi-spectral	100%	~1-Mar-16	~30-Apr-16	~30-Jun-16
Satellite	Sentinel-2[c]	10	Multi-spectral	100%	~1-Mar-19	~30-Apr-20	~30-Jun-21

Satellite	Sentinel-2	10	Multi-spectral	100%	~1-Mar-22	~30-Apr-22	~30-Jun-22
Satellite	Various sensors from Google Earth	0.3	Visible light	100%	2008		2023
ISS	GEDI	25	Lidar Height and Coverage Estimates	0.004%	20-Apr-19	12-Jun- 20	28-Dec-21
Satellite	PALSAR I	50	AGB estimates from radar backscatter	100%		2010	

[a]The Landsat 5 mosaic used as an input into mapping circa 2010 landcover was created using a javascript tool written for Google Earth Engine created by Kasper Hurni and Lukas Wuersch at the Centre for Development and Environment (CDE), University of Bern, Switzerland. The tool allows the user to specify a range of years and dates within the years to create a mosaic of Landsat data. The tool also filters out scenes with more than 80% cloud cover. All other scenes within the range of years and period within a year are included in the mosaic. The project used the default option of creating a mosaic from median values after masking out clouds. The chosen date range from within years was January through July. June and July are in the dry season and generally not optimal for distinguishing forest land-cover from other land-covers, however, they also are a time of year when there is generally less cloud cover in the mountainous parts of the reference region which remain green at that time of year. Also, it was assumed that PALSAR data would be a more influential variable in the model for mapping land-covers outside of mountainous areas since it is not impacted by seasonality. The range of years was set to 2005 to 2010 since any lower range was insufficient to cover most masked cloud gaps from the mosaic. Extending the range beyond 2010 resulted in a poorer mosaic result as the availability of Landsat 5 imagery after 2010 declines significantly. Again, since PALSAR backscatter is the most powerful variable in the land-cover model areas without steep slopes, it was assumed that including Landsat data from prior to 2010 in the mapping would not bias the model for most of the reference region while improving performance in mountainous areas which make up a minority of the reference region. Also, the deforestation mapping was done using PALSAR change detection, so even areas that were incorrectly mapped as forest in 2010 due to the inclusion of older Landsat 5 data would be unlikely to be mapped as deforested if there was no change in the PALSAR backscatter values. The map accuracy assessment presented in Table 24 appears to support both assumptions.

[b]Planetscope basemaps were only acquired for the project and leakage belts as full reference region coverage would have been too large and costly to export to Google Cloud.

[c]The Sentinel-2 mosaic used to map circa 2020 land-cover was also a multiyear mosaic. It was created in Google Earth Engine using March through June imagery from 2019-2021. It was not used to create a

forest benchmark map for a particular timeframe, so the multi-year nature of the mosaic has no effect on the estimation of historical deforestation rates.

Minimum value PALSAR mosaics were created in different combinations of years. This was done to reduce the effects of variable soil moisture associated with variable rainfall in the single year mosaics provided by JAXA. Soil moisture tends to increase backscatter. Since decreases in biomass always results in lower backscatter values, it was assumed that the minimum map was most representative of the final year of the mosaic since any loss of forest in that year would result in a decrease in backscatter in those pixels and their inclusion in the minimum mosaic. Thus, the 2007-2010 PALSAR minimum backscatter mosaic would be most representative of 2010 in terms of distinguishing between forest and non-forest. It would also come with the added benefit of excluding areas of short-term regeneration between 2007 and 2010 and thus actually increase the accuracy of the 2010 map by including backscatter data from 2007-2009 if it was lower than 2010.

3.2 Definition of Classes of Land Use and Land Cover

To map and model land-use land cover change during the historical reference period, the project used the minimum of forest land and non-forest land classes. However, for PA and LB forest carbon stock assessment, forest pixels were stratified into high and low carbon strata based on a 2010 biomass map of Africa created by Bouvet et al in 2018[65].

VM0015 Table 5 List of All Land Use and Land Cover Classes Existing at the Project Start Date in the Reference Region

Class Identifier		Trend in Carbon Density	Presence In	Baseline Activity			Description
ID_{cl}	Name			LG	FW	CP	
1	High Carbon Forest	stable	RR, LK, PA	x		x	Area of 0.5 ha or more with 10% or more cover of natural trees 5m in height or greater that have a predicted AGB of 55Mg/ha or more in the Bouvet et al 2018 map.
2	Low Carbon Forest	stable	RR, LK, PA	x	x	x	Area of 0.5 ha or more with 10% or more cover of natural trees 5m in

[65] Bouvet, A., Mermoz, S., Le Toan, T., Villard, L., Mathieu, R., Naidoo, L., & Asner, G. P. (2018). An above-ground biomass map of African savannahs and woodlands at 25 m resolution derived from ALOS PALSAR. Remote sensing of environment, 206, 156-173.

							height or greater that have a predicted AGB of less than 55Mg/ha in the Bouvet et al 2018 map.
3	Non-Forest	stable	LM		x	x	Area of 0.5 ha or more with less than 10% cover of natural trees 5m in height or greater. Natural trees are defined as any trees not including agroforestry such as cashew, mango, and citrus trees or timber/pole plantation trees such as pine, teak, and eucalyptus.

3.3 Definition of Land Use and Land Cover Change Categories

The list of possible LULCC categories is shown in VM0015 Table 6 and VM0015 Table 7.

There was no obvious pattern to post-deforestation land-uses in the reference region, especially with regards to post-deforestation carbon stocks. Residual trees, longer fallow lengths, and conversion to agroforestry can all result in higher post-deforestation carbon stocks, but the location and timing of these factors are not easily predictable. Residual trees present immediately after deforestation may or may not be cut down in subsequent years. Areas fallowed for 5 years may go into a much shorter fallow cycle or may continue to be fallowed for another 5 years and areas planted for agroforestry can be cleared for annual crops or even charcoal production.

VM0015 Table 6: Potential Land Use and Land Cover Change Matrix

ID_{cl}		Initial LU/LC class	
		i1	i2
Final LU/LC class	f3	i1/f3	i2/f3

VM0015 Table 7: List of Land Use and Land Cover Change Categories

ID_{ct}	Name	Trend in Carbon Density	Presence in	Activity in Baseline Case			Name	Trend in Carbon Density	Presence in	Activity in Project Case		
				LG	FW	CP				LG	FW	CP

i1/f3	High Carbon	constant	RR, LK, PA	X		X	Non-Forest	constant	RR, LK, PA	X		X
i2/f3	Low Carbon	constant	RR, LK, PA		X	X	Non-Forest	constant	RR, LK, PA		X	X

3.4 Analysis of Historical Land-Use and Land-Cover Change

The LULCC mapping process was designed to leverage more recently available datasets like the Global Ecosystem Dynamics Investigation (GEDI) lidar data to maximize the accuracy of the analysis even for time periods preceding this data. The general process is outlined as follows:

1. Create 2020 land-cover training data from GEDI height and cover metrics and supplementary points.
2. Create a 2020 land-cover classification.
3. Develop a 2010 land-cover training data set from areas of low PALSAR backscatter change between 2010 and 2022 based on the 2020 classification and add supplementary points.
4. Create a 2010 land-cover classification.
5. Create a training data for a change detection model using PALSAR backscatter data from 2010-2016.
6. Map deforestation from 2010 to 2022 in two-year increments using change detection model.
7. Remove false alarms from remote areas with various post processing steps and remove area of planned infrastructure.

Much of the analysis was conducted in Google Earth Engine. QGIS and Google Earth Pro were used to review training data sets against high resolution imagery.

GEDI LIDAR and Supplementary 2020 Land Cover Training Data

Canopy height and cover from processed GEDI shots were obtained for 2019-2021 from the following two Google Earth Engine Dataset:

1. GEDI relative height – 'LARSE/GEDI/GEDI02_A_002_MONTHLY'
2. GEDI cover - 'LARSE/GEDI/GEDI02_B_002_MONTHLY'

The datasets were filtered in Earth Engine using the quality and degrade flags to only obtain the best quality data. Daytime observations were discarded since they are less reliable. Dry season data (from June 15 – November 31) was also removed since the absence of tree leaves would lead to an underestimate of canopy cover. Points overlapping PALSAR pixels that may have undergone deforestation or afforestation between 2019 and 2021 were filtered out. These were defined as pixels

that had in reference to the median pixel value in the 2019-2021 dataset had an absolute difference in HV backscatter of 15% or more and where that difference resulted in crossing threshold value of 1867. The threshold value was determined from previous unpublished work using regression of PALSAR HV backscatter values and 2019 GEDI shots classified as either forest or non-forest in Lindi region. The final dataset comprised of 10,992 GEDI shots.

The filtered Lidar shots were split into forest and non-forest training points by defining forest as points with a 98% relative height of greater than or equal to 5 meters and cover of 10% or more and all points as non-forest. Then the points were reviewed for potential error associated with slopes, which lead to height estimate errors, and dense canopies, which lead to height and cover estimate errors, and edge errors associated with the difference between the location of the lidar shot and the pixels boundaries of the PALSAR dataset. All shots falling on slopes of 6 degrees, or more were reviewed using high resolution imagery. Then potential edge and dense canopy errors were identified by reviewing points classed as non-forest with a HV backscatter value of 1867 or more and points classed as forest with a HV value of less than 1867 using high resolution imagery. Identified errors were corrected.

The classification of 2020 land-cover was iterative with additional training points added after each classification run to fix errors identified through comparison of the map to high resolution imagery. The final training set consisted of 11439 points (Figure 30).

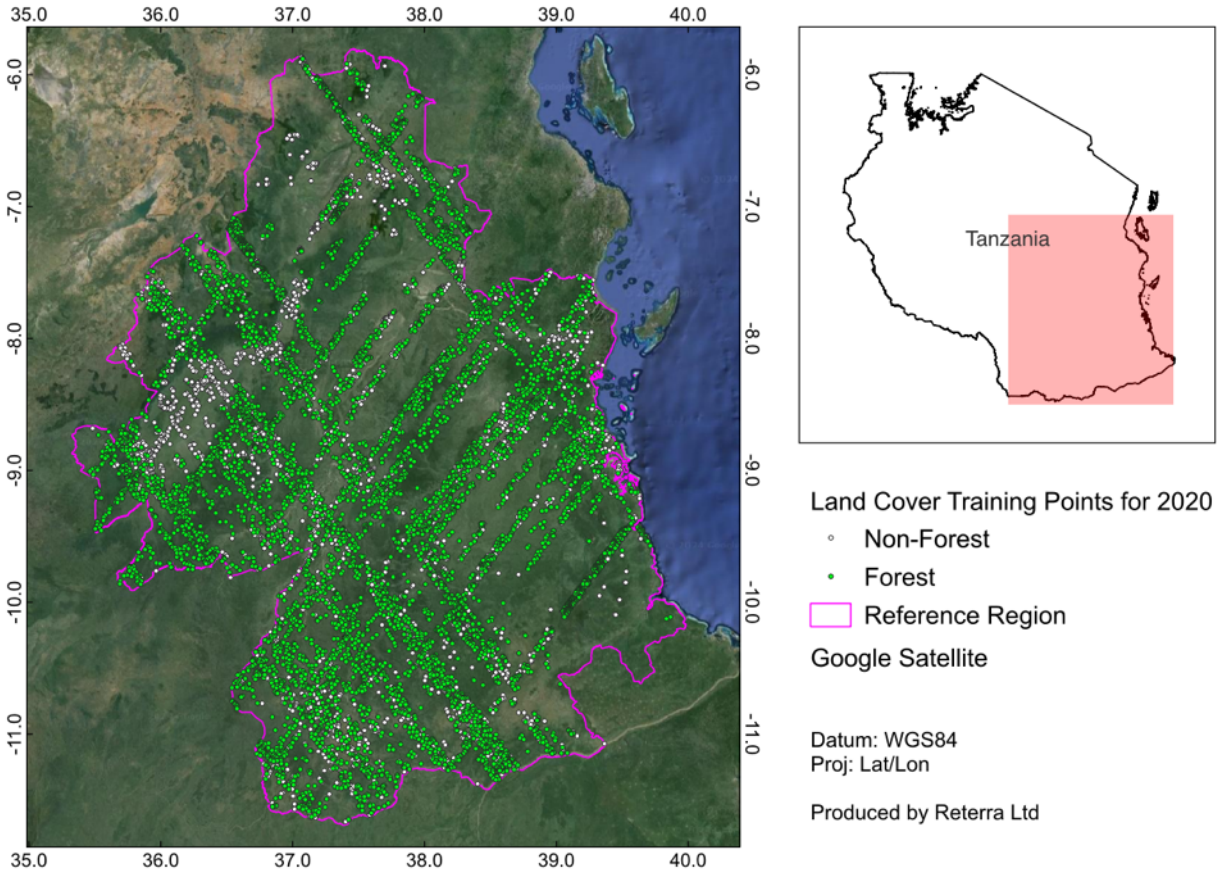


Figure 30 Land cover training points for 2020

Land Cover Classification 2020

The 2020 land-cover classification was made with a smileRandomForest model in Google Earth Engine with the 2020 training data. Default parameters were used except the number of trees which was set to 501. Input variables and processing are listed in Table 19. Twenty percent of the training point dataset was used for validation rather than training. The overall accuracy for the validation set was 91.5%.

Table 19 Land Cover Classification 2020 Input Variables

Google Earth Engine Image Collection	Bands selected / calculated used in model	Date Filter	Preprocessing

'JAXA/ALOS/PALSAR/YEARLY/SAR_EPOCH'	HV, HH/HV	2019-2021	Lee Filter, Median
'COPERNICUS/S2_HARMONIZED'	RED, GREEN, BLUE, NIR, SWIR1, SWIR2	Mar-Jun, 2019-2021	Median, Resampled to 25 meters
'COPERNICUS/DEM/GLO30'	Elevation, Slope, Aspect	NA	Resampled to 25 meters
'OpenLandMap/CLM/CLM_PRECIPITATION_SM2RAIN_M/v01'	Sum of Apr, May, Jun	NA	Resampled to 25 meters

Land Cover 2010 training dataset

The 2010 training dataset consisted of 20,000 random points from pixels showing less than 15% change when comparing a minimum PALSAR HV backscatter mosaic from 2008-2010 to a minimum PALSAR HV backscatter mosaic from 2020-2022, and 198 supplementary points added to improve the 2010 classification accuracy (Figure 31). These should mostly correspond with forest persistence and non-forest persistence between the two time periods. The minimum mosaic is used to reduce noise associated with difference in soil moisture and to include areas with low HV values in 2008 and 2009 in the non-forest class even if they had higher HV values in 2010, which helps reduce woody fallows from 2010 being classified as forest.

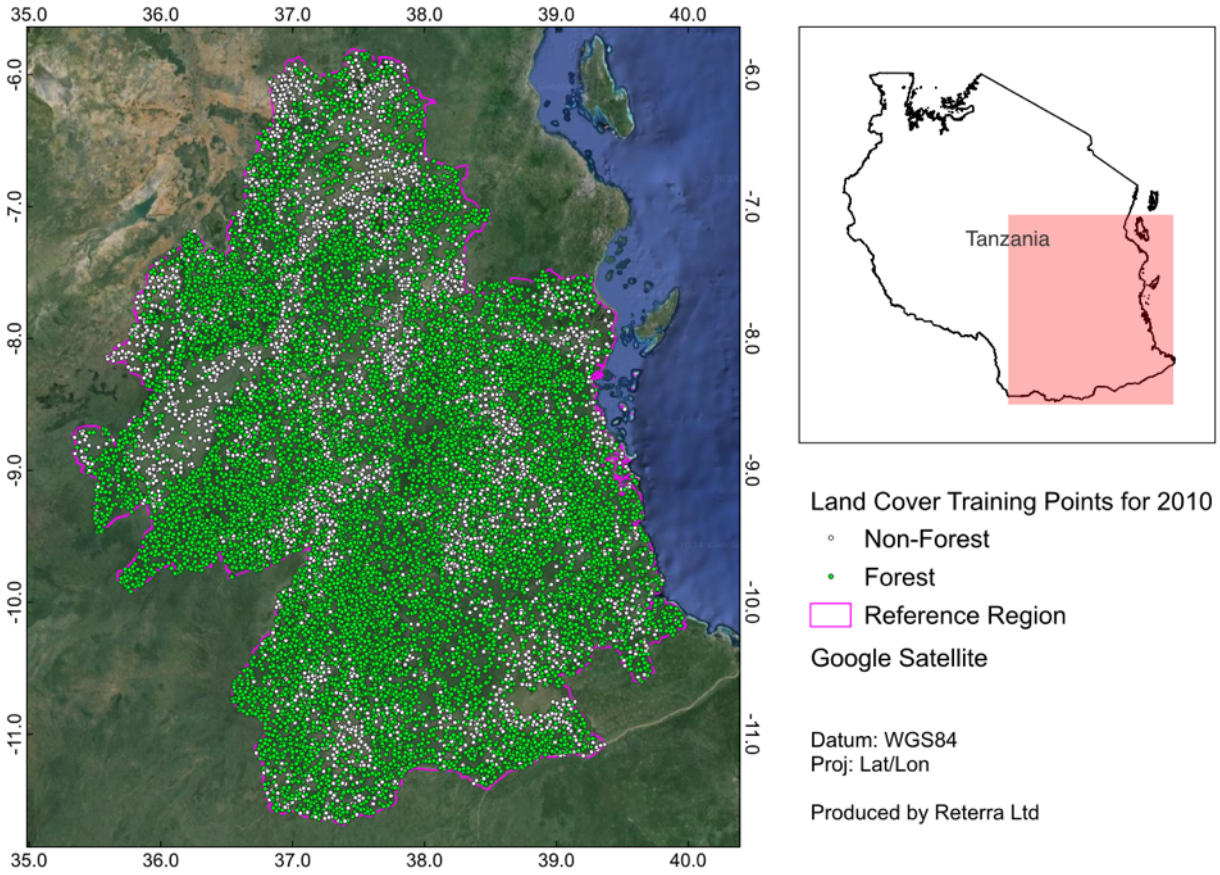


Figure 31 Land cover training points for 2010

Land Cover Classification 2010

The 2020 land-cover classification was made with a smileRandomForest model in Google Earth Engine with the 2010 training data. Default parameters were used except the number of trees which was set to 501. Input variables and processing are listed in Table 20. Twenty percent of the training point dataset was used for validation rather than training. The overall accuracy for the validation set was 93%.

Table 20 Land Cover Classification 2010 Input Variables

Google Earth Engine Image Collection	Bands selected / calculated used in model	Date Filter	Preprocessing
'JAXA/ALOS/PALSAR/YEARLY/SAR_EPOCH'	HV, HH/HV	2008-2010	Lee Filter, Minimum

'LANDSAT/LT05/C01/T1_SR'	RED, GREEN, BLUE, NIR, SWIR1, SWIR2, day of year	Jan-Jul, 2005-2010	Topographic Illumination Correction, Median, registered to Sentinel-2 mosaic used in 2020 classification, Resampled to 25 meters
'COPERNICUS/DEM/GLO30'	Elevation, Slope, Aspect	NA	Resampled to 25 meters
'OpenLandMap/CLM/CLM_PRECIPITATION_SM2RAIN_M/v01'	Sum of Apr, May, Jun	NA	Resampled to 25 meters

Deforestation Change Detection Training

Initial training points for deforestation were selected randomly from pixels classified in 2010 as forest that showed a decrease of 15% or more and ending value below 2500 in HV backscatter between a minimum 2008-2010 HV mosaic and a minimum 2015-2016 HV mosaic. Training points for persistence came from points classified as forest in 2010 not meeting the above criteria. All 2000 potential deforestation and persistence points were reviewed with high resolution imagery overlayed with PALSASR pixel boundaries. Training errors were corrected, and an additional 476 supplementary training points were added to improve the model accuracy.

Deforestation Change Detection Model

The land-cover change model was made with a smileRandomForest model in Google Earth Engine with the 2010-2016 forest persistence and deforestation training data. Default parameters were used except the number of trees which was set to 501. The input variables and processing are listed in Table 21. Twenty percent of the training point dataset was used for validation rather than training. The overall accuracy for the validation set was 95%.

After training, the model was applied to the 2010-2016 period and then to the 2016-2022 period in two years increments. The reference PALSAR mosaic for all change periods was the 2007-2010 minimum mosaic and then the end state PALSAR values came from a minimum mosaic of the final year and preceding year of the time period. Change detection for each time step was restricted to areas of forest not deforested in a previous timestep where the cumulative change detected between 2010, and the end of the time step was 0.5 ha or greater. This reduces the effects of PALSAR radar speckle on the

analysis while allowing for expansions less than 0.5 ha to be mapped if they were an expansion of previous clearing. The final output had values ranging from 0 to 5, reflecting 0 for initial non-forest, 1 for forest persistence, 2 for 2010-2016 change, 3 for 2016-2018 change, 4 for 2018-2020 change, and 5 for 2020-2022 change.

Table 21 Input variables for the change detection model

Google Earth Engine Image Collection	Bands selected / calculated used in model	Date Filter	Preprocessing
'JAXA/ALOS/PALSAR/YEARLY/SAR_EPOCH'	Start and End Mosaic HV and HH/HV, and ratio of ending mosaic HV over start mosaic HV	2007-2010 and 2015-2016	Lee Filter, Minimum
'COPERNICUS/DEM/GLO30'	Elevation, Slope, Aspect	NA	Resampled to 25 meters
'OpenLandMap/CLM/CLM_PRECIPITATION_SM2RAIN_M/v01'	Sum of Jan-Dec	NA	Resampled to 25 meters

Post change detection corrections

The first post classification step was to split the deforestation analysis into the calibration and confirmation periods. This was accomplished in python by reclassifying the change map to produce 3 forest cover maps for 2010, 2016, and 2022. Each forest cover map was sieved using an 8-pixel sieve to remove any forest patches less than 0.5 ha and then the maps were recombined to reproduce the change map.

Next, some corrections to the change map were made in QGIS using the Serval tools plugin. There were a few areas of clouds in mountainous areas that were not filled in the 2010 Landsat mosaic, which were than excluded from the analysis. These were filled in as 2022 non-forest or forest persistence

using recent high-resolution imagery for reference. There were also some small areas of missed deforestation in the initial project instance in Lindi, which were reclassed to the correct period of deforestation using high-resolution data as reference.

There is a large area of planned deforestation associated with the construction of the Nyerere Hydroelectric Dam in the center of the reference region. Using public reports on the final dam height and a digital elevation model clipped to the area upstream of the dam, the final footprint of the dam was calculated and masked. The footprints of new buildings and roads in the vicinity of the dam were also masked using high resolution imagery as reference.

After correcting errors and removing the dam, the map was reprojected from WGS84 Lat/Lon at approximately 25m resolution to World Cylindrical Equal Area projection at 25m resolution, which ensures that pixel-based area estimates are accurate.

Finally, some simple distance rules were used to remove false alarm and non-anthropogenic deforestation from remote areas. This was done in python. It was observed that most deforestation during the historical reference period occurred near other deforestation and that a 2-ha sieve removed most false alarms. Therefore, values at an extreme distance from at least 2-ha of deforestation were very likely to represent error or non-anthropogenic deforestation. Using a frequency analysis, it was identified that 99% of deforestation during the HRP was within 950 meters of 2 ha or more of deforestation during the HRP. The extreme 1% was reclassified as forest persistence. Then, to remove the remaining few larger blocks of error and non-anthropogenic deforestation, a distance to built-up pixels dataset was employed to identify deforestation pixels at extreme distances from settlements. For processing of the distance to built-up dataset, see 4.2.1 of the methodological annex. The LULCC map was scanned for examples of anthropogenic deforestation at extreme distances from built-up pixels. It was identified that no anthropogenic deforestation occurred at more than 22400 meters from a built-up pixel. All deforestation pixels farther than that from built-up pixels were reclassified as forest persistence. These steps reduced the total quantity of mapped deforestation by 1.1%.

The final forest cover benchmark maps for 2010, 2016, and 2022 calculated from the land-cover change map are shown in Figure 32, Figure 33 and Figure 34 respectively. The final change map showing forest persistence from 2010-2022, non-forest (assumed to remain non-forest from 2010-2022), and deforestation from 2010 to 2016 and 2016-2022 is shown in Figure 35.

The 2022 Land Cover map with the forest classes used for forest stratification is shown in Figure 36. This was created by stratifying the 2022 Forest Cover Benchmark map forest classes based on a 2010 biomass map of Africa created by Bouvet et al in 2018[66]. Forest areas with less than 55 Mg/ha of

[66] Bouvet, A., Mermoz, S., Le Toan, T., Villard, L., Mathieu, R., Naidoo, L., & Asner, G. P. (2018). An above-ground biomass map of African savannahs and woodlands at 25 m resolution derived from ALOS PALSAR. Remote sensing of environment, 206, 156-173.

aboveground biomass were reclassified as low carbon forest while all other forests were put into the high carbon class.

