

PROJECT IMPLEMENTATION REPORT



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Makame Savannah
Protecting forests for pastoralists, wildlife and climate

Document Prepared By **Carbon Tanzania¹, and TerraCarbon²**

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Project Title	Makame Savannah REDD
Project ID	1900
Version	1.0
Date of Issue	25 July 2019
Project Location	Makame Wildlife Management Area Kiteto District, Arusha Region, Tanzania
Project Proponent(s)	CT Limited, t/a Carbon Tanzania, Marc Baker Email: marc@carbontanzania.com ; Phone: +255 (0) 784 448761
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Validation Body	VVB ID: 048 Contact: Mr. Venkat info@epicsustainability.com epicsustainability@gmail.com vishnu@epicsustainability.com Location: No. 41, Anugraha 1st Cross Road, Sundarnagar, Near BEL Circle, Bangalore – 560054, India Website: www.epicsustainability.com
Project Lifetime	27 April 2016 - 26 April 2046; 30-year lifetime
GHG Accounting Period	27 April 2016 - 26 April 2046
Monitoring Period of this Report	27 April 2016 – 26 April 2019; 3 years
History of CCB Status	Not applicable
Gold Level Criteria	Community: Masai community owned land and resources through wildlife management area (WMA) designation.

	Biodiversity: Protection of key habitat for 13 IUCN Red List species, 2 endemic birds and providing ecosystem connectivity for migratory mammal populations Climate: Regional level climate analysis and community-based identification of climate threats and adaptation. Development of resource planning and adaptation in response to identified climate change impacts.
Expected Verification Schedule	

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1 SUMMARY OF PROJECT BENEFITS

Unique Project Benefits

Outcome or Impact	Achievements during the Monitoring Period	Section Reference	Achievements during the Project Lifetime
Strengthened land-rights	The Renewal of Resource Management plan means the five WMA village communities enjoy increased capacity and rights to enforce their existing land-use plans that are designed to protect habitat which supports the traditional pastoralists' livelihoods	1.1	First Reporting Period
Improved and secure access to grazing areas for domestic animals	The renewed Resource Management Plan strengthens the status of areas reserved specifically for seasonal grazing of pastoralist herds that form the value-basis of the Masai communities' traditional lifestyle. Those areas are now protected for the designated uses by Village Game Scouts	1.1	First Reporting Period
Access to increased revenue from wildlife-based tourism	The project has improved the communities' ability to attract wildlife-based tourism, both consumptive and non-consumptive as the areas that support wildlife populations are protected better through the project activities. During this period 2 consumptive investors signed long term deals with the WMA.	1.1	First Reporting Period
Ecosystem connectivity for the southern part of the Tarangire-Manyara Ecosystem	Land-Sat results show ecosystem is maintained supporting pastoralist livelihoods, migratory corridors and habitat for threatened species.	1.1	First Reporting Period

Standardized Benefit Metrics

Category	Metric	Achievements during Monitoring Period		Section Reference	Achievements during the Project Lifetime
GHG emission reductions & removals	Net estimated emission removals in the project area, measured against the without-project scenario	2017	2,066	2.1	233,060 t CO ₂ e
		2018	61,029		
		2019	169,965		
	Net estimated emission reductions in the project area, measured against the without-project scenario	2017	1,516	2.1	150,425 t CO ₂ e
		2018	39,759		
		2019	109,150		
Forest ¹ cover	For REDD ² projects: Number of hectares of reduced forest loss in the project area measured against the without-project scenario	2017	65.5	2.1	5,106 ha
		2018	1,371.9		
		2019	3,668.9		
	For ARR ³ projects: Number of hectares of forest cover increased in the project area measured against the without-project scenario	N/A		-	N/A
Improved land management	Number of hectares of existing production forest land in which IFM ⁴ practices have occurred as a result of the project's activities, measured against the without-project scenario	N/A		-	N/A
	Number of hectares of non-forest land in which improved land management has occurred as a result of the	N/A		-	N/A