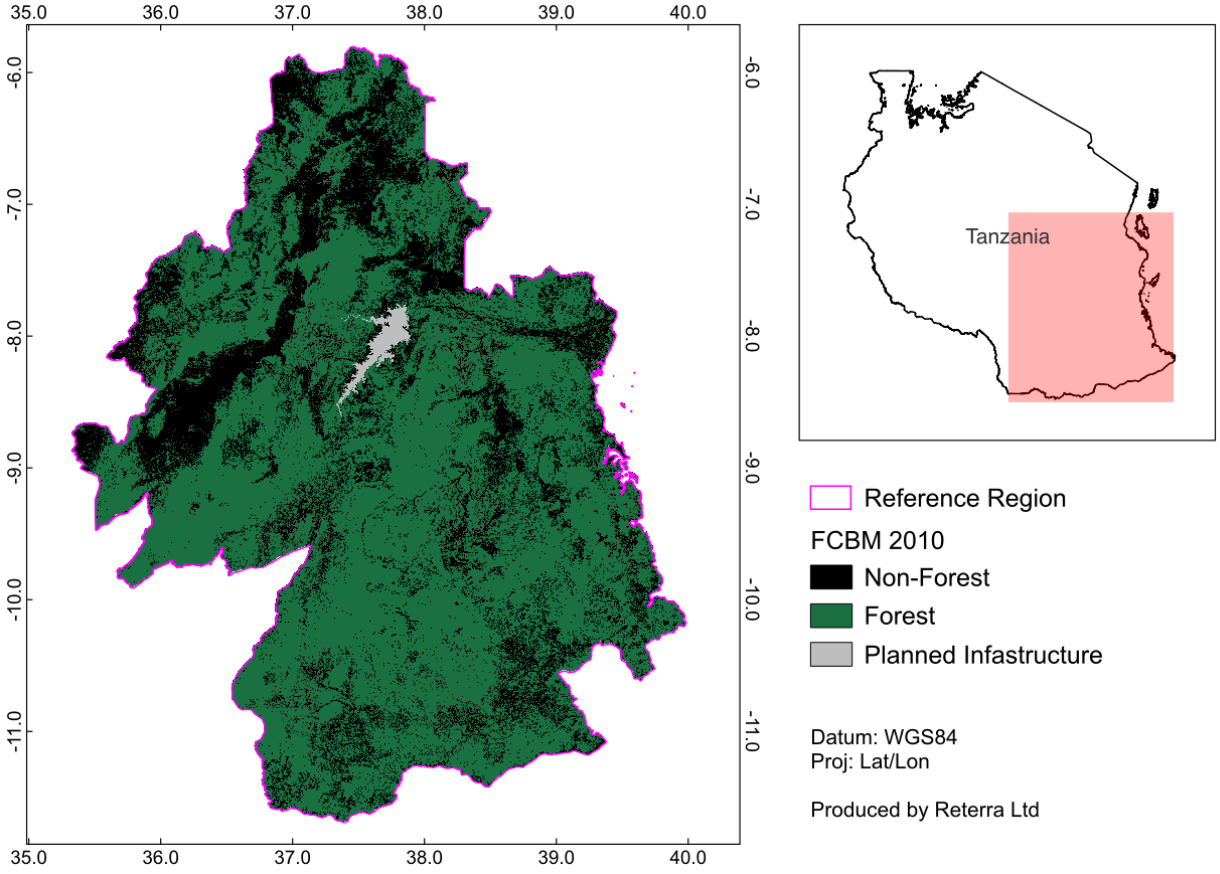


Figure 32 Forest Cover Benchmark Map 2010

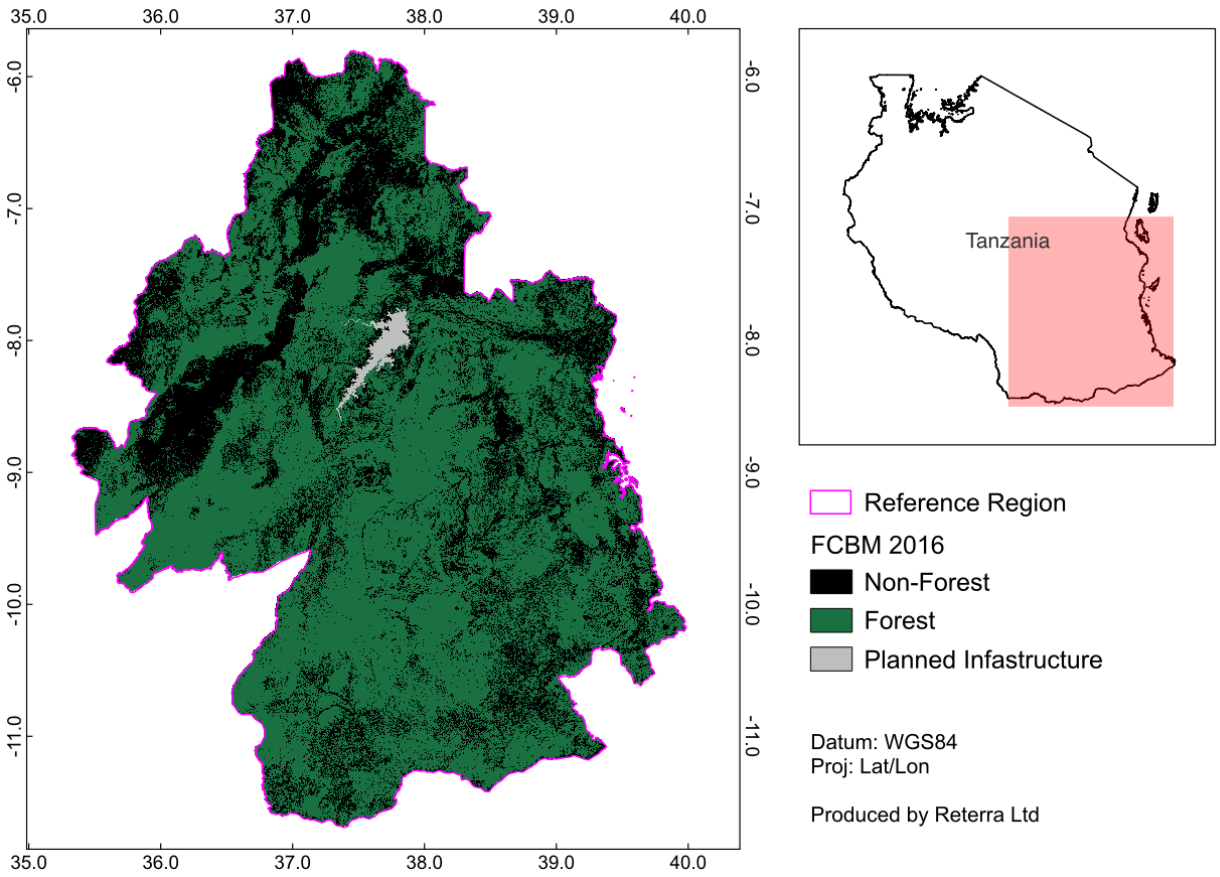


Figure 33 Forest Cover Benchmark Map 2016

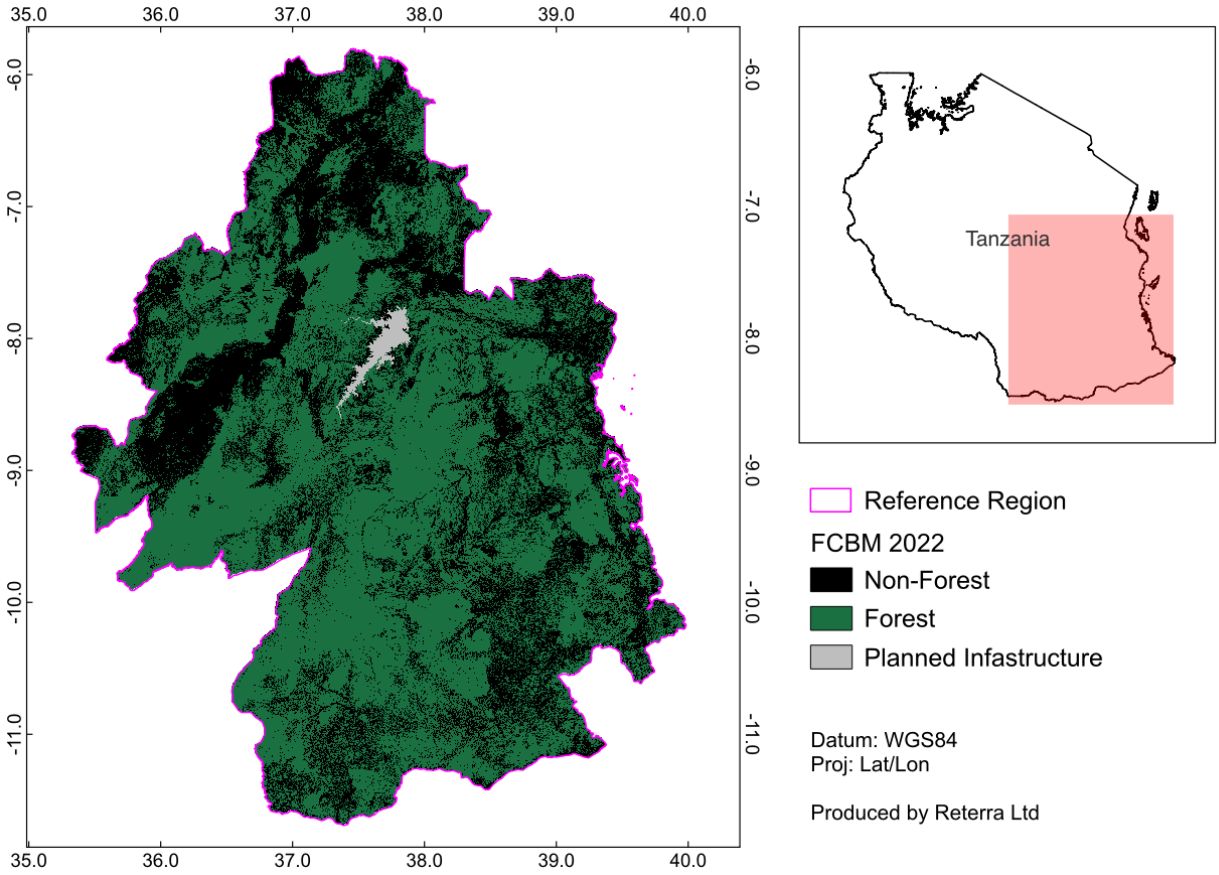


Figure 34 Forest Cover Benchmark Map 2022

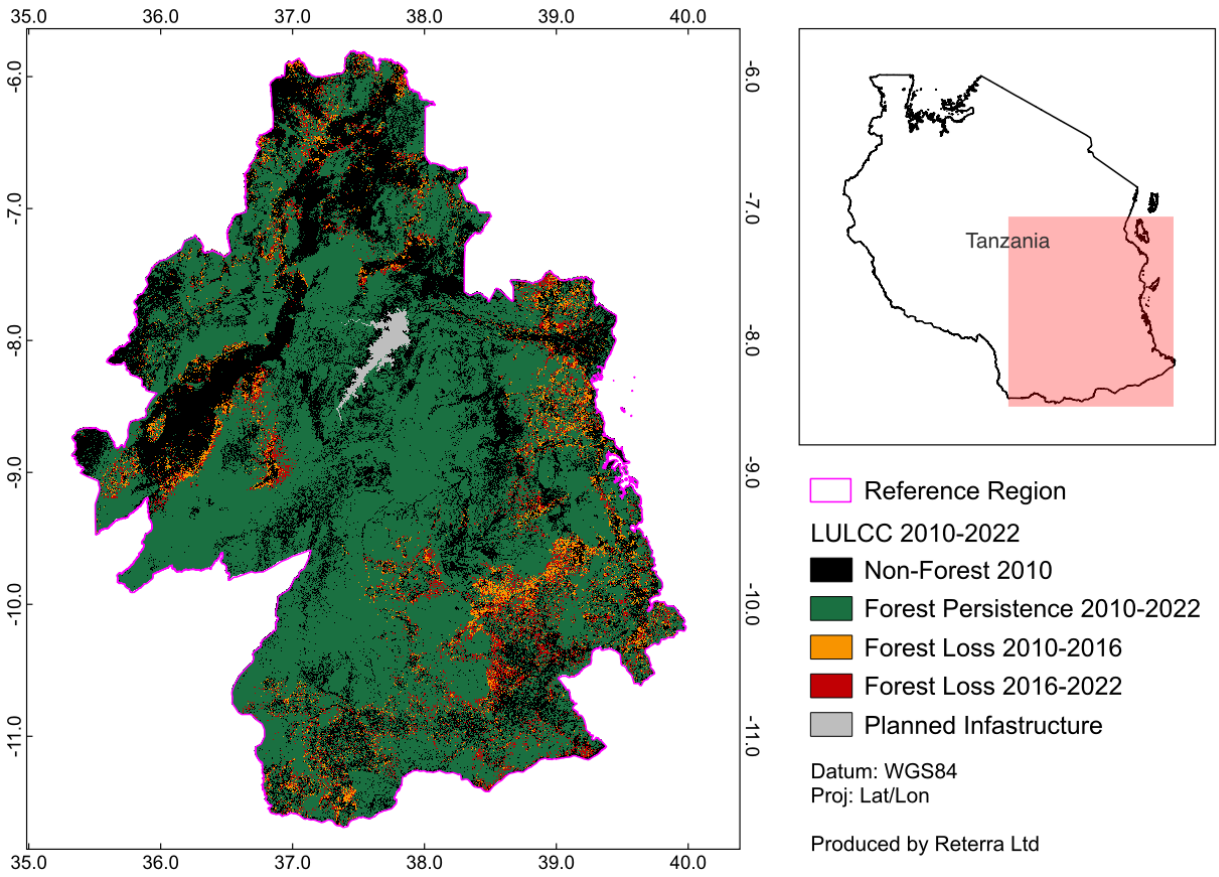


Figure 35 Land Use and Land Cover Change 2010-2022

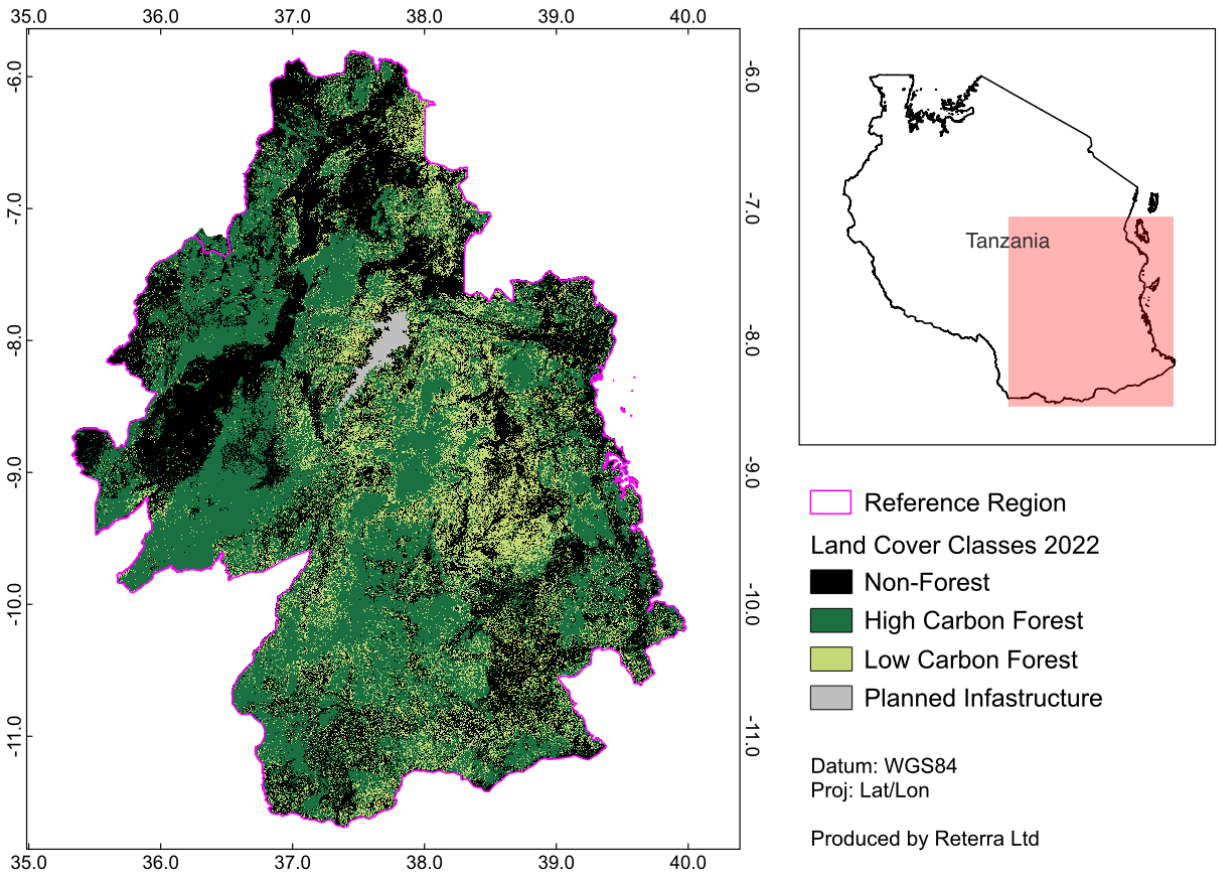


Figure 36 Land Cover Classes 2022

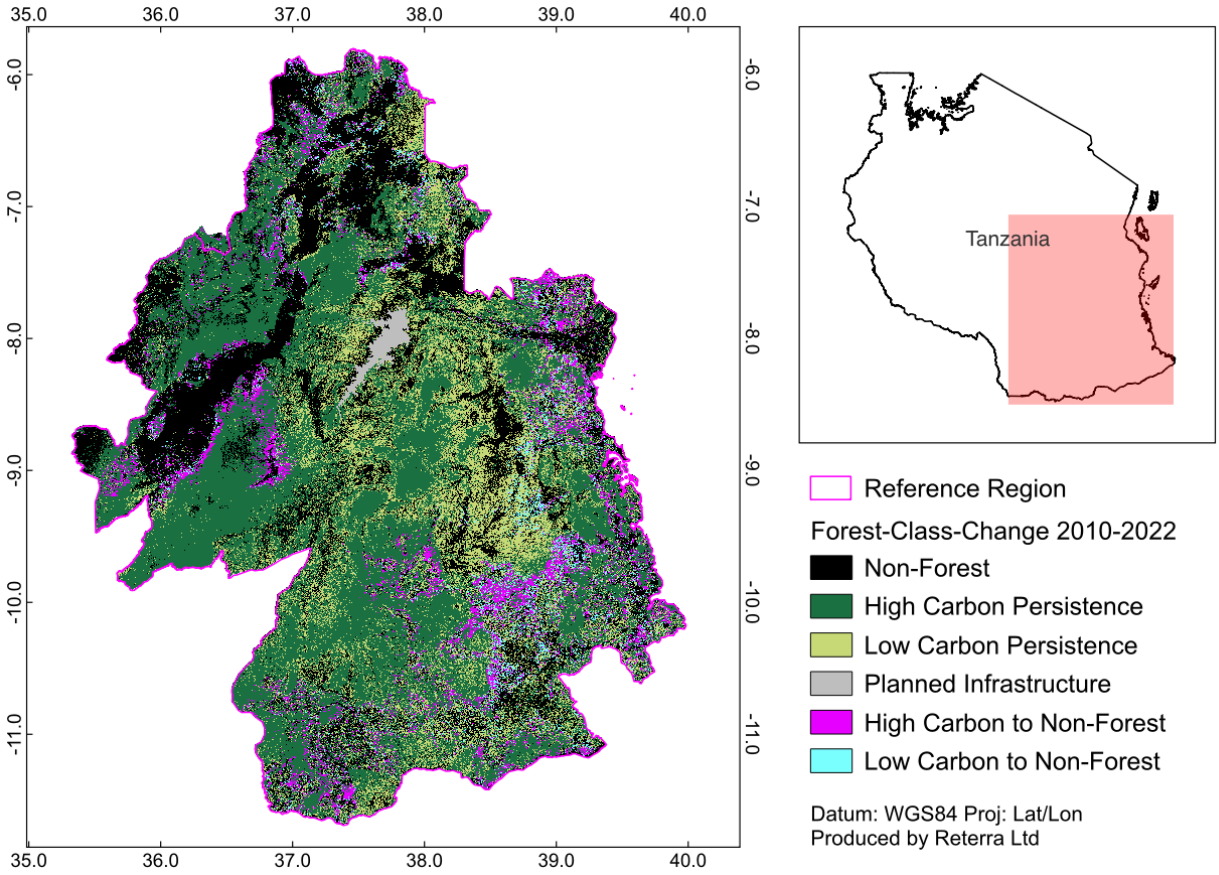


Figure 37 Forest Class Change 2010-2022

Table 22 Land Use Land Cover Change Matrix 2010-2012 in ha

Final \ Initial	High Carbon Forest	Low Carbon Forest	Final Area
High Carbon Forest	8,137,513		8,137,513
Low Carbon Forest		3,456,890	3,456,890
Non-Forest	1,052,899	561,153	1,614,052
Initial Area	9,190,412	4,018,043	13,208,455
Net Change	-1,052,899	-561,153	

Land cover mapping in Eastern Tanzania is exceptionally complicated due extensive cloud cover throughout most of the year, strong season effects on the appearance of vegetation, extensive dry season fires, and highly variable topography and land-covers. Dry season optical imagery can be difficult to interpret regardless of resolution, constraining the best analysis to wetter times of years which are also cloudier. For some Landsat scene footprints, there are historical gaps of up to 10 years in the availability of Landsat scenes with 10% or less cloud cover during the same month.

Fortunately, PALSAR I and II L-band radar data is available for the historical reference period, is cloud penetrating, and less sensitive to seasonal variation in the appearance of data. The Japanese Space Agency, JAXA, provides free annual global mosaics of processed PALSAR I and II HH and HV backscatter data and has uploaded the mosaics to a Google Earth Engine dataset. The mosaic product covering Tanzania is generally comprised of dry season data, which is perfect for mapping forest cover due to lower scene variances associated with soil moisture. L-band radar penetrates leaves and instead interacts with larger branches and stems. Thus, trees are distinguishable from other vegetation regardless of whether they have shed their leaves.

L-band radar however is influenced strongly by topography. The JAXA mosaic products have been terrain flattened, but this cannot correct for the effects of more extreme slopes. Thus, optical data is still useful in mapping the most rugged parts of the landscape.

3.5 Map Accuracy Assessment

Map accuracy assessment was carried out using an initial stratified random sample of 400 non-forest, 800 forest, and 250 deforestation pixels from the Land Use and Land Cover Change 2010-2022 map. Deforestation was oversampled to reduce the uncertainty of the area estimate for that class. However, the sample was drawn from the map before the footprint of the Nyerere dam was added. Additionally, the boundaries of the reference region were slightly modified when the National Bureau of Statistics released an updated ward boundary map in June 2022. As a result, 20 sample points fell outside the final reference region leaving 1510 total accuracy assessment points (Figure 38).

Points were reviewed using high resolution imagery from Google Earth and Planet.com basemaps. PALSAR 1-2 mosaics, Sentinel-2 Mosaics and the Landsat 5 mosaic were also used to aid interpretation. Forest cover at edge pixels was assessed using pixel boundaries from the original map projection as exported from Google Earth Engine, EPSG:4326.

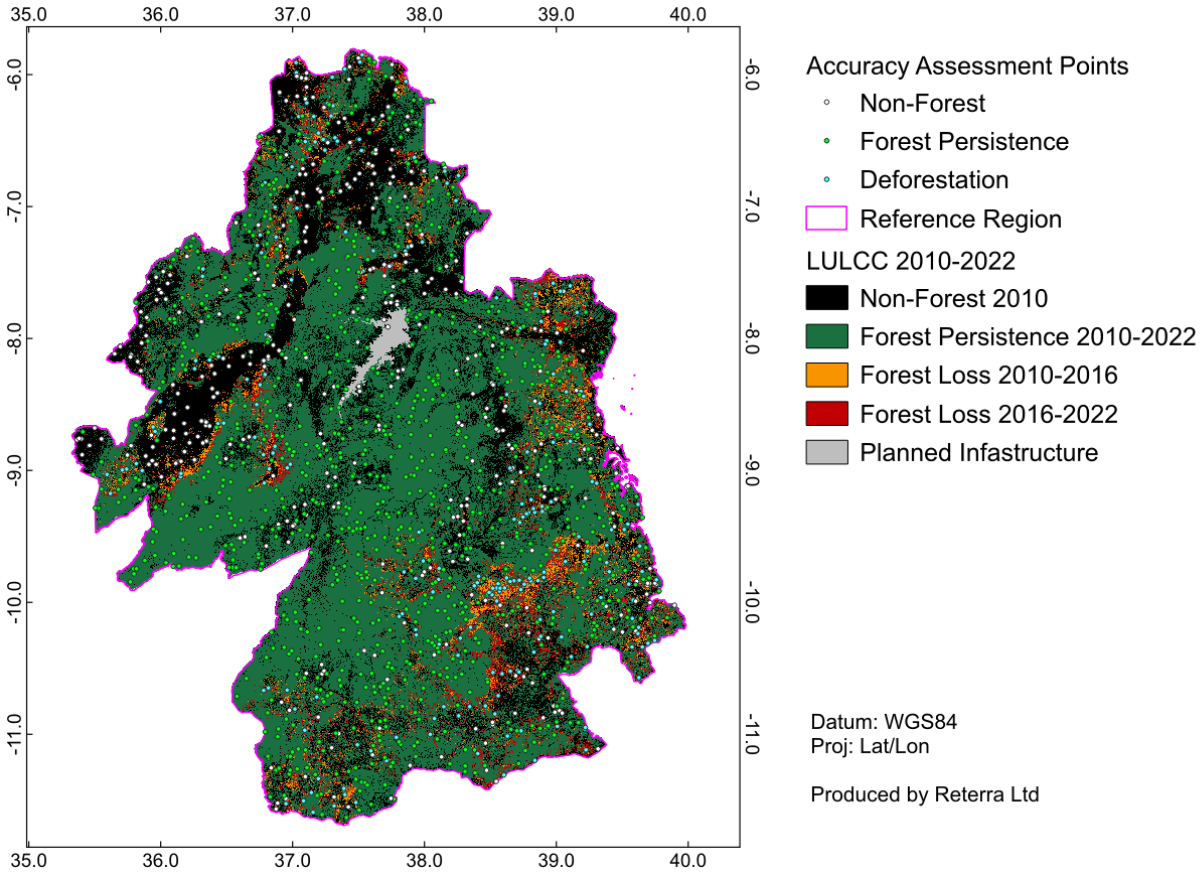


Figure 38 LULCC Accuracy Assessment Points

A confusion matrix of the sample data compared to the mapped classes is shown in Table 23. Table 23 also shows the mapped class areas and class weights for each class which were used to calculate an area weighted confusion matrix (Table 24). The area weighted confusion matrix shows that the accuracy of all categories is greater than 80%, meeting the requirements of the methodology.

Table 23 Accuracy Assessment Point Count Confusion Matrix

	Sample Class					
Mapped Class	Non-Forest	Forest	Deforestation	Total	Mapped Class Area	Class Weight
Non-Forest	353	37	1	391	5,243,087	0.2842
Forest	32	829	12	873	11,594,403	0.6284
Deforestation	9	17	220	246	1,614,052	0.0875

Total	394	883	233	1510	18,451,542	

Table 24 Area Weighted Accuracy Assessment Confusion Matrix

Mapped Class	Sample Class			User's Accuracy	Overall Accuracy
	Non-Forest	Forest	Deforestation		
Non-Forest	0.257	0.027	0.001	0.903	0.931
Forest	0.023	0.597	0.009	0.950	
Deforestation	0.003	0.006	0.078	0.894	
Producer's Accuracy	0.907	0.948	0.893		

Finally, the accuracy of the 2010 and 2022 forest cover benchmark maps were assessed by combining the deforestation areas weighted counts into the 2010 forest class and 2022 non-forest class respectively. The overall accuracies for the 2010 FCBM (Table 25) and 2022 FCBM (Table 26) exceeded the requirement of 90% set by the methodology.

Table 25 2010 Forest Cover Benchmark Map Accuracy

Mapped Class	Sample Class		User's Accuracy	Overall Accuracy
	Non-Forest	Forest		
Non-Forest	0.2565	0.0276	0.9028	0.9462
Forest	0.0262	0.6896	0.9634	
Producer's Accuracy	0.9072	0.9615		

Table 26 2022 Forest Cover Benchmark Map Accuracy

Mapped Class	Sample Class	User's Accuracy	Overall Accuracy

	Non-Forest	Forest		
Non-Forest	0.3387	0.0355	0.9051	0.9354
Forest	0.0291	0.5967	0.9535	
Producer's Accuracy	0.9209	0.9438		

3.6 Estimation of Land Cover and Land Cover Change Areas

The area of total deforestation during the historical reference period and the 90% confidence interval was estimated using the area weighted accuracy data as proposed by Olofsson et al. 2014[67]. The half-width of the two-sided 90% confidence interval (Table 27) was less than 10%, meeting the requirements of VM0015.

Table 27 Bias corrected area estimates and confidence intervals.

Class	Bias corrected %	Bias corrected ha	SE (ha)	90% CI (ha)	%error
Non-Forest	28.3%	5,217,575	109,559	± 180,225	3.45%
Forest	63.0%	11,617,724	118,749	± 195,342	1.68%
Deforestation	8.8%	1,616,244	57,226	± 94,137	5.82%

4 PROJECTION OF FUTURE DEFORESTATION

4.1 Projection of the Quantity of Future Deforestation

To best align with VM0048, the project elected for no stratification of the reference region (VM0015 Table 8) and a historical average approach for estimating the quantity of future deforestation. An analysis of the Land-Use Land-Cover map (Figure 35) showed that there was 647,956 ha of deforestation from 2010-2016 compared to 966,095 ha from 2016-2022. That is an increase of 50%

[67] Olofsson, P., Foody, G. M., Herold, M., Stehman, S. V., Woodcock, C. E., & Wulder, M. A. (2014). Good practices for estimating area and assessing accuracy of land change. Remote sensing of Environment, 148, 42-57.

more deforestation during the more recent period, suggesting that deforestation rates increased during the historical refence period. Furthermore, the analysis of deforestation drivers and agents showed that there was a large increase in population in the reference region during historical reference period, including amongst the main agents of deforestation - older, less educated men living in rural areas. Taken together, this is conclusive evidence that the trend of deforestation during the historical reference period was increasing, and thus it is conservative to use a historical average approach to estimate future deforestation.

VM0015 Table 8 Stratification of the Reference Region

Stratum ID		Description	Area at start of baseline validity period (ha)
IDi	Name		
1	All forest	All forest in the reference region	11,617,724

The area weighted dates of the starting 2010 PALSAR mosaic and ending 2022 PALSAR mosaics used in the HRP mapping were July 7th and September 4th respectively, so the mapped length of the HRP was slightly longer than 12 years, but conservatively rounded to 12 years for the purpose of estimating average annual deforestation. The projected future annual deforestation was estimated by dividing the bias corrected deforestation during the historical reference period (1,616,244 ha) by the length of the reference period (12 years). This gave a projected average annual deforestation rate of 134,687 ha/yr for the revised baseline validity period.

Annual areas of baseline deforestation for the reference region during the baseline validity period starting from April 21, 2022 (the previous baseline validity period ended on April 20th, 2022) were then calculated by distributing the 6 years of deforestation into calendar years based on the number of days during the baseline validity period in each year (VM0015 Table 9). VM0015 Table 10 and VM0015 Table 11 show the same for the project area and leakage belt based on projected annual deforestation in each area (see section 4.2.3) except that the baseline for the project area and leakage belts for the second project instance start on February 9, 2023, rather than April 21, 2022. Additionally, as per VM0015, the 931 ha already credited under the previous baseline validity period (Figure 39) were not considered for crediting in the new baseline validity period. This was accomplished by subtracting the projected baseline deforestation for those areas from the instance 1 baseline for the new baseline validity period, which is equivalent to removing those areas from the project area polygon used to calculate the baseline deforestation from the VM0048 style risk map. Also note that the same 2022 PALSAR mosaic was used to monitor deforestation in the first project instance in the last monitoring report. Thus, any deforestation in project instance 1 between the start of the new baseline validity

period (April 21, 2022) and the area weighted date of the 2022 PALSAR mosaic (Sept 4th, 2022) was captured in that monitoring report.

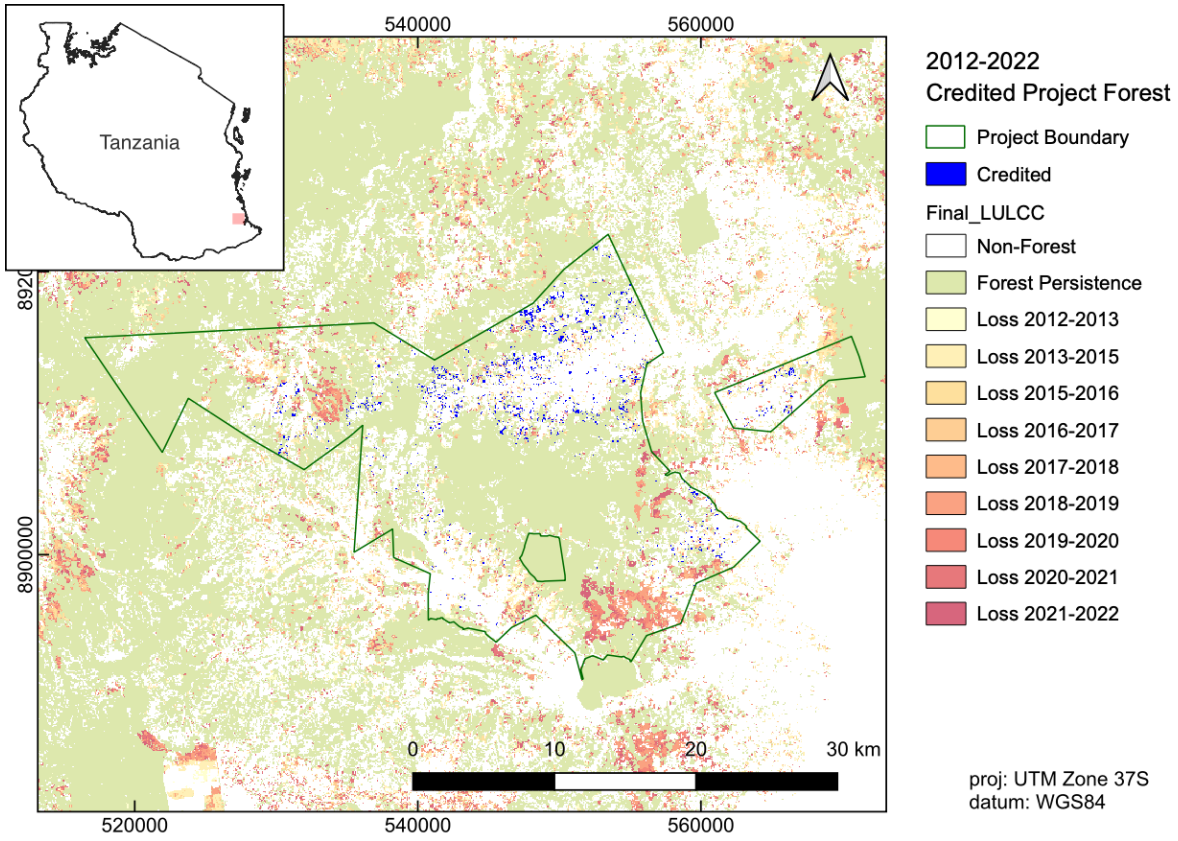


Figure 39 Cumulative Deforestation and Credited Avoided Deforestation 2012-2022 from the verified 2013-2022 monitoring report.

VM0015 Table 9 Annual Areas of Baseline Deforestation in the Reference Region

	Stratum *i* in the reference region	Total	
	1	Annual	cumulative
	$ABSLRR_{i,t}$	$ABSLRR_t$	*ABSLRR*
Project year *t*	ha/yr	ha/yr	ha
2022	94,096	94,096	94,096
2023	134,687	134,687	228,783
2024	134,687	134,687	363,469

2025	134,687	134,687	498,156
2026	134,687	134,687	632,843
2027	134,687	134,687	767,529
2028	40,848	40,848	808,377

VM0015 Table 10 Annual Areas of Baseline Deforestation in the Project Area (ABSLPA)

	Stratum *i* in the reference region in the project area	Total	
	1	Annual	cumulative
	$ABSLPA_{i,t}$	$ABSLPA_t$	*ABSLPA*
Project year *t*	ha/yr	ha/yr	ha
2022	728	728	728
2023	4,783	4,783	5,512
2024	5,231	5,231	10,743
2025	5,231	5,231	15,973
2026	5,231	5,231	21,204
2027	5,231	5,231	26,435
2028	1,586	1,586	28,022

VM0015 Table 11 Annual Areas of Baseline Deforestation in the Leakage Belt (ABSLLK)

	Stratum *i* in the reference region in the leakage belt	Total	
	1	Annual	cumulative
	$ABSLLK_{i,t}$	$ABSLLK_t$	*ABSLLK*
Project year *t*	ha/yr	ha/yr	ha
2022	1,010	1,010	1,010

2023	6,448	6,448	7,458
2024	7,046	7,046	14,504
2025	7,046	7,046	21,551
2026	7,046	7,046	28,597
2027	7,046	7,046	35,643
2028	2,137	2,137	37,780

4.2 Projection of the Location of Future Deforestation

The projection of future deforestation location was done following VM0015 except for one deviation. Instead of projecting individual pixels of future deforestation based on order of deforestation risk, the project used the approach from VT0007 where future deforestation location is predicted as a density map where each pixel in the map is assigned a density representing the proportion of pixels in the same risk class projected to be deforested in each year of the baseline validity period. The proportions are represented in terms of fractions of a hectare so they can be summed to calculate the predicted area of projected deforestation for any discrete area in the landscape. This approach was chosen to align the baseline with that which will be produced by Verra under VM0048, which the project will likely adopt in 2025 subject to data availability from Verra. The density approach was also shown to be more accurate and thus an accepted deviation.

4.2.1 Preparation of Factor Maps

Deforestation in the reference region is primarily driven by the expansion of small holder agriculture for both subsistence and cash crop production. Likely predictors of the future location of deforestation include proximity to deforestation agents, factors that affect the suitability of an area for crop production, proximity to markets and proximity to roads that access markets. VM0015 Table 12 shows the list of the factor maps that were created to represent these different predictors, and the processing steps used to create the maps. For each factor, a map was produced for the beginning of the calibration period (2010), the beginning of the confirmation period (2016), and the beginning of the baseline validity period (2022). In addition to the processing steps described in VM0015 Table 12, all factor maps were projected to match the Land Cover Change Map (Figure 35) projection and pixel spacing, masked by the remaining forest at the time period and then rescaled to a common scale of 0 to 1, which can help to improve modeling performance with multi-layer perceptron models. As required by the methodology, flow-charts outlining how each risk map was generated are presented in Figure 40 through Figure 49. Finally, as visual examples, the 2010 versions of each factor map are presented in Table 28.

VM0015 Table 12 List of Variables, Maps and Factor Maps

Factor Map		Source	Variable Represented		Meaning of the Categories or Pixel Value		Other Maps and Variables used to Create the Factor Map		Algorithm or Equation Used / Comments
ID	File Name		Unit	Description	Range	Meaning	ID	File Name	
1	d_rec_yyyy	HRP LULCC map (Figure 35)	NA	Distance to recent deforestation. This shows where deforestation agents are most active in the landscape and is a much better predictor than distance to forest edge in a landscape like Tanzania where there are significant areas of non-forest which are not anthropogenic.	0-1	Rescaled from meters. Lower values represent forest closer to deforestation in the previous 6 years.	2	HRP_LULCC	Euclidian distance from historical deforestation during the HRP and a proxy for deforestation in the 6 years prior to the HRP assumed to be non-forest at start of HRP within 355 meters of 2010-2016 deforestation. An analysis comparing the distance to the proxy for 2004-2010 to the 2010-2016 deforestation showed that cumulative amount of deforestation observed at increasing distances were nearly identical to the cumulative frequencies of distance to 2010-2016 compared to 2016-2022 deforestation.

									See Figure 40 and Figure 41 for flow-chart diagram of steps.
3	d_built_yyyy	Earth Engine Dataset "JRC/GHSL/P2023A/GHS_BUILT_S/yyyy" built_surface Data comes in 5-year intervals, so 2010 was used for 2012, 2015 was used for 2016, and 2020 was used for 2022.	NA	Distance to built-up pixels in a particular year. This shows where settlements, representing potential markets for farmers are located. They are also related to distance to basic services such as markets, schools, and health facilities.	0-1	Rescaled from meters. Lower values represent forest closer to built-up pixels.	4	built_yyyy	Calculated based on Euclidian distance from built-up pixels. After experimentation, it was determined that filtering out pixels with less than 300 square meters of built surface and applying a 2-pixel sieve removed almost all errors in the map where natural surfaces were classified as built. Then, built up pixels within protected areas were also reviewed and built surfaces associated with planned infrastructure, ranger camps, and safari camps / hotels were removed. Reprojected from 100m to 25m pixels using nearest neighbor before calculating distance. See Figure 42 for flow-chart diagram of steps.
5	d_road_yyyy	Open Street Maps downloaded	NA	Distance to roads that connect major population	0-1	Rescaled from meters. Lower values represent	6	roads	Openstreetmap roads vector data was filtered to trunk, primary, secondary, and tertiary roads and then rasterized using

		June 23, 2024.		centers. Roads are important for moving commercial crops and charcoal; thus, deforestation may be more common near roads.		forest closer to major roads.			into a 25-meter pixel binary map (0 for no road, 1 for road). Then Euclidian distance was calculated from the road pixels. See Figure 43 for flow-chart diagram of steps.
7	d_river_yyyy	Downloaded from hydrosheds.org/products/hydrosheds	NA	Distance to rivers and streams in the hydrosheds dataset. People are unlikely to settle far from rivers and streams as they often do not have other means of accessing water.	0-1	Rescaled from meters. Lower values represent forest closer to a river or stream.	8	rivers	The hydroshed channel data was rasterized into a 25-meter pixel binary map (0 for no channel, 1 for channel). Then Euclidian distance was calculated from the channel pixels. See Figure 44 for flow-chart diagram of steps.
9	pa_yyyy	From a variety of official and unofficial sources	NA	Protected areas under national authorities in the reference region with clearly	0,1	0 = unprotected 1 = protected			Each polygon included was overlayed on high resolution imagery to confirm that the polygon boundaries line up with the cutlines, roads, and

		collected by the project partners over the years, including Protected Planet data.		marked boundaries and where conversion to agriculture would be illegal. This included national parks, game reserves, forest reserves, and nature reserves.					rivers that make up the real on the ground boundaries that are enforced. Protected areas polygons with no agreement with the shape of undisturbed areas in high-resolution imagery and no alternative clearly distinguishable boundaries in high-resolution imagery were excluded. The final boundaries were rasterized into a 25 m pixel binary map. See Figure 45 for flow-chart diagram of steps.
10	elev_yyyy	Google Earth Engine Dataset: "COPERNICUS/DEM /GLO30"	NA	Elevation above sea level. Elevation is correlated with rainfall and temperatures which may influence the relative suitability of an area for cultivation.	0-1	Rescaled from meters. Lower values represent lower elevation			Reprojected from 30m to 25m pixels using bicubic convolution. See Figure 46 for flow-chart diagram of steps.

11	slope_yyyy	Calculated from "COPERNICUS/DEM/GLO30" in Google Earth Engine	NA	Slope in degrees. Areas with lower slope can be more favorable for farming and easier to access.	0-1	Rescaled from slope in degrees. Lower values represent lower slope.			Calculated using the ee.Terrain.slope function in Earth Engine. Reprojected from 30m to 25m pixels using bicubic convolution. See Figure 47 for flow-chart diagram of steps.
12	tpi_yyyy	Calculated from "COPERNICUS/DEM/GLO30" in Google Earth Engine	NA	Topographic position index. This indicates whether the topography of an area is flat, concave, or convex. Flat and concave areas are more favorable for cultivation because they retain soil moisture longer than convex areas.	0-1	Rescaled from topographical index values. Low values represent concave positions, mid values represent flat positions, and high values represent convex positions.			Calculated using a custom Google Earth Engine javascript. Reprojected from 30m to 25m pixels using bicubic convolution. See Figure 48 for flow-chart diagram of steps.

13	cec_yyyy	From Google Earth Engine dataset: "ISDASOIL/Africa/v1/cation_exchange_capacity" Band: mean_0_20	NA	Soil cation exchange capacity. Mean soil cation exchange capacity of the top 20 cm of soil. CEC is an important predictor of general soil fertility and moisture retention capacity.	0-1	Rescaled from cmol(+)/kg. Lower values represent lower cation exchange capacity.			Reprojected from 30m to 25m pixels using bicubic convolution. See Figure 49 for flow-chart diagram of steps.

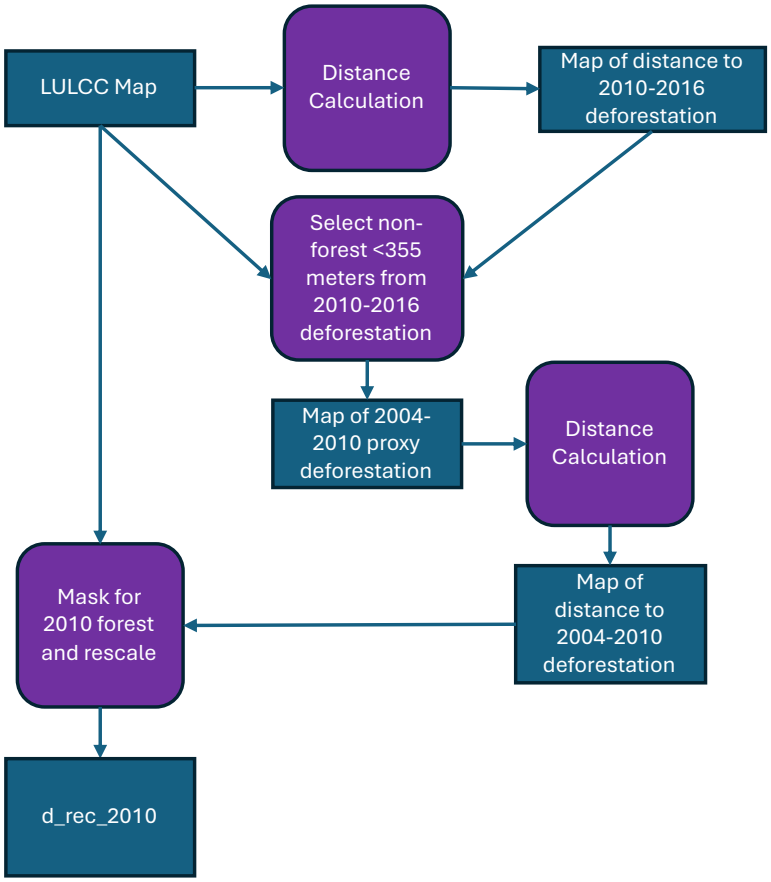


Figure 40 Steps to produce d_rec_2010

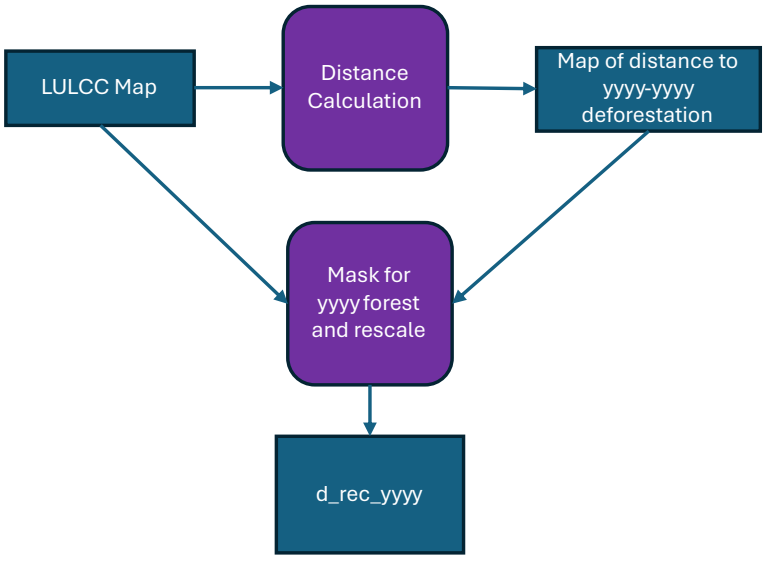


Figure 41 Steps to produce d_rec_2016 and d_rec_2022

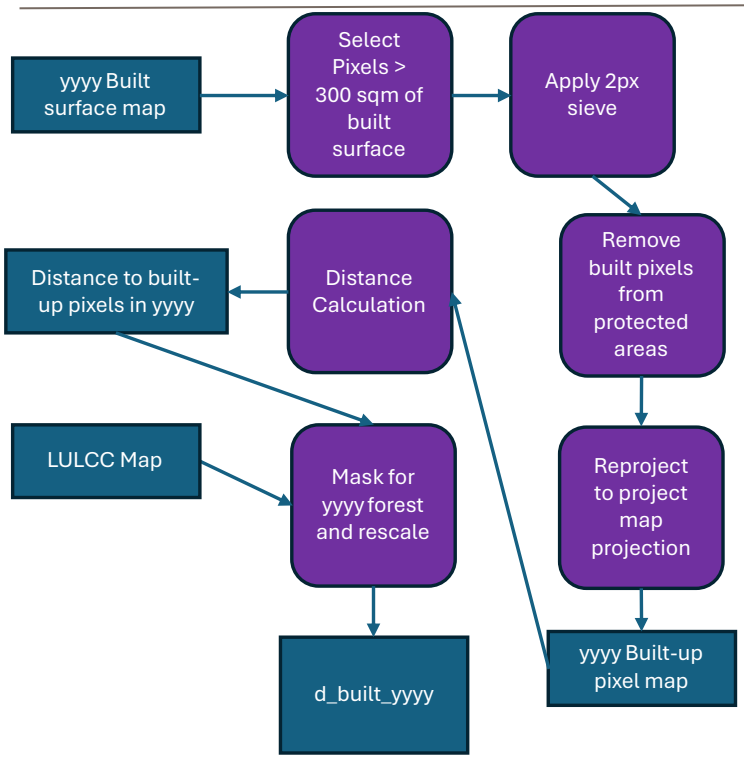


Figure 42 Steps to produce d_built_yyyy

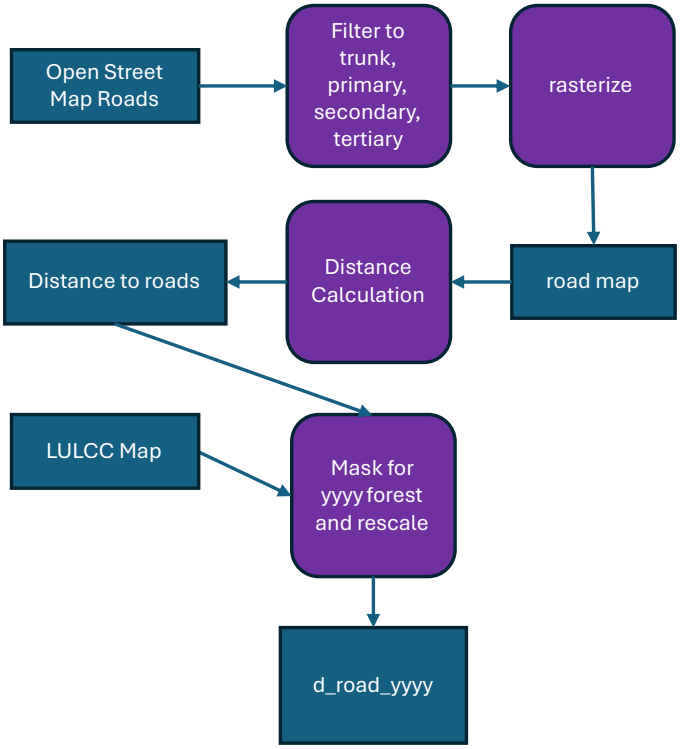


Figure 43 Steps to produce d_road_yyyy

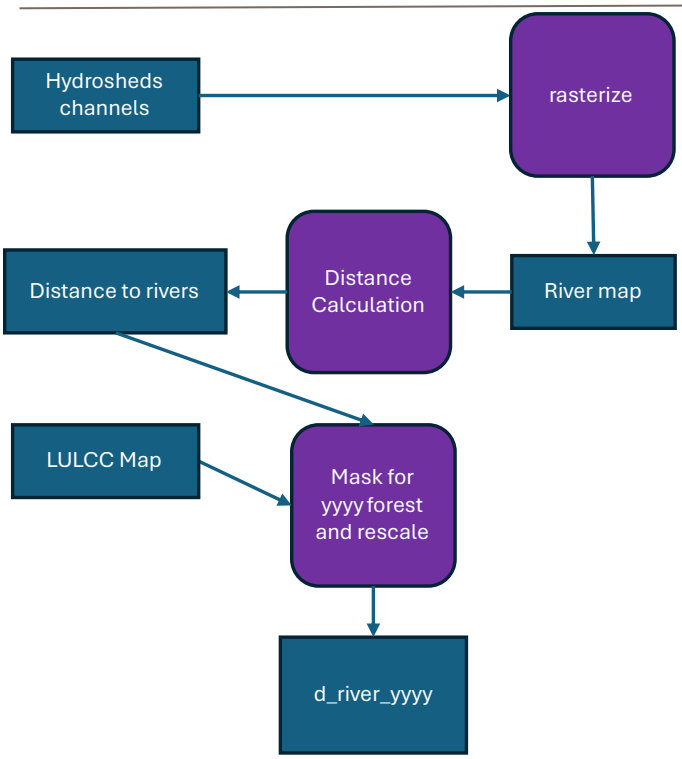


Figure 44 Steps to produce d_river_yyyy

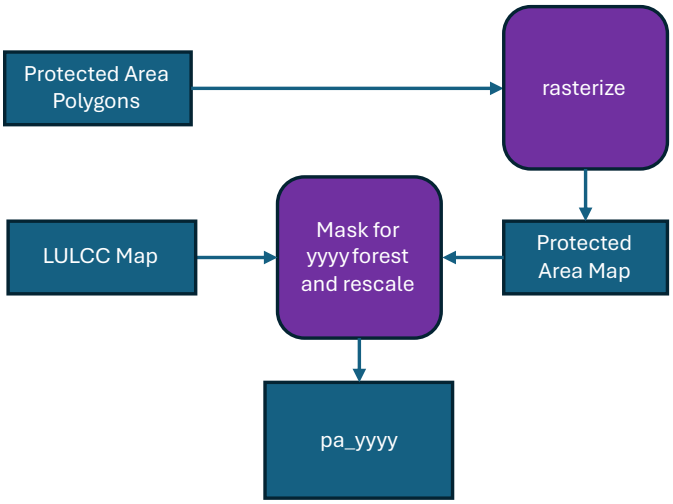


Figure 45 Steps to produce pa_yyyy

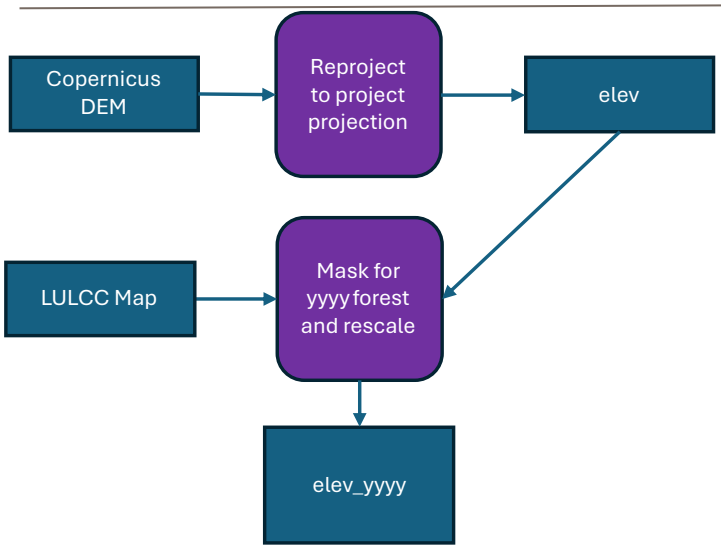


Figure 46 Steps to produce elev_yyyy

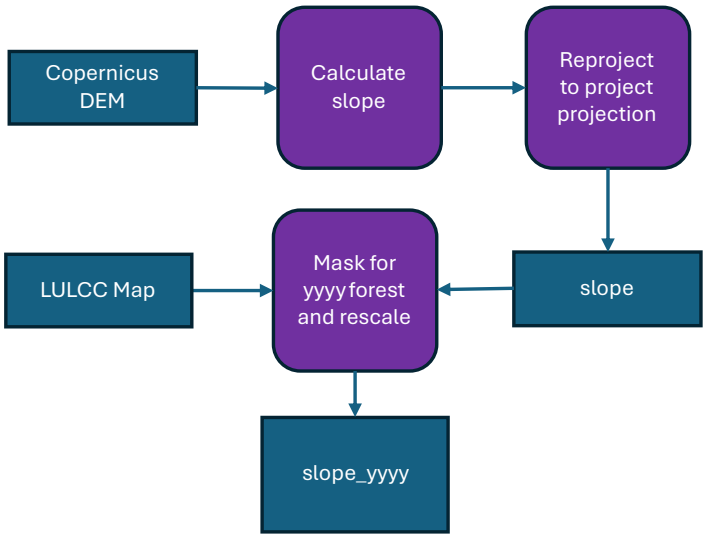


Figure 47 Steps to produce slope_yyyy

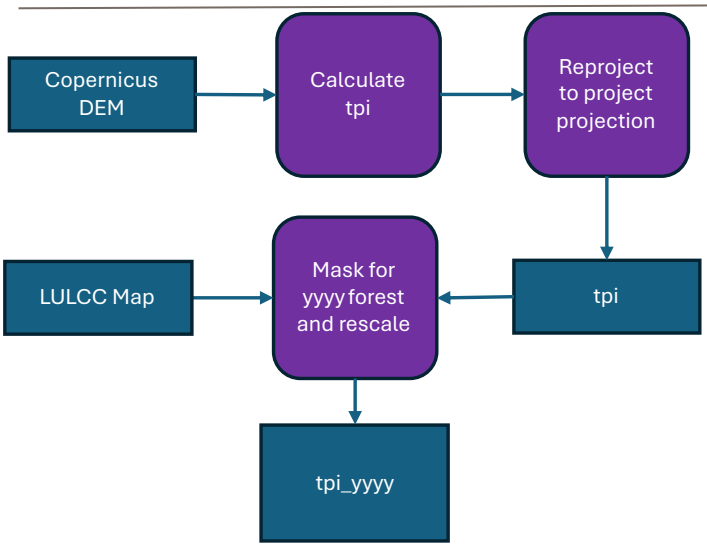


Figure 48 Steps to produce tpi_yyyy

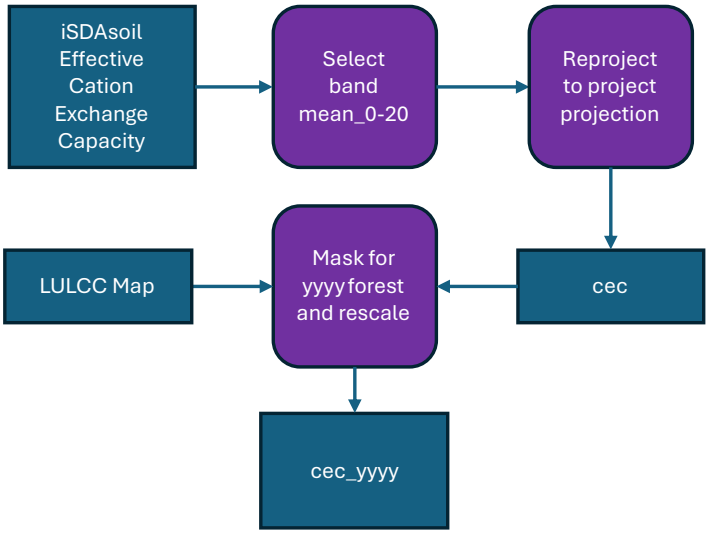
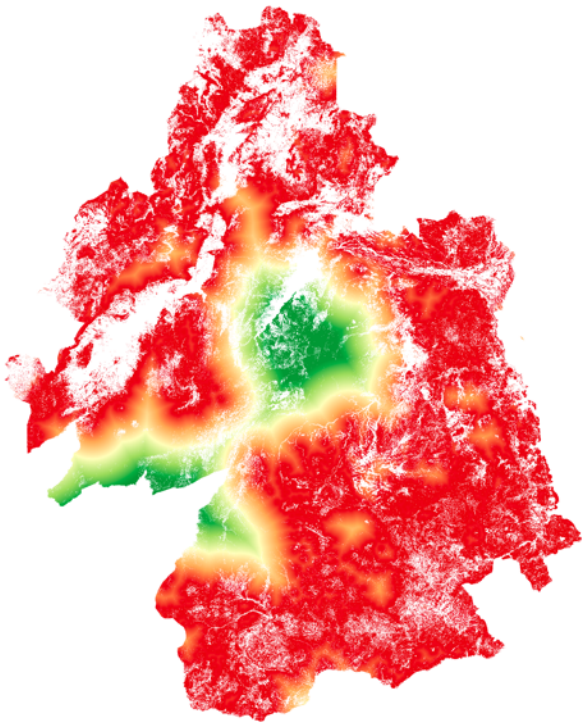
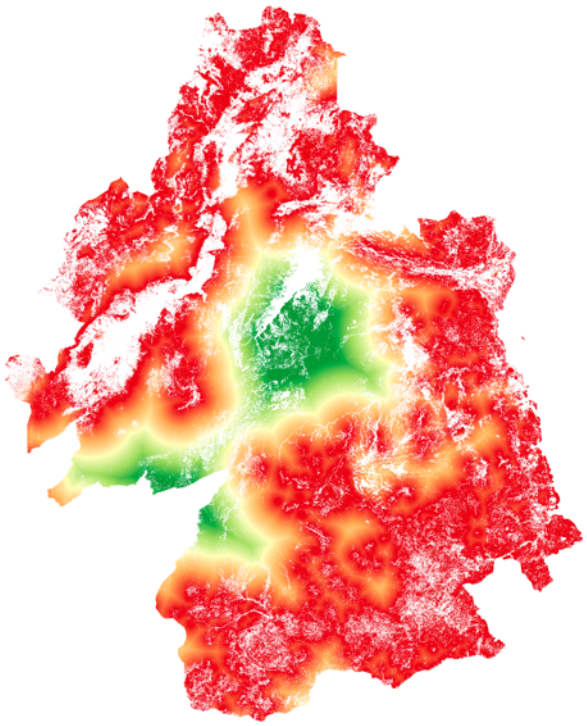


Figure 49 Steps to produce cec_yyyy

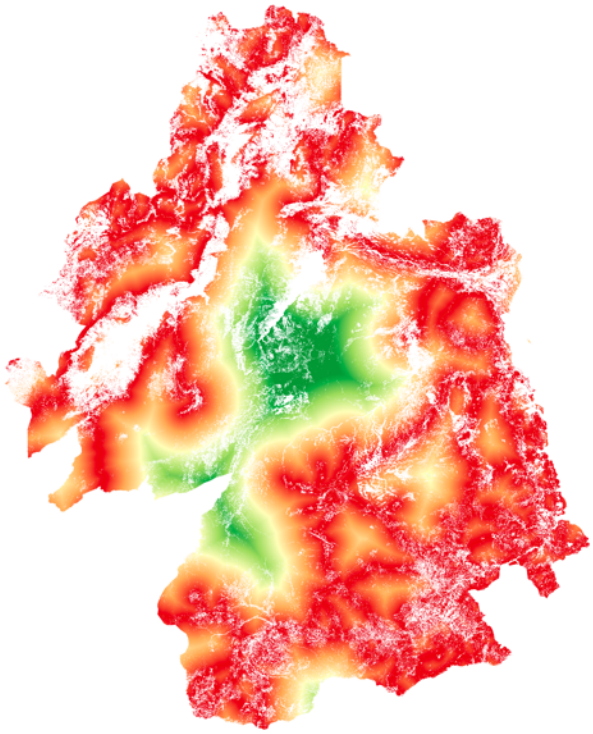
Table 28 Factor maps for 2010 (visualized with 98% histogram stretch. Red = low values, yellow = moderate values, green = high values)



d_rec_2010



d_built_2010



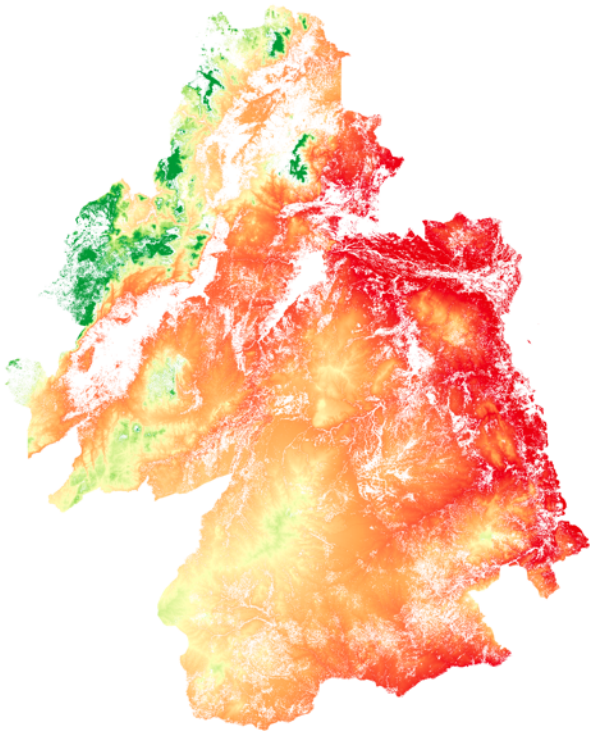
d_road_2010



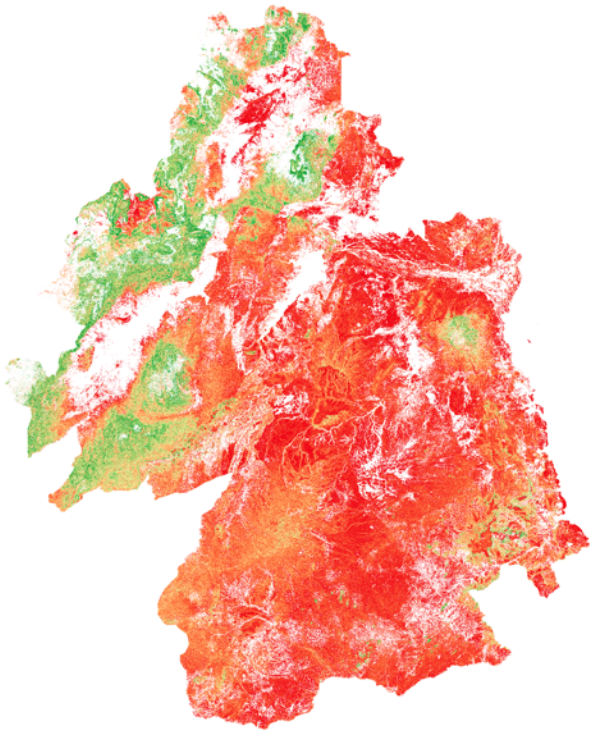
d_river_2010



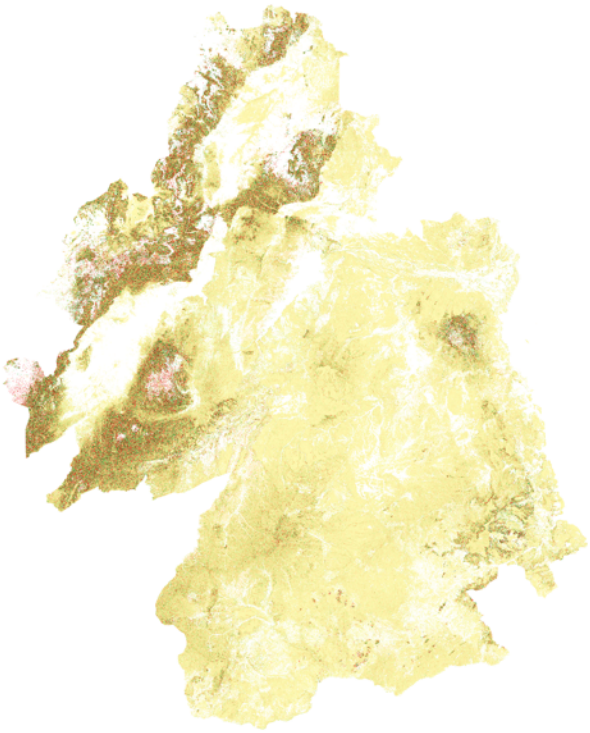
pa_2010



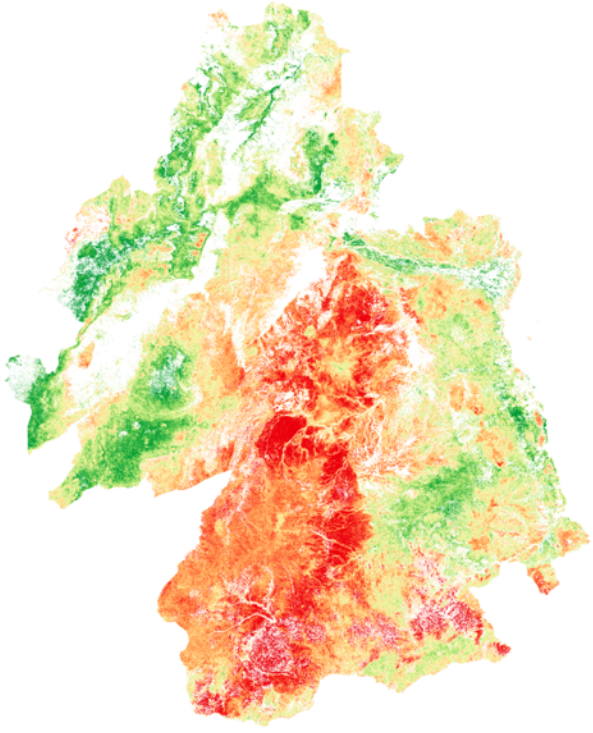
elev_2010



slope_2010



tpi_2010



cec_2010

4.2.2 Selection of the Most Accurate Deforestation Risk Map

As per VM0015 and VT0007, risk model performance was assessed by using the 2010-2016 as a calibration period and 2016-2022 as a confirmation period. Different risk models were created by modeling deforestation risk using different combinations of factor maps and different modeling algorithms including multi-layer perceptron (MLP) and Randomforest (RF).

The models were executed in python using the Sklearn libraries for MLP and RF. Training data consisted of factor map values from a stratified random sample of 30,000 forest persistence and 30,000 deforestation pixels. Ten percent of training data was withheld to calculate pixel-based accuracy for the calibration period which helped inform which model variables to drop to test more parsimonious models. The MLP and RF model parameters are shown in Table 29.

Table 29 Risk Model parameters

Multi-layer perceptron model parameters	Randomforest model parameters
MLPClassifier(hidden_layer_sizes=(5), alpha=0.0001, max_iter=15000, validation_fraction=0.3, n_iter_no_change=1000, early_stopping=True, random_state=42)	RandomForestClassifier(n_estimators=1000, random_state=42, max_depth=7, oob_score=True)

Risk maps were generated for both the calibration period and confirmation period. Each risk map showed the relative certainty of the model that a forest pixel would be deforested during the time based on the training set which was 50% deforestation and 50% forest persistence. A value of 0 represents 0 chance of deforestation, where as a value of 1 represents 100% certainty of deforestation. VM0015 assumes that deforestation will only happen in the highest risk pixels equal to the projected amount of deforestation in the reference region. The quantity of deforestation projected into a particular area is determined by calculating the area of predicted deforestation pixels in the area. However, this means that no risk is projected into pixels with moderate and low risk of deforestation, which may bias the model. Alternatively, VT0007 uses a density map approach whereby pixels with different probabilities of deforestation are assigned different densities of deforestation as a fraction of a hectare. This allows for risk to be projected into all pixels in proportion to the relative risk of each location. The quantity of deforestation projected in a certain area is then calculated by summing the pixels values in that area. The project tested both approaches.

To produce the predicted pixels of deforestation maps as per VM0015, NumPy in python was used to identify the risk threshold in each risk map with the required number of pixels equal to the observed deforestation in the confirmation period. Then those pixels were set to 100% deforestation in terms of a

proportion of a hectare, which is 0.0625 ha per pixel while all other pixels were set to zero. Thus, the predicted deforestation in any area can be calculated by summing the pixels values in that area.

For VT0007 style density maps, v2.09 of the UDEF-ARP tool was used. The tool divides risk map values within each jurisdiction into 30 different vulnerability classes and uses the observed amount of deforestation in each vulnerability class in the calibration period to calculate the deforestation density for each pixel in each risk class. Then, for the confirmation period risk map, after splitting the map into 30 vulnerability classes, the densities from each corresponding risk class in the calibration period are applied. If, like in the case of this project, the quantity of deforestation in the confirmation period is higher than in the in-calibration period, an adjustment factor is applied to each risk class to bring the total predicted deforestation for the confirmation period equal to the observed deforestation for the confirmation period.

Thus, for predicted deforestation pixel and density maps, there are no quantity errors for the confirmation period at the scale of the reference region. It is only the specific pixels of predicted deforestation or pixel density of deforestation which varies from model to model.

As suggested by VM0015, risk map accuracy was assessed at the polygon level using Figure of Merit (FOM). The polygons consisted of a grid of 10x10 km test squares over the entire reference region generated by the UDEF-ARP tool. The projected confirmation period deforestation within each 10x10 km square was compared to the total observed deforestation within each square to calculate the total deforestation quantity agreement and over prediction or under prediction for each square. A 10x10 km grid was chosen because it corresponds roughly with the average size of a village in the project.

FOM = B / (A+B+C)

Where:

FOM = Figure of Merit (dimensionless)

A = Sum of absolute value of all under predictions in test grid cells

B = Sum of the quantity agreement between observed and predicted deforestation within each test cell

C = Sum of all over predictions in test grid cells

FOM scores for different models ranged from 0.507 to 0.658, which is well above the fraction of the landscape representing change in the confirmation period 0.08, the minimum requirement for models under VM0015. Using the VM0015 approach of assigning deforestation to only high-risk pixels resulted in the lowest FOM score. The details of the model with the highest FOM are shown in Table 30.

Table 30 Best FOM Risk Model Details

Factor Maps Included	Model Algorithm	Risk projection approach	FOM

d_rec, d_road, pa, slope, tpi, cec	RandomForest	VT0007 density map produced by UDEF-ARP[68]	0.658

4.2.3 Mapping the Location of Future Deforestation

To project deforestation during the baseline validity period, the project drew a new stratified training sample using persistence and deforestation data for the entire historical reference period and reran the model described in Table 30. Then the calibration and projection risk maps were plugged into the UDEF-ARP tool to generate a projected deforestation density map for the baseline validity period (Figure 50). In the UDEF-ARP tool, future annual reference region deforestation was set to the estimated average annual deforestation of 134,687 ha/yr from the historical reference period as estimated in section 4.1. The resulting density map gives densities in terms of projected annual deforestation density, and it is assumed that the same densities apply to each year of the baseline validity period. The total quantity of projected deforestation in the density map was confirmed using the Zonal statistics tool in QGIS which arrived at a sum of 134,686.9993 ha.

This approach is a deviation from VM0015, where annual deforestation is predicted by working backwards from the highest risk pixels, leaving no risk projected into pixels with more moderate risk of deforestation. However, as demonstrated during the selection of the most accurate risk map, the density map approach resulted in substantially more accurate quantity predictions in the 10x10 square kilometer test grids and thus is a justifiable methodological deviation.

The projected annual baseline deforestation for the project areas and leakage belts during the baseline validity period were calculated by summing the pixel density values within the corresponding polygons using the QGIS zonal statistics tool.

[68] Note that the reference region was treated as a single administrative unit. VT0007 calls for the use of administrative boundaries to subdivide countries into smaller jurisdictions whereby vulnerability classes are calculated separately for each jurisdiction. However, when the project used a district boundary map as the input for that step in the UDEF-ARP tool, the resulting density maps had consistently had lower FOMs. This is because there were changes in deforestation rates in some districts between the calibration and confirmation periods and the model variables can explain some of this change when the model is not constrained to projecting a specific amount of deforestation within a particular district.

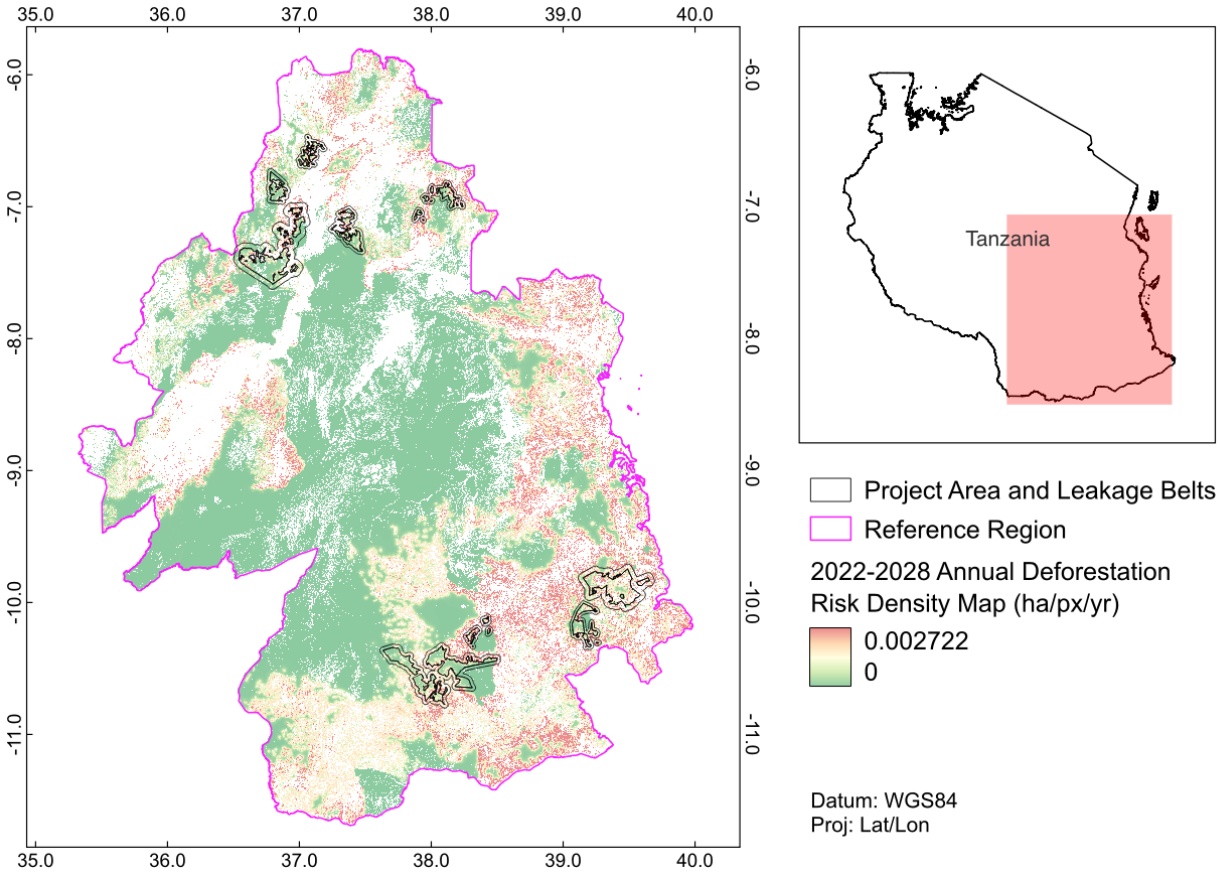


Figure 50 Projected annual deforestation density 2022-2028

5 DEFINITION OF LAND USE AND LAND COVER CHANGE COMPONENT OF THE BASELINE

5.1 Calculation of Baseline Activity Data Per Forest Class

Activity data per forest class per area of interest was calculated in python by summing density map values after masking density values outside the area of focus. For the reference region, the mask applied is the forest class in question, whereas for the project area and leakage belt, the mask applied was a combination of the forest class and area of interest. Then the projections for each area in each forest class were distributed to calendar years across the baseline validity period (starting from April 21, 2022) based on the numbers of days in each year. The temporal distribution of the baseline for the

project area and leakage belts for the second project instance was adjusted to reflect the February 9, 2023, start date, rather than April 21, 2022. Finally, as per VM0015, the 931 ha already credited under the previous baseline validity period (Figure 39) were not considered for crediting in the new baseline validity period. This was accomplished by subtracting the projected baseline deforestation for those areas from the instance 1 baseline for the new baseline validity period, which is equivalent to just removing those areas from the project area polygon used to calculate the baseline deforestation from the VM0048 style risk map. Annual Areas Deforested Per forest class in the reference region, project area, and leakage belt are shown in VM0015 Table 13, VM0015 Table 14, and VM0015 Table 15 respectively.

VM0015 Table 13 Annual Areas Deforested Per forest Class *icl* Within the Reference Region in the Baseline Case (Baseline Activity Data Per Forest Class)

Area deforested per forest class *icl* within the reference region			Total baseline deforestation in the reference region	
ID_{icl}>	1	2		
Name >	High Carbon	Low Carbon	*ABSLRRt*	*ABSLRR*
			annual	cumulative
Project year *t*	ha	ha	ha/yr	ha
2022	60,535	33,561	94,096	94,096
2023	86,648	48,039	134,687	228,783
2024	86,648	48,039	134,687	363,469
2025	86,648	48,039	134,687	498,156
2026	86,648	48,039	134,687	632,843
2027	86,648	48,039	134,687	767,529
2028	26,279	14,569	40,848	808,377

VM0015 Table 14 Annual Areas Deforested Per forest Class icl Within the Project Area in the Baseline Case (Baseline Activity Data Per Forest Class)

Area deforested per forest class *icl* within the project area			Total baseline deforestation in the project area
ID_{icl}>	1	2	

Name >	High Carbon	Low Carbon	*ABSLPAt*	*ABSLPA*
			annual	cumulative
Project year *t*	ha	ha	ha/yr	ha
2022	544	185	728	728
2023	3,854	930	4,783	5,512
2024	4,222	1,009	5,231	10,743
2025	4,222	1,009	5,231	15,973
2026	4,222	1,009	5,231	21,204
2027	4,222	1,009	5,231	26,435
2028	1,280	306	1,586	28,022

VM0015 Table 15 Annual Areas Deforested Per forest Class icl Within the Leakage Belt in the Baseline Case (Baseline Activity Data Per Forest Class)

Area deforested per forest class *icl* within the leakage belt			Total baseline deforestation in the leakage belt	
ID_{icl}>	1	2		
Name >	High Carbon	Low Carbon	*ABSLLKt*	*ABSLLK*
			annual	cumulative
Project year *t*	ha	ha	ha/yr	ha
2022	703	307	1,010	1,010
2023	4,333	2,115	6,448	7,458
2024	4,731	2,315	7,046	14,504
2025	4,731	2,315	7,046	21,551
2026	4,731	2,315	7,046	28,597
2027	4,731	2,315	7,046	35,643
2028	1,435	702	2,137	37,780

5.2 Calculation of Baseline Activity Data Per Post-Deforestation Forest Class

The project chose the Historical LU/LC approach to estimate the proportion of future post-deforestation land uses. Since there was only a single post-deforestation stratum, a single zone was used. The zone was equal to the entirety of the project area, leakage belt, and leakage management areas.

VM0015 Table 16 Zones of the Reference Region Encompassing Different Combinations of Potential Post-Deforestation LU/LC Classes

Zone				Total of all other LU/LC classes present in the zone		Total area of zone	
		Name:					
		F1					
		ID_{fcl}	3				
		Area	% of Zone	Area	% of Zone	Area	% of Zone
iD_z	*Name*	ha	%	ha	%	ha	%
1	Zone 1	928,376	100	928,376	100	928,376	100

VM0015 Table 18 Annual Areas Deforested in Each Zone Within the Project Area in the Baseline Case (Baseline Activity Data Zone)

		Total baseline deforestation in the project area	
iD_z >	1		
Name >	Zone 1	ABSLPAt	ABSLPA
Project year t	ha	ha/yr	ha
2022	728	728	728
2023	4,783	4,783	5,512
2024	5,231	5,231	10,743
2025	5,231	5,231	15,973
2026	5,231	5,231	21,204

2027	5,231	5,231	26,435
2028	1,586	1,586	28,022

VM0015 Table 19 Annual Areas Deforested in Each Zone Within the Leakage Belt in the Baseline Case (Baseline Activity Data Zone)

		Total baseline deforestation in the leakage belt	
iD_z >	1		
Name >	Zone 1	ABSLPAt	ABSLPA
Project year t	ha	ha/yr	ha
2022	1,010	1,010	1,010
2023	6,448	6,448	7,458
2024	7,046	7,046	14,504
2025	7,046	7,046	21,551
2026	7,046	7,046	28,597
2027	7,046	7,046	35,643
2028	2,137	2,137	37,780

6 ESTIMATION OF BASELINE CARBON STOCK CHANGES AND NON-CO2 EMISSIONS

6.1 Estimation of Baseline Carbon Stock Changes

Average carbon stocks were estimated for forest classes existing within the project area and leakage belt using carbon plot data from the project area. There is no reason to suspect that the carbon stocks within the same forest classes within the leakage belt would be higher than in the project area, so the

project area is a reasonable proxy for the leakage belt since the same forest class stratification is applied to both areas. The disturbance driver data collected by the village forest patrol teams shows that conversion to agriculture is the primary driver 95.5% of significant forest disturbances and that most resource harvesting is opportunistic as part of the deforestation process. This is because legal and illegal charcoal harvesting is unprofitable for much of the project area and timber harvesting is always highly selective due to the nature of the forests where a limited number of species are targeted for timber and most trees are too small for timber making. Furthermore, fuelwood harvesting is generally extracted in the form of dead wood, which the project has conservatively excluded from biomass pools, or as part of woody fallow farm clearing and thus does not typically cause degradation in project area forests. Thus, apart from where deforestation occurs due to deforestation drivers, the project area carbon stocks are expected to remain roughly stable, with any legal or illegal small-scale harvesting offset by growth.

Post deforestation carbon stocks were estimated using carbon plots in farms of a known age within the leakage belt polygon. Given the proximity to the project area, these areas provide the most relevant proxy for post-deforestation land-uses in the project area in the baseline scenario.

The project used a combination of carbon stock data gathered from previous studies and from its own carbon stock inventory plots. The existing plot data, which primarily covered Morogoro region, met the requirements of the methodology:

a) All the existing data used to estimate carbon stocks was measured between 2019 and 2022, which is less than 10 years prior to this baseline revision.

b) The existing data was measured in 114 plots that overlap the project area in 2022.

c) The minimum diameter at breast height for inclusion in the plots was 2 cm.

d) The plot data was from random stratified plots from within the project areas and the stratification was known and accounted for when combining the plot estimates.

Carbon Plots

There were 3 sets of carbon plot data:

- COFOREST Morogoro region project forest carbon plot data measured between 2019 and 2022
- VCSL Lindi region and Morogoro region project forest plot data measured in 2024
- VCSL all region post-deforestation plot data measured in 2024

All sets used 15-meter radius plots, which is consistent with the radius used by the National Forestry Resources Monitoring and Assessment of Tanzania (NAFORMA). Trees with a diameter at breast height greater than or equal to 1cm and less than 5cm were measured only within a 1-meter radius subplot. Trees larger than 5cm were measured throughout the entire plot. Diameter at breast height was recorded for every stem meeting the requirements for inclusion. Tree species was also recorded for

every measured tree. Height was not recorded in the COFOREST data and only recorded for some trees in the other datasets. Plot area on slopes was kept consistent by applying a slope correction factor (Equation 1) to increase the length of the plot radius[69].

Equation 1

$$\frac{1}{\sqrt{\cos \alpha}}$$

Where: α = *slope in degrees*

Soil samples for determining SOC were sampled in a random subset of carbon plots. Samples were collected from subplots at the north and south of project area using a 30 cm soil probe following the guidance on page 182 of VM0015 v1.2. The samples were then sent to Department of Ecosystem and Conservation; College of Forestry, Wildlife and Tourism; Sokoine University of Agriculture for determination of percent SOC and bulk density as per the guidance on page 182 of VM0015 v1.2.

Plot measurements were conducted by experienced teams trained and supervised by Dr. Wilson Mugasha, who is one of Tanzania's leading experts in biomass measurement. Data was recorded into ODK forms and uploaded to ODK central servers controlled by the project and the Tanzania Forest Conservation Group. From there, data was downloaded into excel spreadsheets and analyzed. Analyzed data is stored on the project's OneDrive account where it can be shared with the VVB and Verra.

The ODK collect biomass plot form, includes some built in data quality checks:

At the start of the form, the user is prompted to record the plot centre using GPS in the ODK form. The plot centre records from ODK are compared to the centres from the sample plots to ensure that data was gathered from the correct locations and that the correct plot names were selected in the ODK form.

The form also requires the user to measure the plot slope and enter it. The form then calculates the slope adjusted plot radii and returns them to the user. The ODK form then prevents the user from entering trees which are too far from the plot centre for their reported size class, which is also an automatic check of unusually small cbh values in the outer plot radius.

As a check of unusually large stems, the user is prompted to double check the measurements of any tree with a dbh of over 64 cm, and if correct, take a photo of the tape measure at 1.3 cm.

The user is prompted to record the health and decay class of the stem and then requires the user to measure the stem basal diameter and height if the tree is in decay class 2 or higher. This avoids dead stems being recorded as live and stumps being estimated as whole dead trees.

[69] See http://wiki.awf.forst.uni-goettingen.de/wiki/index.php/Slope_correction

During the data analysis, the plot records were sorted by species and size classes to look for any anomalous values. The plot measurement team was asked to explain any unusual values. High resolution imagery was used to confirm the lack of trees in plots with no reported trees. Likewise, the presence of exceptionally large trees on plots will also be confirmed with high resolution imagery. In any case where anomalous values are not well explained, the plot would be remeasured Dr. Wilson Mugasha with his field team. Rejected plot data would be marked as such in ODK Central and excluded from analysis. High values were found during the analysis, but the quality checks showed no non-conformities.

Sampling Framework

The target precision levels were +/- 10% error at the 90% confidence interval for the combined uncertainty of pools within a forest class.

The COFOREST data was gathered under the Tanzania Forest Conservation Group's COFOREST project which ran from 2019 through 2023. The original plot sampling was a stratified random sample in village forest reserves. Roughly equal size samples were made within forest management units where sustainable charcoal harvesting was allowed and the rest of the village forest reserves where only sustainable timber harvesting would be allowed. There was no stratification by forest type. Therefore, before analysis for this project, the dataset was stratified again by eliminating plots from areas mapped as non-forest and then splitting plots into either the high or low carbon initial forest classes from Figure 36. Plots in villages not involved in the VCSL REDD project were also removed. This left 114 plots in Morogoro villages.

Forest carbon plots in Lindi were created from a random sample of points stratified by initial forest class. Sample sizes were set to the relative proportion of each initial forest class in the project areas in Lindi Region. Then, an additional 14 low carbon forest plots were added in Lindi Region and 6 in Morogoro Region to reduce the uncertainty of carbon stocks in that class since VM0015 considers each class separately. The full set of biomass plots in Morogoro is shown in Figure 51 and the full set of plots in Lindi is shown in Figure 52.

Soil was sampled in a random subset of 25 plots in Lindi and then in 14 plots added in Morogoro.

Post-deforestation stocks for land-uses existing within the project area in the baseline case and leakage belt in the project case were assumed to be equal to the post deforestation stocks of the post-deforestation land-uses that occurred within the leakage belt polygons in the previous 20 years. A random set of 80 carbon plots stratified by year of first clearing was created by reviewing historical satellite imagery for a larger set of random points in non-forest within the leakage belt polygon. Points were reviewed until there were at least 4 non-forest points with a first clearing year for each year in the previous 20 years. Then a stratified sample was created to so that only 80 points remained with an even distribution of ages.

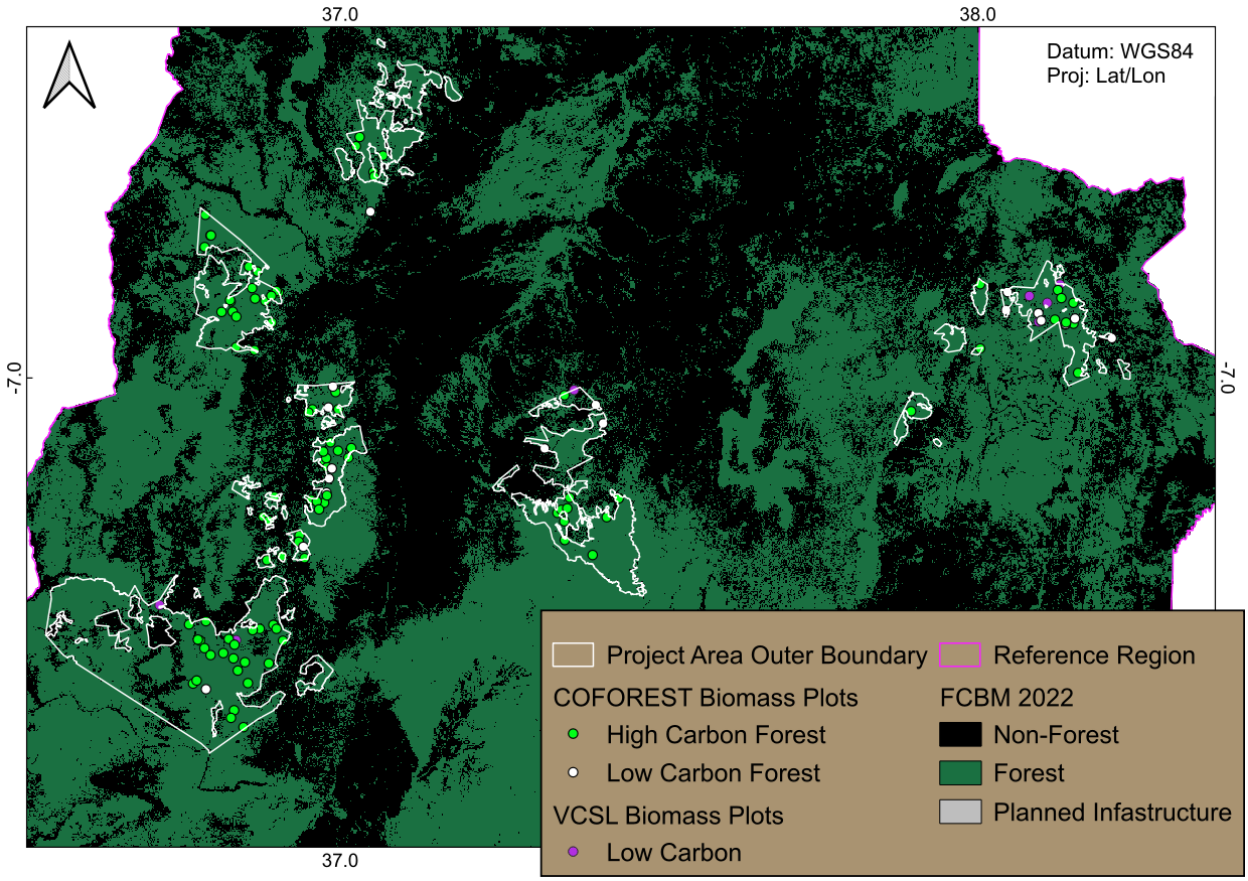


Figure 51 Morogoro COFOREST and VCSL Biomass Plots

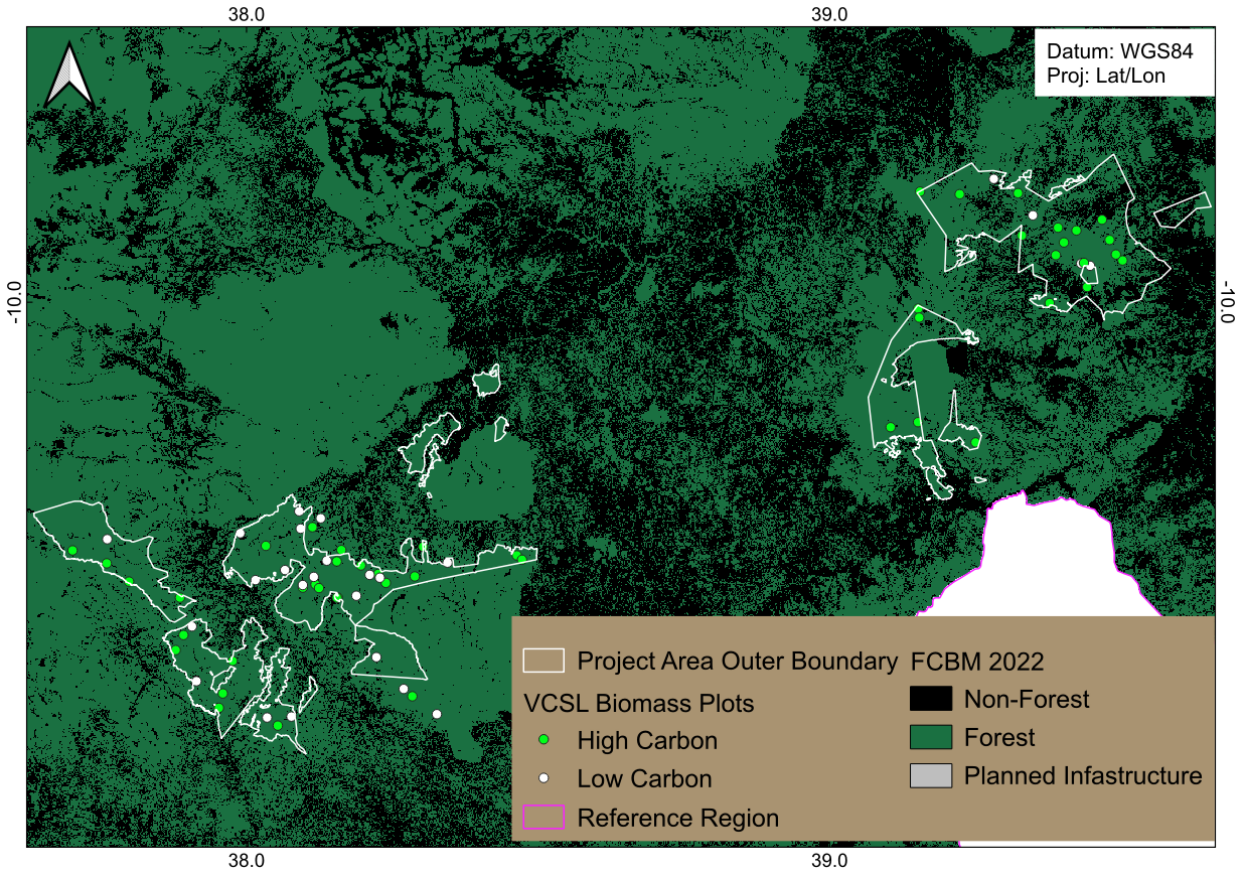


Figure 52 Lindi VCSL Biomass Plots

Allometric equations

Plot stem measurements were converted to estimates of above and below ground tree biomass using allometric questions developed for different forest types in Tanzania. Two forest types, Miombo woodland and lowland forest, were identified by the species compositions in each plot.

For live Miombo trees, the project used the general miombo equations from Mugasha et al 2013[70] that included diameter at breast height (dbh) and height (ht) to estimate above (Equation 2) and belowground tree (Equation 3) biomass. The equations were developed from sample trees in 4 different locations in Tanzania, including Lindi. The aboveground equation was developed from 167 trees and

[70] Mugasha, W. A., Eid, T., Bollandsås, O. M., Malimbwi, R. E., Chamshama, S. A. O., Zahabu, E., & Katani, J. Z. (2013). Allometric models for prediction of above-and belowground biomass of trees in the miombo woodlands of Tanzania. *Forest Ecology and Management*, *310*, 87-101.

has an r-square of 0.96. The below ground equation was developed from 80 trees and has an r-square of 0.92.

Equation 2 Aboveground biomass for Miombo trees

$$AGB = 0.0763 \times dbh^{2.2046} \times ht^{0.4918}$$

Where:

AGB = Aboveground biomass (kg)

dbh = Diameter at breast height (cm)

ht = Height (m)

Equation 3 Belowground biomass for Miombo trees

$$BGB = 0.1766 \times dbh^{1.7844} \times ht^{0.3434}$$

Where:

BGB = *Below*ground biomass (kg)

dbh = Diameter at breast height (cm)

ht = Height (m)

For live Lowland Forest tree aboveground biomass, the project developed its own allometric equation with support from Dr. Mugasha from Sokoine University. The equation was developed using 90 trees from two datasets from two forest sites in Tanzania from Masota et al. 2016[71] and from Mugasha et al. 2016[72]. Data from a third site from Mugasha et al. 2016 was not included because the tree species sampling at that site did not result in a representative sample of species. Ricinodendron heudelotii made up 11 or the 30 sample trees including most of the largest trees. These trees did not fit the pattern of diameter to biomass observed in the other sample trees. Ricinodendron heudelotii is not a very common species in lowland forests (e.g., there was none in the project's carbon plots). The new equation includes diameter at breast height (dbh) and tree height (ht) and wood density (wd) to estimate aboveground biomass (Equation 4). The R-square is 0.89. Wood density values were obtained from the BIOMASS package in R, which matches species names to woody density estimates from a

[71] Masota, A. M., Bollandsås, O. M., Zahabu, E., & Eid, T. (4). Allometric biomass and volume models for lowland and humid montane forests. *Allometric Tree Biomass and Volume Models in Tanzania*, 35.

[72] Mugasha, W. A., Mwakalukwa, E. E., Luoga, E., Malimbwi, R. E., Zahabu, E., Silayo, D. S., ... & Kashindye, A. (2016). Allometric models for estimating tree volume and aboveground biomass in lowland forests of Tanzania. International Journal of Forestry Research, 2016(1), 8076271.

database of published studies. When there is no data for the species, the genus, family, or dataset average is substituted depending on the availability of genus and family data in the database. Species or Genus level data was available for most species. Some current species names were reverted to older names to match the corresponding species and genus names in the database.

Equation 4 Above ground biomass for lowland forest trees

$$AGB = 0.2527750 \times dbh^{1.8749934} \times ht^{0.5374695} \times wd^{0.5958921}$$

Where:

AGB = Aboveground biomass (kg)

dbh = Diameter at breast height (cm)

ht = Height (m)

wd = wood density g/cm^3

Lowland Forest below ground biomass was estimated using the lower range of the root to shoot ratios for tropical dry forests with greater than 20t/ha of AGB (Equation 5) from Mokany 2006[73]. The lower range was used to avoid having to propagate the uncertainty separately just for lowland forest trees.

Equation 5 Below ground biomass for lowland forest trees

$$BGB = AGB \times rs$$

Where:

BGB = Aboveground biomass (kg)

AGB = Aboveground biomass (kg)

rs = root to shoot ratio for tropical dry forests with > 20t/ha of AGB (0.271), dimensionless

Some post deforestation plots contained cashew trees. Biomass for these trees was determined using the AGB and BGB equations (Equation 8) developed by Zahabu et al. as reported in Malimbwi and Chamshama 2016[74]. Where tree height was measured, the AGB equation (Equation 7) that include

[73] Mokany, K., Raison, R. J., & Prokushkin, A. S. (2006). Critical analysis of root: shoot ratios in terrestrial biomes. Global change biology, 12(1), 84-96.

[74] Malimbwi, R. E., Eid, T., & Chamshama, S. A. O. (2016). Allometric tree biomass and volume models in Tanzania.

height was used. Otherwise, the dbh only equation (Equation 6) was used. The equations were developed from destructive harvesting of 45 trees in coastal Tanzania. The R-squares for the AGB dbh only, AGB dbh and height, and BGB equations were 0.79, 0.83, and 0.78 respectively.

Equation 6 Cashew tree aboveground biomass where tree height was not measured.

$$ABG = 0.8450 \times (dbh^2)^{0.8873}$$

Where:

AGB = Aboveground biomass (kg)

dbh = Diameter at breast height (cm)

ht = Height (m)

Equation 7 Cashew tree aboveground biomass where tree height was measured.

$$ABG = 0.3152 \times dbh^{1.7722} \times ht^{0.5003}$$

Where:

AGB = Aboveground biomass (kg)

dbh = Diameter at breast height (cm)

ht = Height (m)

Equation 8 Cashew tree belowground biomass

$$BGB = 0.09287 \times (dbh^2)^{0.9394}$$

Where:

BGB = Aboveground biomass (kg)

dbh = Diameter at breast height (cm)

For Miombo and Lowland Forest trees, where height was not recorded in the field, height was estimated using the dbh and plot basal area equations for either Miombo or Lowland Forest as appropriate from Mugasha et al 2019[75]. The basal area equations were chosen because they are the simplest to implement with the available data and the difference in standard error with more complex equations

[75] Mugasha, W. A., Mauya, E. W., Njana, A. M., Karlsson, K., Malimbwi, R. E., & Ernest, S. (2019). Height-Diameter Allometry for Tree Species in Tanzania Mainland. *International Journal of Forestry Research*, *2019*(1), 4832849.

was less than 1%. The Miombo equation was developed with data from 20,080 trees sampled all over Tanzania, while the Lowland Forest equation was developed from 2,278 trees sampled all over Tanzania.

Equation 9 Height estimation for Miombo trees

$$ht = 1.3 + (13.4969 \times BA^{0.1491}) \times \left(1 - \exp(-0.0492 \times dbh^{0.8423})\right)$$

Where:

ht = *Estimated* tree height (m)

BA = Stand basal area (m^2/ha) calculated from basal area of trees in carbon plot scaled to a hectare

dbh = Diameter at breast height (cm)

Equation 10 Height estimation for Lowland Forest trees

$$ht = 1.3 + (16.0867 \times BA^{0.1052}) \times \left(1 - \exp(-0.0634 \times dbh^{0.7997})\right)$$

Where:

ht = *Estimated* tree height (m)

BA = Stand basal area (m^2/ha) calculated from basal area of trees in carbon plot scaled to a hectare

dbh = Diameter at breast height (cm)

For the Lindi forest carbon plots, there were no trees falling into decomposition class 1 (having lost only leaves). VM0015 provides equation A3-27 for estimating the volume of trees in decomposition class 2, 3, and 4, which is the geometric equation for a truncated cone. However, the project only recorded basal diameter since top diameter is often difficult to measure. So, conservatively, the volumes were estimated using the geometric equation for the volume of a cone[76] and then multiplied by the wood density (Equation 11).

Equation 11 Standing Deadwood Biomass for Trees measured Basal Diameter and Height

$$SdwB = \frac{1}{3} \times \pi \times \left(\frac{bd}{200}\right)^2 \times ht \times wd \times 1000$$

Where:

SdwB = Standing deadwood biomass (kg)

[76] https://en.wikipedia.org/wiki/Cone

bd = basal diameter (cm)

ht = *measured* tree height (m)

wd = wood density (g/cm^3)

Since basal diameter and height for dead trees was not recorded in the Morogoro dataset, the biomass for standing dead wood was conservatively estimated using the merchantable stem equation from Mugasha et al 2013 that includes dbh and height (Equation 12). That equation was developed from 139 trees and has an r-squared value of 0.78.

Equation 12 Aboveground biomass for Miombo tree merchantable stem

$$AGB = 0.0291 \times dbh^{1.8384} \times ht^{0.8790}$$

Where:

AGB = Aboveground biomass (kg)

dbh = Diameter at breast height (cm)

ht = Height (m)

Decomposition class 1 trees were only found in the post-deforestation plots. Standing dead wood biomass was predicted by applying the appropriate allometric equation for live trees as described previously in this section and then subtracting 3% to account for the missing leaves and small twigs as suggested by VM0015 v1.2 on page 179.

Belowground biomass for standing dead trees was assumed to be equal to the above ground biomass of the cone estimated stem or merchantable stem multiplied by the IPCC default root to shoot ratio for tropical dry forests with greater than 20t/ha of biomass (Equation 5).

Plot soil percent organic carbon and bulk density data provided by the lab was used to estimate soil organic carbon using Equation 13.

Equation 13 Soil Organic Carbon

$$C_{SOC} = bd \times sd \times C \times 100 \times \frac{44}{12}$$

Where:

C_{SOC} = Carbon stock per hectare in soil organic carbon (t CO_2e/ha)

bd = soil bulk density (g/cm^3)

sd = soil sampling depth (30 cm)

C = percent soil organic carbon (%)

Forest Carbon Stock Analysis

Carbon plot data analysis was conducted in linked Excel spreadsheets. Biomass was calculated for each stem recorded in a plot with the appropriate allometric equation as described previously in this section. Then the biomass results were converted to carbon dioxide equivalents per plot scaled to 1 hectare equivalent using Equation 14, which is a combined version of A3-11, 12, and 13 from VM0015 that can be applied to all biomass pools. The carbon fraction of tree biomass was estimated using the IPCC defaults for tropical trees with greater than 10 cm dbh (0.49) and less then 10 cm dbh (0.46) from table 4.3 in IPCC GL2006. A review of the contribution of foliage to AGB in Mugasha et al, 2013 and 2016 datasets showed that it was negligible, contributing an average of 0.3% to Miombo tree AGB and 2% on average to lowland tree AGB. This is because the destructive harvesting was conducted in the dry season when most Miombo and a good number of lowland forest trees had shed their leaves. Thus, there was no need to include foliage in the carbon fraction weighting.

Equation 14 Conversion of stem carbon biomass to t CO_2e/ha

$$PC_{pl,i} = \sum_{st=1}^{st_{pl}} DM_{st,i} \times CF \times \frac{44}{12} \times \frac{XP_{st}}{1000}$$

Where:

$PC_{pl,i}$ = Carbon Stock in Plot *pl* in carbon pool *i* (t CO_2e/ha)

$DM_{st,i}$ = Dry matter in carbon pool *i* in stem *st* (kg)

CF = Carbon Fraction of Dry Matter (0.46 for trees < 10 cm dbh and 0.49 for trees >= 10 cm dbh)

XP_{st} = Plot expansion factor for stem *st* (3184.7 for stems < 5 cm dbh and 14.15 for stems >= 5 cm dbh)

An examination of the plot level estimates showed two large outliers in the low carbon class associated with plots which randomly fell into small, isolated patches of riverine forest equivalent to single forest map pixels. One of the plots had almost twice as much total AGB as the highest plot estimate in the high carbon forest class, while the other plot AGB was nearly equal to the highest plot in the high carbon forest class. To reduce uncertainty, the AGB and BGB values in these two plots were replaced with the next highest estimate for AGB and BGB in the low carbon class.

Once each plot was summed in t CO_2e/ha equivalents, a pivot table was used to calculate the average and standard deviation for the plots in each sampling stratum area from the VCSL and COFOREST project datasets. Then, to calculate the mean stock in each pool for each forest type for the entire

project area, we calculated the weighted average mean[77] by applying the area-based weights for each sampling area (Equation 15).

Equation 15 Weighted mean carbon stocks in a carbon pool

$$\Upsilon = \sum_{h=1}^{L} \frac{N_h}{N} \times \Upsilon_h$$

Where

Υ = the mean stock of a pool for the forest type in all sampling areas

N = the total area of the forest type in all sampling area

N_h = the total area of the forest type in sampling area h

Υ_h = the mean stock of a pool of the forest type in sampling area h

Then, the total variance for each pool in each forest type was calculated using Equation 16, which is the appropriate equation for calculating the variance of stratified random sampling[78]:

Equation 16 Total carbon pool variance in a forest type

$$var(\Upsilon) = \sum_{h=1}^{L} \left(\frac{N_h}{N}\right)^2 \times \left(\frac{N_h - n_h}{N_h}\right) \times \frac{s_h^2}{n_h}$$

Where

$var(\Upsilon)$ = total pool variance of forest type in all sampling areas

N = the total area of the forest type in all sampling areas

N_h = the total area of the forest type in sampling area h

n_h = the number of sample plots in the forest type in sampling area h

S_h = the standard deviation of the forest type pool in sampling area h

Then the 90% confidence interval of each pool in each forest type was calculated by taking the square root of the total pool variance and multiplying by 1.645. There was essentially no difference in soil

[77] https://en.wikipedia.org/wiki/Weighted_arithmetic_mean

[78] https://en.wikipedia.org/wiki/Stratified_sampling

organic carbon in high and low carbon forest classes, so initial SOC for both initial forest classes were recalculated as a single initial class.

The results for all pools are presented in VM0015 Table 23. The results after adjusting for uncertainty are presented in

Project year t	Initial forest class icl					
	Name	Low Carbon Forest				
	IDcl	i2				
	Average carbon stock per hectare ± 90% CI					
	Cabicl		Cbbicl		Ctoticl	
	C stock tCO2e/ha	± 90% tCO2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha
2022	75.77	10.07	34.22	3.85	109.99	10.78
2023	75.77	10.07	34.22	3.85	109.99	10.78
2024	75.77	10.07	34.22	3.85	109.99	10.78
2025	75.77	10.07	34.22	3.85	109.99	10.78
2026	75.77	10.07	34.22	3.85	109.99	10.78
2027	75.77	10.07	34.22	3.85	109.99	10.78
2028	75.77	10.07	34.22	3.85	109.99	10.78

VM0015 Table 25. They are identical because the half width of the 90% confidence interval for the total carbon stock in each initial forest class was less than 10%.

VM0015 Table 23 Carbon Stocks Per Hectare of Initial Forest Classes icl Existing in the Project Area and Leakage Belt – Estimated

Project year t	Initial forest class icl	
	Name	High Carbon Forest
	ID_{cl}	i1

	Average carbon stock per hectare ± 90% CI					
	Cab_{icl}		Cbb_{icl}		$Ctot_{icl}$	
	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha
2022	142.99	11.97	54.58	4.53	197.57	12.8
2023	142.99	11.97	54.58	4.53	197.57	12.8
2024	142.99	11.97	54.58	4.53	197.57	12.8
2025	142.99	11.97	54.58	4.53	197.57	12.8
2026	142.99	11.97	54.58	4.53	197.57	12.8
2027	142.99	11.97	54.58	4.53	197.57	12.8
2028	142.99	11.97	54.58	4.53	197.57	12.8

Project year t	Initial forest class icl					
	Name	Low Carbon Forest				
	ID_{cl}	i2				
	Average carbon stock per hectare ± 90% CI					
	Cab_{icl}		Cbb_{icl}		$Ctot_{icl}$	
	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha
2022	75.77	10.07	34.22	3.85	109.99	10.78
2023	75.77	10.07	34.22	3.85	109.99	10.78
2024	75.77	10.07	34.22	3.85	109.99	10.78
2025	75.77	10.07	34.22	3.85	109.99	10.78
2026	75.77	10.07	34.22	3.85	109.99	10.78
2027	75.77	10.07	34.22	3.85	109.99	10.78

2028	75.77	10.07	34.22	3.85	109.99	10.78

VM0015 Table 25 Carbon Stocks Per Hectare of Initial Forest Classes icl Existing in the Project Area and Leakage Belt – Values After Discounting for Uncertainty

Project year t	Initial forest class icl					
	Name	High Carbon Forest				
	ID_{cl}	i1				
	Average carbon stock per hectare ± 90% CI					
	Cab_{icl}		Cbb_{icl}		$Ctot_{icl}$	
	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha
2022	142.99	11.97	54.58	4.53	197.57	12.8
2023	142.99	11.97	54.58	4.53	197.57	12.8
2024	142.99	11.97	54.58	4.53	197.57	12.8
2025	142.99	11.97	54.58	4.53	197.57	12.8
2026	142.99	11.97	54.58	4.53	197.57	12.8
2027	142.99	11.97	54.58	4.53	197.57	12.8
2028	142.99	11.97	54.58	4.53	197.57	12.8
Note	No discount applied since total uncertainty is less than 10%					

Project year t	Initial forest class icl			
	Name	Low Carbon Forest		
	ID_{cl}	i2		
	Average carbon stock per hectare ± 90% CI			
	Cab_{icl}		Cbb_{icl}	$Ctot_{icl}$

	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha
2022	75.77	10.07	34.22	3.85	109.99	10.78
2023	75.77	10.07	34.22	3.85	109.99	10.78
2024	75.77	10.07	34.22	3.85	109.99	10.78
2025	75.77	10.07	34.22	3.85	109.99	10.78
2026	75.77	10.07	34.22	3.85	109.99	10.78
2027	75.77	10.07	34.22	3.85	109.99	10.78
2028	75.77	10.07	34.22	3.85	109.99	10.78
Note	No discount applied since total uncertainty is less than 10%					

Post Deforestation Carbon Stock Analysis

Post-deforestation woody pool stocks were calculated as a single sampling area stratified by years since deforestation. Pool averages and standard deviations for each year were calculated using a pivot table. The uncertainty for each pool for each year was also calculated in excel using the appropriate t-statistic depending on the numbers of samples in each year. Then the long-term average of each pool was calculated by averaging the annual estimates. The 90% confidence interval of the long-term averages for each pool were calculated using the pooled standard errors of each year (Equation 17). The results are presented in VM0015 Table 26.

Equation 17 90% Confidence Interval for the 20-year average post-deforestation pool carbon stock

$$CI_{20years} = 1.645 \times \sqrt{\frac{1}{n^2}\sum_{i=1}^{n}(SE_i^2)}$$

Where

$CI_{20years}$ = half width of the 90% confidence interval for the 20-year average of the pool

n = number of deforestation age classes (20)

SE_i = standard error of the pool estimates for deforestation age class i

VM0015 Table 26 Long-Term (20-Year) Average Carbon Stocks Per Hectare of Post-Deforestation LU/LC Classes Present in the Reference Region.

Project year t	Post deforestation class fcl					
	Name	Post deforestation				
	ID_{fcl}	f3				
	Average carbon stock per hectare ± 90% CI					
	Cab_{fcl}		Cbb_{fcl}		$Ctot_{fcl}$	
	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO_2e/ha	± 90% tCO_2e/ha	C stock tCO2e/ha	± 90% tCO2e/ha
t*	6.09	8.96	1.65	2.43	7.74	9.28
t*+1	27.84	37.92	7.55	10.28	35.39	39.29
t*+2	7.13	7.22	1.93	1.96	9.06	7.48
t*+3	2.38	3.12	0.51	0.78	2.89	3.22
t*+4	16.12	25.46	4.37	6.9	20.49	26.38
t*+5	9.41	15.9	2.54	4.32	11.95	16.48
t*+6	9.11	10.21	2	2.94	11.11	10.62
t*+7	4.48	10.54	1.21	2.86	5.69	10.92
t*+8	7.84	17.22	2.12	4.67	9.96	17.84
t*+9	8.25	18.62	2.24	5.05	10.49	19.29
t*+10	9.85	19.2	2.67	5.2	12.52	19.89
t*+11	0.54	1.27	0.15	0.34	0.69	1.31
t*+12	7.9	12.55	1.84	3.41	9.74	13.01
t*+13	6.18	11.09	1.24	1.93	7.42	11.26
t*+14	1.69	2.45	0.46	0.66	2.15	2.54
t*+15	6.03	5.63	1.63	1.53	7.66	5.83

t*+16	18.87	17.14	4.17	3.48	23.04	17.49
t*+17	12.1	24.23	3.28	6.57	15.38	25.1
t*+18	20.18	45.82	5.47	12.42	25.65	47.47
t*+19	31.56	41.78	7.07	8.47	38.63	42.63
Average	10.68	3.38	2.7	0.85	13.38	3.49
Average to be used in project area calculations	14.06		3.55			
Average to be used in leakage belt calculations	7.3		1.85			

VM0015 Table 27 Long-Term (20-Year) Area-Weighted Average Carbon Stock Per Zone

Zone		Post-deforestation LU/LC classes fcl		Average weighted long-term (20-year) average carbon stocks per zone z	
		Name	Post-deforestation		
		IDfcl	f3		
IDz	Name			C stock (t CO_2e/ha)	
		Cab_{fcl}	Cbb_{fcl}	$Ctot_z$	90% CI
1	Zone1	10.68	2.7	13.38	3.49

Calculation of Emissions Factors

Emissions factors were calculated for each initial forest class (icl) and the singe post-deforestation class (fcl) as per VM0015:

1. For above-ground biomass:

a. Initial forest classes (icl): immediate release of 100 percent of the carbon stock (as estimated in Table 25) is assumed to happen during year t = t* (year when deforestation occurs).

b. Post-deforestation classes (fcl): linear increase from 0 t CO_2e/ha in year t = t* to 100 percent of the long-term (20-year) average carbon stock (as estimated in VM0015 Table 27 after adjusting for uncertainty) in year t = t*+ 9 is assumed to happen in the 10-year period following deforestation (i.e., 1/10th of the final carbon stock is accumulated each year).

2. For below-ground biomass:

a. Initial forest classes (icl): an annual release of 1/10th of the initial carbon stock (as estimated in Table 25) is assumed to happen each year between t = t* and t = t*+ 9.

b. Post-deforestation classes (fcl): linear increase from 0 t CO_2e/ha in year t = t* to 100 percent of the long-term (20-year) average carbon stock (as estimated in VM0015 Table 27 after adjusting for uncertainty) in year t = t*+ 9 is assumed to happen in the 10-year period following deforestation (i.e., 1/10th of the final carbon stock is accumulated each year).

The results for each icl and the single fcl for the project area and leakage belt calculations are reported in the following versions of VM0015 Table 33. Version 1.2 of the methodology requires that baseline stock changes be estimated for the entire reference region, but doesn't specify which uncertainty adjustment, if any, should be applied to those calculations. Therefore, for post deforestation stock changes for reference region, the unadjusted values from VM0015 Table 27 were used.

VM0015 Table 33 Emission Factors for High Carbon Forest Class (i1) (Method 1)

Year after deforestation		$\Delta Cab_{icl,t}$	$\Delta Cbb_{icl,t}$
1	t*	-142.99	-5.458
2	t*+1		-5.458
3	t*+2		-5.458
4	t*+3		-5.458
5	t*+4		-5.458
6	t*+5		-5.458

7	t*+6		-5.458
8	t*+7		-5.458
9	t*+8		-5.458
10	t*+9		-5.458
11	t*+10		
12	t*+11		
13	t*+12		
14	t*+13		
15	t*+14		
16	t*+15		
17	t*+16		
18	t*+17		
19	t*+18		
20	t*+19		
21	t*+20		

VM0015 Table 33 Emission Factors for Low Carbon Forest Class (i2) (Method 1)

Year after deforestation		$\Delta Cab_{icl,t}$	$\Delta Cbb_{icl,t}$
1	t*	-75.77	-3.422
2	t*+1		-3.422
3	t*+2		-3.422
4	t*+3		-3.422
5	t*+4		-3.422
6	t*+5		-3.422
7	t*+6		-3.422

8	t*+7		-3.422
9	t*+8		-3.422
10	t*+9		-3.422
11	t*+10		
12	t*+11		
13	t*+12		
14	t*+13		
15	t*+14		
16	t*+15		
17	t*+16		
18	t*+17		
19	t*+18		
20	t*+19		
21	t*+20		

VM0015 Table 33 Emission Factors for post deforestation class (f3) in reference region (Method 1)

Year after deforestation		$\Delta Cab_{fcl,t}$	$\Delta Cbb_{fcl,t}$
1	t*	1.068	0.27
2	t*+1	1.068	0.27
3	t*+2	1.068	0.27
4	t*+3	1.068	0.27
5	t*+4	1.068	0.27
6	t*+5	1.068	0.27
7	t*+6	1.068	0.27

8	t*+7	1.068	0.27
9	t*+8	1.068	0.27
10	t*+9	1.068	0.27
11	t*+10		
12	t*+11		
13	t*+12		
14	t*+13		
15	t*+14		
16	t*+15		
17	t*+16		
18	t*+17		
19	t*+18		
20	t*+19		
21	t*+20		

VM0015 Table 33 Emission Factors for post deforestation class (f3) in project area (Method 1)

Year after deforestation		$\Delta Cab_{fcl,t}$	$\Delta Cbb_{fcl,t}$
1	t*	1.406	0.355
2	t*+1	1.406	0.355
3	t*+2	1.406	0.355
4	t*+3	1.406	0.355
5	t*+4	1.406	0.355
6	t*+5	1.406	0.355
7	t*+6	1.406	0.355
8	t*+7	1.406	0.355

9	t*+8	1.406	0.355
10	t*+9	1.406	0.355
11	t*+10		
12	t*+11		
13	t*+12		
14	t*+13		
15	t*+14		
16	t*+15		
17	t*+16		
18	t*+17		
19	t*+18		
20	t*+19		
21	t*+20		

VM0015 Table 33 Emission Factors for post deforestation class (f3) in leakage belt (Method 1)

Year after deforestation		$\Delta Cab_{fcl,t}$	$\Delta Cbb_{fcl,t}$
1	t*	0.73	0.185
2	t*+1	0.73	0.185
3	t*+2	0.73	0.185
4	t*+3	0.73	0.185
5	t*+4	0.73	0.185
6	t*+5	0.73	0.185
7	t*+6	0.73	0.185
8	t*+7	0.73	0.185
9	t*+8	0.73	0.185

10	t*+9	0.73	0.185
11	t*+10		
12	t*+11		
13	t*+12		
14	t*+13		
15	t*+14		
16	t*+15		
17	t*+16		
18	t*+17		
19	t*+18		
20	t*+19		
21	t*+20		

Calculation of Baseline Carbon Stock Changes

Baseline carbon stock changes were calculated using VM0015 Equation 10.

VM0015 Equation 10

$$\Delta CBSLPA_t = \sum_{p=1}^{P}\left(\sum_{icl=1}^{icl} ABSLPA_{icl,t} \times \Delta Cp_{icl,t=t*} + \sum_{icl=1}^{icl} ABSLPA_{icl,t-1} \times \Delta Cp_{icl,t=t*+1} + \sum_{icl=1}^{icl} ABSLPA_{icl,t-2} \times \Delta Cp_{icl,t=t*+2} + \ldots \sum_{icl=1}^{icl} ABSLPA_{icl,t-19} \times \Delta Cp_{icl,t=t*+19}\right)$$

Where

$\Delta CBSLPA_t$ = Total baseline carbon stock change within the project area at year *t* (t CO_2e)

$ABSLPA_{icl,t}$ = Area of initial forest class *icl* deforested at time t within the project area in the baseline case (ha)

$ABSLPA_{icl,t-1}$ = Area of initial forest class *icl* deforested at time t-1 within the project area in the baseline case (ha)

$ABSLPA_{icl,t-19}$	=	Area of initial forest class *icl* deforested at time t-19 within the project area in the baseline case (ha)
$\Delta Cp_{icl,t=t*}$	=	Average emission factor for carbon pool *p* in initial forest class icl applicable at time *t* (t CO_2e/ha)
$\Delta Cp_{icl,t=t*+1}$	=	Average emission factor for carbon pool *p* in initial forest class icl applicable at time *t* (t CO_2e/ha)
$\Delta Cp_{icl,t=t*+19}$	=	Average emission factor for carbon pool *p* in initial forest class icl applicable at time *t* (t CO_2e/ha)
Icl	=	1, 2, 3, …, *Icl* initial (pre-deforestation) forest classes (dimensionless)
z	=	1, 2, 3, …, *Z* zones (dimensionless)
p	=	1, 2, 3, …, *P* carbon pools included in the baseline (dimensionless)
t	=	1, 2, 3, …, *T*, a year of the proposed project crediting period (dimensionless)
*t**	=	Year in which area $ABSLPA_{icl,t}$ is deforested in the baseline case

To simply accounting during this baseline validity period, continued baseline, and project stock changes in project years 11-19 associated with baseline and observed deforestation during project years 2-10 were calculated separately. Due to higher deforestation at the end of the first baseline validity period, project stock changes exceeded the baseline stock changes by 5369 t CO_2e. This amount was conservatively subtracted from the emissions reductions reported in the 2013-2022 monitoring report and thus does not need to be accounted for during this baseline validity period.

VM0015 Table 35 Baseline Carbon Stock Change for AGB in the Reference Region (Method 1)

Carbon Stock Changes in the Aboveground Biomass per Initial Forest Class icl			Total Carbon Stock Change in Aboveground Biomass of Initial Forest Classes in the Reference Region		Carbon Stock Changes in Aboveground Biomass Per Post deforestation Zone z		Total Carbon Stock Change in Aboveground Biomass of Post-deforestation Zones in the Reference Region		Total Net Carbon Stock Change in Aboveground Biomass of Post-deforestation Zones in the Reference Region	
ID_{icl}>	1	2	$\Delta Cab\ BSLRR_{icl,t}$ Annual	$\Delta Cab\ BSLRR_{icl}$ Cumulative	ID_{iz}	3	$\Delta Cab\ BSLRR_{z,t}$ Annual	$\Delta Cab\ BSLRR_{z}$ Cumulative	$\Delta Cab\ BSLRR_{t}$ Annual	$\Delta Cab\ BSLRR$ Cumulative
Name>	High Carbon	Low Carbon			Name>	Post-Deforestation				
Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-8,655,896	-2,542,928	-11,198,824	-11,198,824	2022	100,495	100,495	100,495	-11,098,330	-11,098,330
2023	-12,389,812	-3,639,878	-16,029,690	-27,228,514	2023	244,340	244,340	344,835	-15,785,350	-26,883,679
2024	-12,389,812	-3,639,878	-16,029,690	-43,258,204	2024	388,185	388,185	733,020	-15,641,504	-42,525,184
2025	-12,389,812	-3,639,878	-16,029,690	-59,287,893	2025	532,031	532,031	1,265,050	-15,497,659	-58,022,843
2026	-12,389,812	-3,639,878	-16,029,690	-75,317,583	2026	675,876	675,876	1,940,926	-15,353,814	-73,376,657
2027	-12,389,812	-3,639,878	-16,029,690	-91,347,273	2027	819,721	819,721	2,760,647	-15,209,969	-88,586,625
2028	-3,757,566	-1,103,897	-4,861,463	-96,208,736	2028	863,346	863,346	3,623,994	-3,998,117	-92,584,742

VM0015 Table 35 Baseline Carbon Stock Change for BGB in the Reference Region (Method 1)

Carbon Stock Changes in the Belowground Biomass per Initial Forest Class icl			Total Carbon Stock Change in Belowground Biomass of Initial Forest Classes in the Reference Region		Carbon Stock Changes in Belowground Biomass Per Post deforestation Zone z		Total Carbon Stock Change in Belowground Biomass of Post- deforestation Zones in the Reference Region		Total Net Carbon Stock Change in Belowground Biomass of Post-deforestation Zones in the Reference Region	
ID_{icl}>	1	2	$\Delta Cbb\ BSLRR_{icl,t}$ Annual	$\Delta Cbb\ BSLRR_{icl}$ Cumulative	ID_{iz}	3	$\Delta Cbb\ BSLRR_{z,t}$ Annual	$\Delta Cbb\ BSLRR_{z}$ Cumulative	$\Delta Cbb\ BSLRR_{t}$ Annual	$\Delta Cbb\ BSLRR$ Cumulative
Name>	High Carbon	Low Carbon			Name>	Post-Deforestation				
Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-330,400	-114,846	-445,246	-445,246	2022	25,406	25,406	25,406	-419,840	-419,840
2023	-803,325	-279,234	-1,082,559	-1,527,805	2023	61,771	61,771	87,177	-1,020,788	-1,440,628
2024	-1,276,251	-443,622	-1,719,872	-3,247,678	2024	98,137	98,137	185,314	-1,621,736	-3,062,364
2025	-1,749,176	-608,010	-2,357,185	-5,604,863	2025	134,502	134,502	319,816	-2,222,683	-5,285,047
2026	-2,222,101	-772,397	-2,994,499	-8,599,362	2026	170,867	170,867	490,684	-2,823,631	-8,108,678
2027	-2,695,027	-936,785	-3,631,812	-12,231,174	2027	207,233	207,233	697,916	-3,424,579	-11,533,257
2028	-2,838,455	-986,640	-3,825,095	-16,056,269	2028	218,262	218,262	916,178	-3,606,833	-15,140,091

VM0015 Table 36 Baseline Carbon Stock Change for AGB in the Project Area (Method 1)

Carbon Stock Changes in the Aboveground Biomass per Initial Forest Class icl			Total Carbon Stock Change in Aboveground Biomass of Initial Forest Classes in the Project Area		Carbon Stock Changes in Aboveground Biomass Per Post deforestation Zone z		Total Carbon Stock Change in Aboveground Biomass of Post- deforestation Zones in the Project Area		Total Net Carbon Stock Change in Aboveground Biomass of Post-deforestation Zones in the Project Area	
ID_{icl}>	1	2	$\Delta Cab\ BSLPA_{icl,t}$ Annual	$\Delta Cab\ BSLPA_{icl}$ Cumulative	ID_{iz}	3	$\Delta Cab\ BSLPA_{z,t}$ Annual	$\Delta Cab\ BSLPA_{z}$ Cumulative	$\Delta Cab\ BSLPA_{t}$ Annual	$\Delta Cab\ BSLPA$ Cumulative
Name>	High Carbon	Low Carbon			Name>	Post-Deforestation				
Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-77,718	-13,993	-91,712	-91,712	2022	1,024	1,024	1,024	-90,688	-90,688
2023	-551,047	-70,439	-621,486	-713,198	2023	7,749	7,749	8,773	-613,737	-704,425
2024	-603,662	-76,470	-680,131	-1,393,329	2024	15,104	15,104	23,877	-665,027	-1,369,452
2025	-603,662	-76,470	-680,131	-2,073,460	2025	22,459	22,459	46,336	-657,673	-2,027,124
2026	-603,662	-76,470	-680,131	-2,753,592	2026	29,813	29,813	76,149	-650,318	-2,677,442
2027	-603,662	-76,470	-680,131	-3,433,723	2027	37,168	37,168	113,317	-642,963	-3,320,406
2028	-183,078	-23,192	-206,269	-3,639,992	2028	39,399	39,399	152,716	-166,871	-3,487,276

VM0015 Table 36 Baseline Carbon Stock Change for BGB in the Project Area (Method 1)

Carbon Stock Changes in the Belowground Biomass per Initial Forest Class icl			Total Carbon Stock Change in Belowground Biomass of Initial Forest Classes in the Project Area		Carbon Stock Changes in Belowground Biomass Per Post deforestation Zone z		Total Carbon Stock Change in Belowground Biomass of Post- deforestation Zones in the Project Area		Total Net Carbon Stock Change in Belowground Biomass of Post-deforestation Zones in the Project Area	
ID_{icl}>	1	2	$\Delta Cbb\ BSLPA_{icl,t}$ Annual	$\Delta Cbb\ BSLPA_{icl}$ Cumulative	ID_{iz}	3	$\Delta Cbb\ BSLPA_{z,t}$ Annual	$\Delta Cbb\ BSLPA_{z}$ Cumulative	$\Delta Cbb\ BSLPA_{t}$ Annual	$\Delta Cbb\ BSLPA$ Cumulative
Name>	High Carbon	Low Carbon			Name>	Post-Deforestation				
Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-2,967	-632	-3,599	-3,599	2022	259	259	259	-3,340	-3,340
2023	-24,000	-3,813	-27,814	-31,412	2023	1,957	1,957	2,215	-25,857	-29,197
2024	-47,042	-7,267	-54,309	-85,721	2024	3,814	3,814	6,029	-50,496	-79,692
2025	-70,084	-10,720	-80,805	-166,526	2025	5,671	5,671	11,699	-75,134	-154,827
2026	-93,127	-14,174	-107,301	-273,827	2026	7,528	7,528	19,227	-99,773	-254,600
2027	-116,169	-17,628	-133,796	-407,623	2027	9,385	9,385	28,611	-124,412	-379,011
2028	-123,157	-18,675	-141,832	-549,454	2028	9,948	9,948	38,559	-131,884	-510,895

VM0015 Table 37 Baseline Carbon Stock Change for AGB in the Leakage Belt (Method 1)

Carbon Stock Changes in the Aboveground Biomass per Initial Forest Class icl			Total Carbon Stock Change in Aboveground Biomass of Initial Forest Classes in the Leakage Belt		Carbon Stock Changes in Aboveground Biomass Per Post deforestation Zone z		Total Carbon Stock Change in Aboveground Biomass of Post- deforestation Zones in the Leakage Belt		Total Net Carbon Stock Change in Aboveground Biomass of Post-deforestation Zones in the Leakage Belt	
ID_{icl}>	1	2	$\Delta Cab\ BSLLK_{icl,t}$ Annual	$\Delta Cab\ BSLLK_{icl}$ Cumulative	ID_{iz}	3	$\Delta Cab\ BSLLK_{z,t}$ Annual	$\Delta Cab\ BSLLK_{z}$ Cumulative	$\Delta Cab\ BSLLK_{t}$ Annual	$\Delta Cab\ BSLLK$ Cumulative
Name>	High Carbon	Low Carbon			Name>	Post-Deforestation				
Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-100,572	-23,243	-123,814	-123,814	2022	737	737	737	-123,077	-123,077
2023	-619,568	-160,251	-779,819	-903,634	2023	5,444	5,444	6,182	-774,375	-897,452
2024	-676,466	-175,442	-851,909	-1,755,543	2024	10,588	10,588	16,770	-841,321	-1,738,773
2025	-676,466	-175,442	-851,909	-2,607,451	2025	15,732	15,732	32,502	-836,177	-2,574,950
2026	-676,466	-175,442	-851,909	-3,459,360	2026	20,876	20,876	53,378	-831,033	-3,405,983
2027	-676,466	-175,442	-851,909	-4,311,269	2027	26,020	26,020	79,397	-825,889	-4,231,872
2028	-205,158	-53,208	-258,366	-4,569,635	2028	27,580	27,580	106,977	-230,786	-4,462,658

VM0015 Table 37 Baseline Carbon Stock Change for BGB in the Leakage Belt (Method 1)

Carbon Stock Changes in the Belowground Biomass per Initial Forest Class icl			Total Carbon Stock Change in Belowground Biomass of Initial Forest Classes in the Leakage Belt		Carbon Stock Changes in Belowground Biomass Per Post deforestation Zone z		Total Carbon Stock Change in Belowground Biomass of Post- deforestation Zones in the Leakage Belt		Total Net Carbon Stock Change in Belowground Biomass of Post-deforestation Zones in the Leakage Belt	
ID_{icl}>	1	2	$\Delta Cbb\ BSLLK_{icl,t}$ Annual	$\Delta Cbb\ BSLLK_{icl}$ Cumulative	ID_{iz}	3	$\Delta Cbb\ BSLLK_{z,t}$ Annual	$\Delta Cbb\ BSLLK_{z}$ Cumulative	$\Delta Cbb\ BSLLK_{t}$ Annual	$\Delta Cbb\ BSLLK$ Cumulative
Name>	High Carbon	Low Carbon			Name>	Post-Deforestation				
Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	Project year t	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-3,839	-1,050	-4,889	-4,889	2022	187	187	187	-4,702	-4,702
2023	-27,488	-8,287	-35,775	-40,664	2023	1,380	1,380	1,567	-34,395	-39,097
2024	-53,309	-16,211	-69,520	-110,184	2024	2,683	2,683	4,250	-66,836	-105,934
2025	-79,130	-24,134	-103,264	-213,448	2025	3,987	3,987	8,237	-99,277	-205,211
2026	-104,951	-32,058	-137,009	-350,457	2026	5,290	5,290	13,527	-131,718	-336,930
2027	-130,772	-39,981	-170,754	-521,210	2027	6,594	6,594	20,121	-164,159	-501,089
2028	-138,603	-42,384	-180,988	-702,198	2028	6,989	6,989	27,111	-173,998	-675,087

6.2 Baseline Non-CO2 Emissions from Forest Fires

Slash-and-burn is the primary means of clearing land for farms. Slash is often piled before burning to ensure that it all burns, and to increase control over the fire, though in some cases slash is burned where it falls. In general, almost all the above-ground woody biomass is burned before cultivation. Thus, as per the methodology, we calculated baseline non-CO2 emissions from forest fires using VM0015 equations 11-14. $Fburnt_{icl}$ was estimated from the project's disturbance data (Table 15) as being proportionate to the percent of forest disturbances where agriculture was a driver. $Pburnt_{p,icl}$ was conservatively estimated as the difference between starting AGB and uncertainty adjusted long term average post deforestation AGB in each forest class. Parameters are summarized in VM0015 Table 41 and CO_2 equivalents of baseline non-CO2 emissions from the project area are shown VM0015 Table 42.

VM0015 Equation 11

$$EBBtot_{icl,t} = EBBN_2O_{icl,t} + EBBCH_{4icl,t}$$

Where

$EBBtot_{icl,t}$ = Total GHG emissions from biomass burning in forest class *icl* in year *t* (t CO_2e /ha)

$EBBN_2O_{icl,t}$ = N_2O emissions from biomass burning in forest class icl in year *t* (t CO_2e /ha)

$EBBCH_{4icl,t}$ = CH_4 emissions from biomass burning in forest class icl in year *t* (t CO_2e /ha)

VM0015 Equation 12

$$EBBN_2O_{icl,t} = EBBCO_{2icl,t} \times \frac{12}{44} \times NCR \times ER_{N_2O} \times \frac{44}{28} \times GWP_{N_2O}$$

VM0015 Equation 13

$$EBBCH_{4icl,t} = EBBCO_{2icl,t} \times \frac{12}{44} \times ER_{CH_4} \times \frac{16}{12} \times GWP_{CH_4}$$

Where

$EBBCO_{2\ icl,t}$ = Per hectare CO_2 emissions from biomass burning in slash-and-burn in forest class *icl* in year *t* (t CO_2e /ha)

$EBBN_2O_{icl,t}$ = Per hectare N_2O emissions from biomass burning in slash-and-burn in forest class *icl* at year *t* (t CO_2e /ha)

$EBBCH_{4\ icl,t}$ = Per hectare CH_4 emissions from biomass burning in slash-and-burn in forest class *icl* at year *t* (t CO_2e /ha)

NCR	=	Nitrogen to carbon ratio (IPCC default value = 0.01) (dimensionless)
ER_{N_2O}	=	Emission ratio for N_2O (IPCC default value = 0.007 from VM0015 v1.2)
ER_{CH_4}	=	Emission ratio for CH_4 (IPCC default value = 0.012 from VM0015 v1.2)
GWP_{N_2O}	=	Global Warming Potential for N_2O (IPCC default value = 265 in the 5th assessment report)
GWP_{CH_4}	=	Global Warming Potential for CH_4 (IPCC default value = 28 in the 5th assessment report)

VM0015 Equation 14

$$EBBCO2_{icl,t} = Fburnt_{icl} \times \sum_{p=1}^{p} \left(C_{p,icl,t} \times Pburnt_{p,icl} \times CE_{p,icl} \right)$$

Where:

$EBBCO2_{icl,t}$	=	Per hectare CO2 emissions from biomass burning in forest class *icl* in year *t* (t CO_2e /ha)
$Fburnt_{icl}$	=	Proportion of forest area burned during the historical reference period in forest class *icl* (%)
$C_{p,icl,t,}$	=	Average carbon stock per hectare in carbon pool p burned in forest class *icl* in year *t* (t CO_2e /ha)
$Pburnt_{p,icl}$	=	Average proportion of mass burned in carbon pool *p* in forest class *icl* (%)
$CE_{p,icl}$	=	Average combustion efficiency of carbon pool *p* in forest class *icl* (dimensionless – used the IPCC default of 50% as per VM0015)
p	=	Combustible carbon pool (above-ground biomass, dead wood, litter)
icl	=	1, 2, 3, …, *Icl* (pre-deforestation) forest classes
t	=	1, 2, 3, …, *T*, a year of the proposed project crediting period (dimensionless)

VM0015 Table 41 Parameters Used to Calculate Non-CO_2 Emissions from Forest Fires

Initial Forest Class		Parameters								
		$Fburnt_{icl}$	Cab	$Pburnt_{ab,t}$	$CE_{ab,icl}$	ECO_2-ab	$EBBCO_{2tot}$	$EBBNO_{2icl}$	$EBBCH_{4icl}$	$EBBtot_{icl}$
ID_{cl}	Name	%	t CO_2e/ha	%	%	t CO_2e/ha	t CO_2e/ha	t CO_2e/ha	t CO_2e/ha	t CO_2e/ha

1	HC	95.95%	142.99	90.17%	50%	64.47	61.85	0.49	7.56	8.05
2	LC	95.95%	75.77	81.44%	50%	30.86	29.61	0.43	3.62	4.05

VM0015 Table 42 Baseline Non-CO2 Emissions from Forest Fires in the Project Area

Project year t	Emissions of Non-CO2 Gases from Baseline Forest Fires				Total Baseline Non-CO_2 Emissions from Forest Fires in the Project Area	
	ID_{icl}	= 1	ID_{icl}	= 2		
	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	Annual	Cumulative
					$EBBBSLPA_t$	*EBBBSLPA*
	ha	t CO_2e/ha	ha	t CO_2e/ha	t CO_2e/ha	t CO_2e/ha
2022	544	4,375	185	748	5,123	5,123
2023	3,854	31,020	930	3,764	34,783	39,906
2024	4,222	33,981	1,009	4,086	38,067	77,974
2025	4,222	33,981	1,009	4,086	38,067	116,041
2026	4,222	33,981	1,009	4,086	38,067	154,108
2027	4,222	33,981	1,009	4,086	38,067	192,176
2028	1,280	10,306	306	1,239	11,545	203,721

VM0015 Table 42 Baseline Non-CO2 Emissions from Forest Fires in the Leakage Belt

Project year t	Emissions of Non-CO2 Gases from Baseline Forest Fires				Total Baseline Non-CO_2 Emissions from Forest Fires in the Leakage Belt	
	ID_{icl}	= 1	ID_{icl}	= 2		
	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	Annual	Cumulative
					$EBBBSLLK_t$	*EBBBSLLK*
	ha	t CO_2e/ha	ha	t CO_2e/ha	t CO_2e	t CO_2e
2,022	703	5,661	307	1,242	6,903	6,903
2,023	4,333	34,877	2,115	8,563	43,440	50,343
2,024	4,731	38,080	2,315	9,375	47,454	97,797

2,025	4,731	38,080	2,315	9,375	47,454	145,252
2,026	4,731	38,080	2,315	9,375	47,454	192,706
2,027	4,731	38,080	2,315	9,375	47,454	240,160
2,028	1,435	11,549	702	2,843	14,392	254,552

7 PROJECT EMISSIONS

7.1 Ex Ante Estimation of Actual Carbon Stock Changes and Non-CO2 Emissions in the Project Area

The goal of this step is to provide an ex-ante estimate of future carbon stock changes and non-CO2 emissions from forest fires under the project scenario ("actual"). Actual carbon stock changes and GHG emissions are subject to MRV-A, but they are estimated at the beginning of a baseline validity period to assist in guiding optimal implementation of emission reduction measures, and to allow reasonable projections of revenue to be made.

7.1.1 Ex Ante Estimation of Actual Carbon Stock Changes

There are three categories of carbon stock changes that will have some impact on carbon stocks in the project scenario:

1. Planned timber and charcoal harvesting;
2. Planned boundary clearing; and
3. Unplanned deforestation that is unavoidable

Ex Ante Estimation of Actual Carbon Stock Changes due to Planned Activities

Planned harvesting

Project villages have planned harvesting for timber and charcoal during the project. However, these activities predate the project and would have continued in the baseline scenario. They are included in the discussion here to demonstrate that the activities would not significantly impact the project area carbon stocks in either the project or baseline scenarios. Furthermore, while the explanations below show that the baseline level of harvesting would not significantly impact stocks in the baseline scenario, as per the project contracts, the project will help each participating authority adjust their harvesting plans where necessary to ensure that the harvesting does not exceed the mean annual

increment for their forests, which will prevent harvesting from unexpectedly increasing to have significant impacts on stocks in the project scenario.

It should also be noted that planned timber harvesting may be introduced to villages forest reserves which VCSL helped establish in Nachingwea, however, the planned harvesting would not exceed baseline harvesting. Any planned harvesting would occur as described below, which includes very conservative assumptions to ensure that harvesting doesn't impact the overall stock of timber trees. However, the even greater constraint on harvesting appears to be cost, as villages almost never manage to harvest and sell their entire quota. This is how timber harvesting is also controlled in the baseline scenario. While village governments are more effective at collecting timber revenue due to their proximity to the forest, the Tanzania Forest Service has road checkpoints all over the country to ensure that royalties are collected on native timber regardless of source. Additionally, transport costs, lack of roads, and the naturally low density of trees suitable for timber harvesting in natural forests limit harvesting. Thus, even in the baseline scenario where there was no village forest reserve or harvesting plans, timber harvesting is limited by costs. The project area disturbance data reported in Table 15 found evidence of timber harvesting in just 0.22% of disturbances by area. The vast majority of cut trees in cut are for farm clearings and in almost all cases, they are simply burned where they fall.

The contracts signed between the project and participating forest owners specify that harvesting should be limited to less than 1% of biomass within the project area forests. To put this in ecological context, the mean annual increment (MAI) of miombo woodlands in Tanzania has been estimated at 1.6 ± 0.2 m^3 ha^{-1} $year^{-1}$ based on NAFORMA national forest inventory data (Manyanda et al., 2020[79]). Converting this to biomass terms using a reasonable mean wood density for Miombo species (0.63 kg/m^3) and a carbon fraction of 0.49 gives an annual increment of approximately 1.8 tCO_2e ha^{-1} $year^{-1}$ at the central estimate, equivalent to roughly 1.4% of mean standing biomass across the project area. Even at the lower confidence bound of 1.4 m^3 ha^{-1} $year^{-1}$, annual biomass increment equates to approximately 1.2% of standing biomass. However, as explained in more detail below, there is little worry that actual harvesting levels will ever approach even 1%.

Timber

Many of the project villages have timber harvesting plans (quotas) developed using either the Mpingo Conservation and Develop Initiative (MCDI) or MJUMITA's timber harvesting manual, which is based on MCDI's. The MCDI approach to quota setting has been approved by FSC and MCDI has helped 14 villages in Kilwa district obtain FSC certification. The quotas are set every 5 years on a per species basis based on the results of transect data where size class data is gathered for individual species. Then conservative assumptions are applied to estimate a sustainable offtake based not only on the

[79] Manyanda, B. J., Mugasha, W. A., Nawir, A. A., & Malimbwi, R. E. (2020). Estimates of volume and carbon stock removals in miombo woodlands of mainland Tanzania. International Journal of Forestry Research, 2020, Article 4043965. https://doi.org/10.1155/2020/4043965

existing stock of harvestable sized trees, but also making sure that there are enough smaller trees that will grow into the harvestable size in the next 5 years. The model assumes a 50-year rotation for the harvestable size class. For instance, if the harvestable size class is 45cm dbh and above, the quota would be set to allow 1/50 of that size class to be harvested if there are sufficient stems in the 22.5 to 45 cm size class to replace the harvestable size class in 50 years accounting for tree mortality in both classes. The model also adjusts for species specific factors like heart rot, which lowers quotas even further. Harvesting is required to be spread out, but this tends to occur even without close supervision because of the low density of species and size classes suitable for timber harvesting in any one area.

To illustrate, the two highest allowable annual cuts reported in the VCSL 2024 CCB survey are from Majonanga village (6,239 m^3) and Nyali village (3,700 m^3). Converting these volumes to equivalent AGB carbon stock using Equation 18, with an assumed average wood density of 0.63 kg/m^3 and a carbon fraction of 0.49, gives annual harvest impacts of 7,164 tCO_2e for Majonanga and 4,188 tCO_2e for Nyali. Dividing these figures by the total AGB of each village's forest reserve — estimated by applying stratum-level AGB values to the areas of high carbon and low carbon forest determined from the stratification map — gives 1,580,682 tCO_2e for Majonanga and 758,276 tCO_2e for Nyali. The allowable annual cuts therefore represent 0.45% and 0.55% of village forest reserve AGB respectively. Nyali has an exceptionally high quota relative to its forest reserve size because its higher-elevation wet Miombo forest supports a disproportionately large number of harvestable-sized trees compared to other villages. Even so, its quota remains well below 1% of standing biomass.

However, in practice, both MCDI villages[80] and MJUMITA villages haven't managed to find enough market to meet their quotas, so actual harvesting is substantially less than what is permitted. MJUMITA data from VCSL project villages in Morogoro from 2020-2022 shows an average annual offtake of 1337 m^3. The offtake is reported in whole tree volumes based on a conversion table that converts from sawn timber to round logs and then a second step where an additional 30% is added to account for the rest of the tree. However, the MJUMITA staff member who collected the data said that Kilosa district often didn't do the second step. Therefore, the total take was recalculated assuming that the data reported for Kilosa only included the first step. The combination of the table conversions and adding 30% is equivalent to a total tree recovery rate of 24% of sawn timber.

In a recent study in Lindi currently in print, researchers found that for 315 Miombo trees harvested for timber, an average of 48.14% was removed as round logs from the forest[81]. Assuming an average recovery from logs to sawn timber of 50% would give a total tree recovery of 24%, matching the current assumptions used by forest authorities.

[80] Frey, Gregory E., Susan Charnley, and Jasper Makala. "Economic viability of community-based forest management for certified timber production in southeastern Tanzania." World Development 144 (2021): 105491.

[81] The average removal figure comes from Dr. Wilson Mugasha who is the second author on the paper.

After recalculating assuming that Kilosa district villages did not add the extra 30% to their whole tree volume estimates, the total average annual harvested tree volume was 1744 m^3. The three most common species targeted in the COFOREST villages, making up more than 90% of the records where the species was reported were Brachystegia bussei, Brachystegia microphylla, and Brachystegia spiciformis. The average density of these three species is 0.63 t/m^3 . Converting from volume to AGB in tCO2e using that density and a carbon fraction of 0.49 gives a total AGB offtake of 1974 t CO_2e.

Equation 18 Conversion of timber volume to equivalent AGB stock consumed

$$eAGB_{tim} = Tim_{m^3} \times wd \times cf \times \frac{44}{12}$$

Where

$eAGB_{tim}$ = equivalent above ground carbon stock required to produce t tons of charcoal (t CO_2e)

Tim_{m^3} = timber volume (m^3)

wd = average timber tree density (kg/m^3) (average of 0.63 t/m^3 applied)

cf = carbon fraction of biomass (0.49 in this case since all trees harvested are > 10 cm dbh)

The area weighted average AGB in the COFOREST villages forest reserves subjected to this harvesting was 133.9 tCO2e. These village forest reserves covered 108,630 ha. Thus, the AGB total stocks of the reserves is 14,546,494 tCO2e and the harvesting level is equivalent to 0.014% of total stocks per year. Clearly, this level of harvesting, will be more than offset by growth and will not lead to a long-term decrease in stocks.

The same holds true even for a high-volume harvesting village. Mihima village in Lindi reported the highest actual harvested timber volume in the 2024 CCB survey (976 m^3 — more than four times the next highest reported volume and approaching their annual quota of 1,189 m^3). Applying the same conversion methodology described above, this harvesting is equivalent to just 0.11% of the biomass in Mihima's village forest reserve. This confirms that even in the most active harvesting village in the most intensively harvested year on record, impacts on standing biomass remain negligible compared to a MAI of at least 1.2% per year.

The project doesn't not have as detailed of data for the project villages in Lindi region, but each village was asked if they had a harvesting plan and legal harvesting occurring, and what tool was used to establish the quotas. Only 13 of 32 villages reported legal timber harvesting from their VLFR. Nine of the 13 had been supported by MCDI while the other 4 were supported by district forest officers.

Assuming[82] that the timber revenue from the previous 3 years from these villages was from species of the same average value as in the COFOREST villages gives an average offtake of 1,657 m^2. Given that a larger percentage of the project forest is in Lindi, this suggests that the timber harvesting rates in Lindi are even lower than in Morogoro, which makes sense given that Lindi is farther from Dar es Salaam, the primary market for native hard woods than Morogoro.

The project will continue to monitor annual timber offtake reports, but there is currently no need to measure the impact of harvesting on carbon stocks and no need to account for emissions because harvesting in the project scenario will not be greater than the baseline scenario and in both cases, the harvesting will not significantly impact the project area stocks.

Charcoal

Sustainable charcoal production was introduced by the Tanzania Forest Conservation Group and MJUMITA to COFOREST project villages in 2014, with most COFOREST villages in the VCSL project starting production by 2015. The charcoal harvesting is limited to forest management units specified for charcoal harvesting. The original harvesting plan was based on a 24-year rotation. Each harvesting unit was divided into 50x50 meter grids, and the harvesting plan allowed for 1/24th of the squares to be harvested each year.

There are restrictions on what can be harvested in each square. Trees with a dbh of 10cm or less cannot be cut as well as high valuable timber species such as Pterocarpus, Afzelia, and Dalbergia species. Trees along gullies and within 50 meters of a river are also protected from cutting. Additionally, within each grid cell, harvesters must leave at least 3 trees between 10 and 30 cm dbh.

If the villages were harvesting all the squares eligible for harvesting each year, they would degrade carbon stocks within the forest management unit. However, like timber, due to various challenges related to policy and market, the villages have been harvesting far less than their plans would allow. According to the MJUMITA charcoal harvest data, COFOREST project villages in the VCSL project harvested an average of 731 tons of charcoal per year between 2020 and 2022. It should also be noted given that the reported harvesting is well below quota, and village governments can only charge royalties on forest products harvested inside their village forest reserves, there is currently no incentive for them to under report harvesting. In fact, it is believed that some of the charcoal reported by villages as being harvested from the forest management units likely comes from surrounding farmland, which would have been lost anyway during farm clearing rather than their village forest reserve, so the true harvest from within the project area is probably less.

The reported tonnage can be converted back to carbon stocks using the following equation:

[82] This is a conservative assumption because Lindi region forests have more high value species like Pterocarpus and Dalbergia which have royalties 2x of the most harvested species in the COFOREST project.

Equation 19 Conversion of charcoal to equivalent AGB stock consumed

$$eAGB_{char} = Char_t \times \left(\frac{100}{kef}\right) \times cf \times \frac{44}{12}$$

Where

$eAGB_{char}$ = equivalent above ground carbon stock required to produce t tons of charcoal (t CO_2e)

$Char_t$ = charcoal (tons)

kef = average charcoal kiln efficiency (%)

cf = carbon fraction of biomass (0.49 in this case since all trees harvested are > 10 cm dbh)

The average kiln efficiency is 19.25% +/- 2.3%. This is known because the COFOREST project did a careful study[83] of kiln efficiency in 2015 in COFOREST project villages in Kilosa district.

Applying the equation yields 6821 tCO2e of AGB consumed annually for charcoal production. The forest charcoal forest management units cover 16,485 ha. The area weighted average AGB for the area is 2,178,334 tCO2e. Thus, the current level of harvesting for charcoal is equivalent to 0.31% of stocks annually. This is significantly more proportionately than the intensity of timber harvesting, but still low enough to not cause long term reductions in stocks given the rapid regeneration of charcoal harvesting squares from coppicing and root suckers. The project will continue to monitor charcoal harvesting levels and work with villages to adjust their charcoal harvesting plans to ensure that harvesting levels remain at or below baseline levels.

Planned boundary clearing

The only activity that is strictly a project activity and that could impact carbon stocks is planned boundary clearing. This activity is meant to enhance the protection of the project area by improving the clarity of the project boundaries. The clearing will be repeated as needed to keep a 3-meter-wide cutline along the edges of forest reserves where the edge is not adjacent to another forest reserve or following an existing boundary feature like the forest edge, a road, trail, or river. The cutlines will go around any tree larger than 15cm dbh to limit the impact of the clearing on stocks. This is possible because the gaps between larger trees are generally greater than 3 meters[84].

For ex-ante estimates, experience from the few villages that have started the activity is used. In 2023, 19 villages cleared cutlines equivalent to 233 ha.

[83] https://www.tfcg.org/wp-content/uploads/2018/05/MJUMITA-Charcoal-Kiln-Study-2015-FINAL.pdf

[84] It is often possible to drive through miombo woodland without roads because the spacing between woody stems is so large.

The cutlines were overlayed on the 2022 land-cover class map to calculate the proportion of non-forest[85], high carbon forest and low carbon forest intersected by the cutlines. This exaggerates the proportion of cutlines passing through the forests because the lines will pass on the outside of forests when passing along a forest edge, but for the purpose of ex-ante calculations this generates conservative estimates. Note the technically, all non-forest pixels intersected by cutlines are part of the leakage management area but are assessed together with the project area pixels for simplicity.

To estimate the proportions of stocks in each land-cover type affected by cutlines, the VCSL and COFOREST biomass and post-deforestation plots were reanalyzed after filtering out all stems 15 cm and above. For simplicity, it was assumed that all BGB stocks were emitted instantly.

The total forest reserve area demarcated by the 2023 cutlines was 94,161 ha. Thus, the ratio of cutline area to VLFR area in 2023 was 0.0025. It was also assumed that the same ratio will apply to the rest of the project area and that the proportion of land-cover classes intersected by cutlines will also be the same as 2023. The estimated carbon stock decreases are shown in VM0015 Table 43 Ex Ante Estimated Actual Carbon Stock Decrease Due to Planned Deforestation/Degradation in the Project Area.

VM0015 Table 43 Ex Ante Estimated Actual Carbon Stock Decrease Due to Planned Deforestation/Degradation in the Project Area

Project year t	Areas of Planned Deforestation / Degradation × Carbon Stock Change (Decrease) in the Project Area						Total Carbon Stock Decrease due to Planned Deforestation / Degradation	
	ID_{cl}	1	ID_{cl}	2	ID_{cl}	3	Annual	Cumulative
	$ADPD_{icl,t}$	$Ctot_{icl,t}$	$ADPD_{icl,t}$	$Ctot_{icl,t}$	$ADPD_{fcl,t}$	$Ctot_{fcl,t}$	$\Delta CPDdPA_t$	$\Delta CPDdPA$
	ha	tCO_2e/ha	ha	tCO_2e/ha	ha	tCO_2e/ha	tCO_2e	tCO_2e
2022	0	45.32	0	32.47	0	5.08	0	0
2023	135	45.32	34	32.47	65	5.08	7,544	7,544
2024	195	45.32	48	32.47	93	5.08	10,881	18,425
2025	195	45.32	48	32.47	93	5.08	10,881	29,306
2026	0	45.32	0	32.47	0	5.08	0	29,306

[85] Assumed equal to long term post-deforestation stocks.

2027	0	45.32	0	32.47	0	5.08	0	29,306
2028	0	45.32	0	32.47	0	5.08	0	29,306

VM0015 Table 46 Total Ex Ante Carbon Stock Decrease Due to Planned Activities in the Project Area

Project year t	Total Carbon Stock Decrease due to Planned Deforestation / Degradation		Total Carbon Stock Decrease due to Planned Logging Activities		Total Carbon Stock Decrease due to Planned Fuel-wood and Charcoal Activities		Total Carbon Stock Decrease due to Planned Activities	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CPDdPA_t$	$\Delta CPDdPA$	$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPFdPA_t$	$\Delta CPFdPA$	$\Delta CPAdPA_t$	$\Delta CPAdPA$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2022	0	0	0	0	0	0	0	0
2023	-7,544	-7,544	0	0	0	0	-7,544	-7,544
2024	-10,881	-18,425	0	0	0	0	-10,881	-18,425
2025	-10,881	-29,306	0	0	0	0	-10,881	-29,306
2026	0	-29,306	0	0	0	0	0	-29,306
2027	0	-29,306	0	0	0	0	0	-29,306
2028	0	-29,306	0	0	0	0	0	-29,306

Ex Ante Estimation of Carbon Stock Changes due to Unavoidable Unplanned Deforestation Within the Project Area

Despite being in legally protected forest reserves, the threat level to the project forests is very high. Not all the project activities can be implemented at once and the effectiveness of certain activities will improve with time. For instance, the boundary demarcation activity will take a couple of years to complete. Additionally, many people farm in the village forest reserves knowing full well that they are breaking the rules. Enhanced and more regular patrols will eventually convince such people that clearing farms in the village forest reserve is not worth it. Additionally, as community members come to see the real tangible financial and social benefits of protecting the forest, forest protection will become more effective.

The initial effectiveness is based on experience from the first year of the first project instance. Effectiveness is then expected to increase over 3 years to eventually reach 75% once all project activities are being implemented on a regular basis.

Stock changes from unplanned deforestation in the project scenario is calculated with VM0015 Equation 16

VM0015 Equation 16

$$\Delta CUDdPA_t = \Delta CBSL_t \times (1 - EI)$$

Where

Where:

$\Delta CUDdPA_t$	=	Total ex ante actual carbon stock change due to unavoided unplanned deforestation at year t in the project area (t CO2e)
$\Delta CBSL_t$	=	Total baseline carbon stock change at year t in the project area (t CO2e)
EI	=	Ex ante estimated Effectiveness Index (%)
t	=	1, 2, 3, ..., *T*, a year of the proposed project crediting period (dimensionless)

VM0015 Table 47 Table 47: Ex Ante Estimated Net Carbon Stock Change in the Project Area Under the Project Scenario

Project year t	Total Carbon Stock Decrease due to Planned Activities		Total Carbon Stock Decrease due to Unavoided Unplanned Deforestation		Total Carbon Stock Change in the Project Case	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CPAdPA_t$	$\Delta CPAdPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2022	0	0	-61,118	-61,118	-61,118	-61,118
2023	-7,544	-7,544	-415,736	-476,854	-423,280	-484,398
2024	-10,881	-18,425	-357,761	-834,615	-368,643	-853,040
2025	-10,881	-29,306	-183,202	-1,017,817	-194,083	-1,047,123
2026	0	-29,306	-187,523	-1,205,340	-187,523	-1,234,646

2027	0	-29,306	-191,844	-1,397,184	-191,844	-1,426,490
2028	0	-29,306	-74,689	-1,471,872	-74,689	-1,501,178

7.1.2 Ex Ante Estimation of Actual Non-CO2 Emissions from Forest Fires

Ex ante emissions from biomass burning are also calculated using the effectiveness index as per VM0015 Equation 17.

VM0015 Equation 17

$$EBBPSPA_t = EBBBSPA_t \times (1 - EI)$$

Where

$EBBPSPA_t$	=	Total ex ante actual non-CO2 emissions from forest fires due to unavoided unplanned deforestation at year t in the project area (t CO2e)
$EBBBSPA_t$	=	Total non-CO2 emissions from forest fires at year t in the project area (t CO2e)
EI	=	Ex ante estimated Effectiveness Index (%)
t	=	1, 2, 3, …, *T*, a year of the proposed project crediting period (dimensionless)

VM0015 Table 48 Total Ex Ante Estimated Actual Emissions of Non-CO2 Gases Due to Forest Fires in the Project Area

Project year t	Total Ex Ante Estimated Actual Non-CO_2 emissions from forest fires in the project area	
	EBBPSPA	*EBBPSPA*
	Annual	Cumulative
	tCO_2e	tCO_2e
2,022	3,330	3,330
2,023	22,609	25,939
2,024	19,034	44,973
2,025	9,517	54,490

2,026	9,517	64,006
2,027	9,517	73,523
2,028	2,886	76,410

7.1.3 Total Ex Ante Estimation for the Project Area

VM0015 Table 49 Total Ex Ante Estimated Actual Net Carbon Stock Changes and Emissions of Non-CO2 Gases in the Project Area

Project year t	Total Ex Ante Carbon Stock Decrease due to Planned Activities		Total Ex Ante Carbon Stock Decrease due to Unavoided Unplanned Deforestation		Total Ex Ante Net Carbon Stock Change		Total Ex Ante Estimated Actual Non-CO_2 Emissions from Forest Fires in the Project Area	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CPAdPA_t$	$\Delta CPAdPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	$EBBPSPA_t$	$EBBPSPA_t$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2,022	0	0	-61,118	-61,118	-61,118	-61,118	3,330	3,330
2,023	-7,544	-7,544	-415,736	-476,854	-423,280	-484,398	22,609	25,939
2,024	-10,881	-18,425	-357,761	-834,615	-368,643	-853,040	19,034	44,973
2,025	-10,881	-29,306	-183,202	-1,017,817	-194,083	-1,047,123	9,517	54,490
2,026	0	-29,306	-187,523	-1,205,340	-187,523	-1,234,646	9,517	64,006
2,027	0	-29,306	-191,844	-1,397,184	-191,844	-1,426,490	9,517	73,523
2,028	0	-29,306	-74,689	-1,471,872	-74,689	-1,501,178	2,886	76,410

7.2 Ex Post Monitoring of Carbon Stock Changes and GHG Emissions Within the Project Area

7.2.1 Monitoring Project Implementation

Monitoring of unavoided unplanned deforestation will follow VMD0055 in anticipation of transition to VM0048. The method is summarized here. For a full description, see VMD0055. Monitoring period activity data is measured within sample plots distributed in a representative manner across the project

area and leakage belt. Sample plot interpretation will be based on planet.com basemaps, Sentinel-2, higher resolution imagery in Google Earth when available. Sample plot interpretation will follow the same procedures as in 3.5.

The project sampling frame encompasses both the project area and leakage belt, minus any areas mapped as identified exclusions in the most recent jurisdictional map of identified exclusions. The stratification of the monitoring plots will consider three factors:

1. Forest class (High carbon or low carbon forest)
2. Accounting area (project or leakage belt)
3. Likelihood of observing deforestation

Following VMD0055 requirements, a minimum of 3 strata with different likelihoods of deforestation will be defined. For this project, this will be defined based on the densities from the deforestation risk map and the number of sampling points in each density class will be proportionate to the expected amount of deforestation. The uncertainty of the deforestation estimate will be calculated in the same manner as the uncertainty of the historical deforestation estimate described in section 3.6. Following VM0015 requirements, the number of sample points used will be sufficient such that the half-width of the 90 percent confidence interval does not exceed 20%. As per VCS rules, if the uncertainty exceeds 10%, then an inflation factor will be calculated using Equation 20 and applied to increase the estimate using

Equation 20 Calculation of inflation factor

$$IF_{UDef} = \frac{U\%(A_{UDef})}{100 \times t_{aplha=10\%}} \times t_{alpha=66.67\%}$$

Where

IF_{UDef}	=	Inflation factor for area of unplanned deforestation (%)
$U\%(A_{UDef})$	=	Percentage uncertainty of the estimated area of unplanned deforestation within the project sampling frame over the monitoring period (%)
$t_{alpha=10\%}$	=	Value of the t distribution for a two-sided 90 percent confidence interval (a value of 1.6449 may be used for AD analyses)
$t_{alpha=66.67\%}$	=	Value of the t distribution for a one-sided 66.67% confidence interval (a value of 0.4307 may be used for AD analyses)

Then the estimates of deforestation in the project area and leakage belt are each inflated by multiplying by $(1+IF_{UDEF})$. The uncertainty adjusted estimates will then be used to construct ex post tables of activity data per stratum in the project area and leakage belt (VM0015 Table 10, VM0015 Table 11); per initial forest class (VM0015 Table 14, VM0015 Table 15) and, per post-deforestation zone z (VM0015 Table 18, VM0015 Table 19). Not that this is a deviation from VM0015 which appears to expect monitoring of the entire reference region. However, since the activity data from the reference

region is not used for any purpose in VM0015 and limiting the monitoring sample plots within the leakage belt and project area will increase the accuracy of the estimated change from these areas, this is a justifiable deviation.

7.2.2 Monitoring of Carbon Stock Changes

Given that the average carbon stocks per LU/LC class are not expected to change significantly during the baseline validity period, the project does not anticipate monitoring carbon stocks during this baseline validity period. Emissions from unavoided unplanned deforestation will be calculated using the same emissions factors and the same equations used to calculate baseline emissions and presented in an ex-post version of VM0015 Table 36.

In the unlikely event of forest fires in the portions of the project area which are not fire adapted and where significant carbon stock decreases may have resulted, the project will install new biomass sampling plots to estimate the decrease. The affected areas will be demarcated with hand drawn polygons covering affected areas visible in planet.com basemaps. Then the changes and affected areas will be reported in VM0015 Table 51. The same approach will be used to assess damage from catastrophic events and reported in VM0015 Table 52. Then they are combined in VM0015 Table 53. And then that is combined with the ex-post version of VM0015 Table 46 in VM0015 Table 54.

VM0015 Table 51 Ex Post Actual Carbon Stock Decrease Due to Forest Fires in the Project Area

Project year *t*	Areas Affected by Forest Fires × Carbon Stock Change (Decrease)				Total Carbon Stock Decrease due to Forest Fires	
	ID_{cl}	1	ID_{cl}	2	Annual	Cumulative
	$AUFP_{icl,t}$	$\Delta Ctot_{icl,t}$	$AUFP_{icl,t}$	$\Delta Ctot_{icl,t}$	$\Delta CUFdPA_t$	$\Delta CUFdPA$
	ha	tCO_2e/ha	ha	tCO_2e/ha	tCO_2e	tCO_2e
2022						
....						
T						

VM0015 Table 52 Ex Post Carbon Stock Decrease Due to Catastrophic Events in the Project Area

Project year *t*	Areas Affected by Catastrophic Events × Carbon Stock Change (Decrease)	Total Carbon Stock Decrease due to Catastrophic Events

	ID_{cl}	1	ID_{cl}	2	Annual	Cumulative
	$ACPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$ACPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$\Delta CUCdPA_t$	$\Delta CUCdPA$
	ha	tCO_2e/ha	ha	tCO_2e/ha	tCO_2e	tCO_2e
2022						
....						
T						

VM0015 Table 53 Total Ex Post Carbon Stock Decrease Due to Forest Fires and Catastrophic Events

Project year *t*	Total Carbon Stock Decrease due to Forest Fires		Total Carbon Stock Decrease due to Catastrophic Events		Total Carbon Stock Decrease due to Forest Fires and Catastrophic Events	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CUFdPA_t$	$\Delta CUFdPA$	$\Delta CUCdPA_t$	$\Delta CUCdPA$	$\Delta CFCdPA_t$	$\Delta CFCdPA$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2022						
...						
T						

VM0015 Table 54 Ex Post Estimated Net Carbon Stock Change in the Project Area

Project year *t*	Total Carbon Stock Decrease due to Planned Activities		Total Carbon Stock Decrease due to Fires and Catastrophic Events		Total Ex Post Carbon Stock Change in the Project Case	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CPadPA_t$	$\Delta CPAdPA$	$\Delta CFCdPA_t$	$\Delta CFCdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2022						

...						
T						

7.2.3 Monitoring Non-CO2 Emissions from Forest Fires

Non-CO2 emissions from forest fires will be calculated for unavoided unplanned deforestation and in the unlikely event of a significant forest fire. This will be reported using VM0015 Table 41 to estimate an ex-post version of VM0015 Table 42.

7.2.4 Total Ex Post Estimated Actual Net Carbon Stock Changes and GHG Emissions in the Project Area

All sources of stock changes and emissions for the project area will be summarized in an ex-post version of VM0015 Table 49.

8 LEAKAGE EMISSIONS

8.1 Ex Ante Estimation of Leakage (Step 8)

Two sources of leakage are considered under VM0015:

1. Decrease in carbon stocks and increase in GHG emissions associated with leakage prevention measures; and
2. Decrease in carbon stocks and increase in GHG emissions associated with activity displacement leakage.

8.1.1 Ex Ante Estimation of Decrease in Carbon Stocks and Increase in GHG Emissions Due to Leakage Prevention Measures

Carbon Stock Changes due to Activities Implemented in Leakage Management Zones

Project activities are listed in the project description. The only project activity which will technically impact the leakage management areas is the planned forest reserve boundary clearing where the boundaries pass through already deforested areas in the leakage management areas. However, this impact was already assessed under planned deforestation in the project area and shown to be insignificant ex-ante. The primary leakage prevention activity includes promoting labor intensive conservation agriculture techniques to improve agricultural productivity and sustainability. These

techniques include soil conservation measures and promoting alternatives to the use of burning to clear land. The techniques promoted by the project will slow the loss of carbon stocks in leakage management areas compared to the baseline scenario. The other major leakage prevention activity includes promoting alternative livelihoods through saving and credits schemes, REDD revenue sharing and improving access to secondary school. These activities are not expected to affect carbon stocks in leakage management areas. Thus, in summary, leakage prevention activities have no negative effect on carbon stocks in the leakage management areas.

Ex Ante Estimation of CH4 and N2O Emissions from Grazing Animals

There are no plans to promote grazing animals as part of project interventions. No significant increase in grazing animals is expected under the project scenario.

Total ex ante estimated carbon stock changes and increases in GHG emissions due to leakage prevention measures

The results of section 8.1.2 and 8.1.3 show that there are no anticipated GHG emission increases associated with leakage prevention.

8.1.2 Ex Ante Estimation of Decreases in Carbon Stocks and Increases in GHG emissions due to Activity Displacement Leakage

Ex ante, activity displacement leakage is approximated based on the anticipated combined effectiveness of the proposed leakage prevention measures and project activities.

This is done by multiplying the estimated baseline carbon stock changes for the project area less planned and unavoided unplanned project stock changes by a Displacement Leakage Factor (DLF) representing the percentage of deforestation expected to be displaced outside the project boundary. Where deforestation agents do not participate in leakage prevention activities and project activities, the DLF is 100 percent. Where leakage prevention activities are implemented, the factor is equal to the proportion of baseline agents estimated to be given the opportunity to participate in leakage prevention activities and project activities. The project expects to give nearly 100% of deforestation agents the opportunity to participate in leakage prevention activities. The benefit sharing system provides benefits to all community members. Furthermore, part of the forest patrol teams work is to inform deforestation agents about and connect them to agricultural extension services. This is initially focused on deforestation agents found deforesting inside the project area, but as deforestation the project area comes under control, the deforestation patrol teams will work to connect deforestation agents in the leakage belts to agricultural extension services. Of the thousands of deforestation agent records in the forest patrol database, so far only one deforestation agent said they were not interested in extension services. Most agents provided their phone numbers to the forest patrol teams so they may be contacted for extension training. Another way the project reduced potential leakage is that the patrols in 2023 focused on educating deforestation agents in the project area rather than evicting them. They were warned that they were in a village forest reserve and that they would be fined for any further

clearance and could be evicted after repeated offences. Otherwise, they were allowed to continue to farm any farm they had established in the village forest reserve prior to the first forest patrol to contact them. They were also educated about REDD and the benefits it would bring to the village. Therefore, DLF is conservatively estimated at 15%.

The ex-ante emissions from forest fires (biomass burning) due to activity displacement leakage are calculated by multiplying baseline forest fire emissions in the project area after subtracting emissions from unavoided unplanned deforestation in the PA by the same DLF used to estimate the decrease in carbon stocks.

These sources of stock reduction and emissions are presented in VM0015 Table 61.

VM0015 Table 61 Ex Ante Estimated Leakage due to Activity Displacement

Project year t	Total Ex Ante Estimated Decrease in Carbon Stocks due to Displaced Deforestation		Total Ex Ante Estimated Increase in GHG Emissions due to Displaced Forest Fires	
	Annual	Cumulative	Annual	Cumulative
	$\Delta CADLK_t$	$\Delta CADLK$	$\Delta EADLK_t$	$\Delta EADLK$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2022	-4,936	-4,936	269	269
2023	-32,447	-37,384	1,826	2,095
2024	-52,032	-89,416	2,855	4,950
2025	-80,809	-170,224	4,283	9,233
2026	-84,385	-254,609	4,283	13,515
2027	-86,330	-340,939	4,283	17,798
2028	-33,610	-374,549	1,299	19,097

8.1.3 Ex Ante Estimation of Total Leakage

The ex-ante results of all sources of leakage are summarized in Table 62.

VM0015 Table 62 Ex Ante Estimated Total Leakage

Project year *t*	Total Ex Ante GHG Emissions from Increased Grazing Activities		Total Ex Ante Increase in GHG Emissions due to Displaced Forest Fires		Total Ex Ante Decrease in Carbon Stocks due to Displaced Deforestation		Carbon Stock Decrease due to Leakage Prevention Measures		Total Net Carbon Stock Change due to Leakage		Total Net Increase in Emissions due to Leakage	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta EgLK_t$	$\Delta EgLK$	$\Delta EADLK_t$	$\Delta EADLK$	$\Delta CADLK_t$	$\Delta CADLK$	$\Delta CLPMLK_t$	$\Delta CLPMLK$	ΔCLK_t	ΔCLK	ΔELK_t	ΔELK
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2022	0	0	269	269	-4,936	-4,936	0	0	-4,936	-4,936	5,205	5,205
2023	0	0	1,826	2,095	-32,447	-37,384	0	0	-32,447	-37,384	34,273	39,479
2024	0	0	2,855	4,950	-52,032	-89,416	0	0	-52,032	-89,416	54,887	94,366
2025	0	0	4,283	9,233	-80,809	-170,224	0	0	-80,809	-170,224	85,091	179,457
2026	0	0	4,283	13,515	-84,385	-254,609	0	0	-84,385	-254,609	88,668	268,125
2027	0	0	4,283	17,798	-86,330	-340,939	0	0	-86,330	-340,939	90,612	358,737
2028	0	0	1,299	19,097	-33,610	-374,549	0	0	-33,610	-374,549	34,909	393,646

8.2 Monitoring Leakage

The same two potential sources of leakage considered ex-ante must be monitored ex-post.

8.2.1 Monitoring of Carbon Stock Changes and GHG Emissions Associated With Leakage Prevention Activities

As described in the corresponding ex-ante section, the project leakage prevention activities will increase rather than reduce carbon stocks in leakage management areas and will not create emissions from grazing animals.

8.2.2 Monitoring of Carbon Stock Decreases and Increases in GHG Emissions due to Activity Displacement Leakage

Monitoring of Carbon Stock Changes

Deforestation above the baseline in the leakage belt area is considered activity displacement leakage. The ex-post activity data for the leakage is collected with activity data for the project area as described in section 7.2.1.

This activity data is then used in combination with the emissions factors calculated for the baseline to generate an ex-post version of VM0015 Table 37. The ex-post and baseline stock changes are then compared in VM0015 Table 63 to calculate if any leakage has occurred.

As per VM0015, if strong evidence is collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project areas, the detected deforestation may not be attributed to the project activity nor considered leakage.

VM0015 Table 63 Total Net Baseline Carbon Stock Change in the Leakage Belt (Method 1)

Project year *t*	Total Ex Ante Net Baseline Carbon Stock Change		Total Ex Post Net Actual Carbon Stock Change		Total Ex Post Leakage	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CBSLLK_t$	$\Delta CBSLLK_t$	$\Delta CBSLLK_t$	$\Delta CBSLLK_t$	$\Delta CBSLLK_t$	$\Delta CBSLLK$
	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-127,779	-127,779				
2023	-808,770	-936,549				

2024	-908,157	-1,844,706				
2025	-935,454	-2,780,161				
2026	-962,752	-3,742,912				
2027	-990,049	-4,732,961				
2028	-404,784	-5,137,745				

Monitoring Increases in GHG Emissions

In the event of any stock changes in excess of baseline, the same parameters used in VM0015 Table 41 will be used to calculate an ex-post version of VM0015 Table 42 for leakage emissions from biomass burning. Leakage emissions from biomass burning is then calculated by comparing the baseline to actual emissions for each year *t*. When cumulative emissions from biomass burning exceed baseline in year *t*, leakage has occurred.

8.2.3 Total Ex Post Estimated Leakage

The results of all ex-post estimations of leakage will be summarized using an ex-post version of VM0015 Table 62.

9 ESTIMATED GHG EMISSIONS REDUCTIONS

9.1 Ex Ante Total Net GHG Emission Reductions (Step 9)

9.1.1 Significance Assessment

The significance of emissions from the project area and leakage management activities over the entire baseline validity period was assessed ex-ante as per Appendix 2 of VM0015 and is shown in Table 31. Significance is determined by dividing each source by the net GHG ERRs for the baseline validity period from VM0015 Table 64 before deducting leakage emissions.

The results show that the exaggeration of benefits from excluding the deadwood pool and stock changes from project boundary clearing are likely insignificant. This will be confirmed ex-post at the conclusion of each monitoring period. Emissions from biomass burning are also insignificant but must be included because they are included in the baseline.

Table 31 Testing significance of GHG emissions sources

Emissions source in project area or leakage management activity	Emissions or Exaggeration of benefits	Relative contribution per source	Rank	Significance
Unavoided stock changes in AGB and BGB from deforestation in the project area	1,471,872	0.90	1	0.56
Unavoided GHG emissions from biomass burning in the project area	76,410	0.05	2	0.03
Exaggerated benefits from excluding standing deadwood pool	58,076	0.04	3	0.02
Long term stock changes from AGB and BGB due to boundary clearing	29,306	0.02	4	0.01
Total	1,635,664			

9.1.2 Calculation of Ex Ante Total Net GHG Emissions Reductions

The net anthropogenic GHG emission reduction of the proposed AUD project activity is calculated as follows:

VM0015 Equation 19

$$\Delta REDDt = (\Delta CBSLPA_t + EBBBSLPA_t) - (\Delta CPSPA_t + EBBPSPA_t) - (\Delta CLK_t + ELK_t)$$

Where

$\Delta REDDt$ = Ex ante estimated net anthropogenic GHG emission reduction attributable to the AUD project activity at year *t* (t CO_2e)

$\Delta CBSLPA_t$ = Sum of baseline carbon stock changes in the project area at year t (t CO_2e)

Note – the absolute values of $\Delta CBSLPA_t$ must be used in Eq. (19).

$EBBBSLPA_t$ = Sum of baseline emissions from biomass burning in the project area at year *t* (t CO_2e)

$\Delta CPSPA_t$ = Sum of ex ante estimated actual carbon stock changes in the project area at year *t* (t CO_2e)

Note – where $\Delta CPSPA_t$ represents a net increase in carbon stocks, a negative sign before the absolute value of $\Delta CPSPA_t$ must be used. Where $\Delta CPSPA_t$ represents a net decrease, a positive sign must be used.

$EBBPSPA_t$ = Sum of (ex-ante estimated) actual emissions from biomass burning in the project area at year *t* (t CO_2e)

ΔCLK_t = Sum of ex ante estimated leakage net carbon stock changes at year *t* (t CO_2e)

Note – where the cumulative sum of ΔCLK_t within a baseline validity period is greater than zero, ΔCLK_t must be set to zero.

ELK_t = Sum of ex ante estimated leakage emissions at year t (t CO_2e)

t = 1, 2, 3, …, *T*, a year of the proposed project crediting period (dimensionless)

9.1.3 Calculation of Ex-Ante Verified Carbon Units (VCUs)

The potential number of Verified Carbon Units (VCUs) at year *t* is estimated as follows:

VM0015 Equation 20

$$VCUt = \Delta REDD_t - VBC_t$$

VM0015 Equation 21

$$VBC_t = (\Delta CBSLPA_t - \Delta CPSPA_t) \times RF_t$$

Where

$VCUt$ = Number of potential Verified Carbon Units at year t (t CO_2e)

Note – where VCUt is less than zero, no VCUs will be granted to the proponents of the AUD project activity. VCUs are only granted where the following condition is met:

VM0015 Equation 22

$$\sum_{t=0}^{t} \Delta REDD_t > 0$$

$\Delta REDD_t$ = Ex ante estimated net anthropogenic GHG emission reductions attributable to the AUD project activity at year *t* (t CO_2e)

VBC_t = Number of buffer credits deposited in the VCS AFOLU non-permanence buffer at year *t* (t CO_2e)

$\Delta CBSLPA_t$ = Sum of baseline carbon stock changes in the project area at year *t* (t CO2e)

$\Delta CPSPA_t$ = Sum of ex ante estimated actual carbon stock changes in the project area at year *t* (t CO2e)

RF_t	=	Risk factor used to calculate buffer credits (%) Note – RF_t is a risk factor to be determined using the latest version of the VCS AFOLU Non- Permanence Risk Tool. (for the 2022-2028 baseline validity period ex-ante estimates a value of 17.4553% was used, which is the stock change weighted estimate for gazetted and ungazetted project areas during the 2022-2024 monitoring period)
t	=	1, 2, 3, …, *T,* a year of the proposed project crediting period (dimensionless)

Ex-ante results are presented in VM0015 Table 64.

9.2 Ex Post Net GHG Emission Reductions

The calculation of ex post net GHG emission reductions will be like the ex-ante calculation with the only difference that ex post estimated carbon stock changes and GHG emissions must be used in the case of the project scenario and leakage. The ex post estimated net anthropogenic GHG emissions and calculation of Verified Carbon Units (VCUt, and VBCt) will be reported using an ex-post version of VM0015 Table 64.

VM0015 Table 64 Ex Ante Estimated Net GHG Emission Reductions: (ΔREDDt) and Verified Carbon Units (VCUt)

Project year *t*	Baseline Carbon Stock Changes		Baseline GHG Emissions		Ex Ante Project Carbon Stock Changes		Ex Ante Project GHG Emissions		Ex Ante Leakage Carbon Stock Changes		Ex Ante Leakage GHG Emissions		Ex Ante Net Anthropogenic GHG Emission Reductions		Ex Ante VCUs Tradable		Ex Ante Buffer Credits	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CBSLPA_t$	$\Delta CBSLPA$	$EBBBSLPA_t$	$EBBBSLPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	$EBBPSPA_t$	$EBBPSPA$	ΔCLK_t	ΔCLK	ELK_t	ELK	$\Delta REDD_t$	$\Delta REDD$	VCU_t	VCU	VBC_t	VBC
	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e	t CO_2e
2022	-94,028	-94,028	5,123	5,123	-61,118	-61,118	3,330	3,330	-4,936	-4,936	269	269	29,497	29,497	23,753	23,753	5,744	5,744
2023	-639,594	-733,621	34,783	39,906	-423,280	-484,398	22,609	25,939	-32,447	-37,384	1,826	2,095	194,215	223,712	156,457	180,210	37,758	43,503
2024	-715,523	-1,449,144	38,067	77,974	-368,643	-853,040	19,034	44,973	-52,032	-89,416	2,855	4,950	311,027	534,739	250,478	430,688	60,549	104,052
2025	-732,807	-2,181,951	38,067	116,041	-194,083	-1,047,123	9,517	54,490	-80,809	-170,224	4,283	9,233	482,183	1,016,922	388,148	818,835	94,036	198,087
2026	-750,091	-2,932,042	38,067	154,108	-187,523	-1,234,646	9,517	64,006	-84,385	-254,609	4,283	13,515	502,451	1,519,373	404,253	1,223,088	98,198	296,285
2027	-767,375	-3,699,417	38,067	192,176	-191,844	-1,426,490	9,517	73,523	-86,330	-340,939	4,283	17,798	513,469	2,032,843	413,009	1,636,097	100,461	396,746
2028	-298,755	-3,998,172	11,545	203,721	-74,689	-1,501,178	2,886	76,410	-33,610	-374,549	1,299	19,097	197,816	2,230,659	158,705	1,794,802	39,111	435,857