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

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

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

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

Category	Metric	Achievements during Monitoring Period	Section Reference	Achievements during the Project Lifetime
	project's activities, measured against the without-project scenario			
Training	Total number of community members who have improved skills and/or knowledge resulting from training provided as part of project activities	550	1.1	550
	Number of female community members who have improved skills and/or knowledge resulting from training provided as part of project activities of project activities	210	1.1	210
Employment	Total number of people employed in project activities, ⁵ expressed as number of full-time employees ⁶	30	1.1	30
	Number of women employed in project activities, expressed as number of full-time employees	0	1.1	0
Livelihoods	Total number of people with improved livelihoods ⁷ or income generated as a result of project activities	>7500	3.1	>7500
	Number of women with improved livelihoods or income generated as a result of project activities	>1500	3.1	>1500
Health	Total number of people for whom health services were improved as a result of project activities, measured against the without-project scenario	0	3.1	0

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

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

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

Category	Metric	Achievements during Monitoring Period	Section Reference	Achievements during the Project Lifetime
	Number of women for whom health services were improved as a result of project activities, measured against the without-project scenario	0	3.1	0
Education	Total number of people for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario	0	-	0
	Number of women and girls for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario	0	-	0
Water	Total number of people who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	0	3.1	0
	Number of women who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	0	3.1	0
Well-being	Total number of community members whose well-being ⁸ was improved as a result of project activities	>10,000	3.1	>10,000
	Number of women whose well-being was improved as a result of project activities	>5000	3.1	>10,000

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

Category	Metric	Achievements during Monitoring Period	Section Reference	Achievements during the Project Lifetime
Biodiversity conservation	Change in the number of hectares significantly better managed by the project for biodiversity conservation, ⁹ measured against the without-project scenario	>350,000Ha	4.1	>350,000Ha
	Number of globally Critically Endangered or Endangered species ¹⁰ benefiting from reduced threats as a result of project activities, ¹¹ measured against the without-project scenario	5	4.1	5

⁹ 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.

¹⁰ Per IUCN's Red List of Threatened Species

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

2. GENERAL

Project Description

2.1.1. Implementation Description

During the current monitoring period the project activities have been implemented as planned. Leakage and non-permanence risk factors are being monitored using remotely sensed satellite and aerial imagery, as detailed in Section 3.1 below and following the methodology outlined in M-MON VMD-0015. No major disturbances were observed during the monitoring period that resulted in significant loss of forest carbon stocks. Leakage was monitored by comparing forest cover in the with-project scenario and the without-project scenario. Forest loss due to leakage is calculated and documented in Section 3.2 below. Over the 3-year monitoring period the project area resulted in 233,060 tons t CO₂e removals with a buffer pool contribution of 44,281 t CO₂e and a total emission reduction of 150,425 t CO₂e after accounting for leakage and uncertainty (22,291 t CO₂e).

2.1.2. Project Category and Activity Type

Project Scope 14: Agriculture, Forest and other Land Use (AFOLU)

Project Category: Reducing Emissions from Deforestation and Degradation (REDD)

Type of Activity: Avoided Unplanned Deforestation (AUDD)

Grouped project: No

This project is registered under the Verified Carbon Standard (VCS) and Climate, Community & Biodiversity Standards (CCBS) as a Reducing Emissions from Deforestation and Degradation (REDD) project. It has been developed in compliance with the Verified Carbon Standard, Version 3.7 and VCS AFOLU Requirements, and Climate, Community & Biodiversity Standards, Version 3.1. The project reduces emissions from unplanned frontier deforestation.

2.1.3. Project Proponent(s)

Organization name	CT Limited t/a Carbon Tanzania
Contact person	Mr. Marc Baker
Title	Director, Operations, Carbon Tanzania
Address	PO Box 425, Arusha
Telephone	+255 (0) 784 448761
Email	marc@carbontanzania.com

2.1.4. Other Entities Involved in the Project

Organization name	Makame Wildlife Management Area Authorized Association (Makame WMA – AA)
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Role in the project	Legal body managing the WMA and the natural resources within it. Responsible for implementing the resource plan and ensuring areas set aside for conservation are conserved. Manages finances to ensure that people and villages receive revenue from the project.
Contact person	Edward Lekaita
Title	Makame WMA Board Member
Address	Olasiti, Arusha
Telephone	+255 (0) 786 455 990
Email	olekaita@gmail.com

Organization name	Village Councils of Makame, Ngabolo, Ndedo, Katikati and Irikishoibor villages, in Kiteto District
Role in the project	Villages participating in the WMA mechanism are obliged to uphold and enforce the provisions of the Resource Management Plan (RMP) that defines the different management regimes for each designated areas within the WMA. They are also tasked with managing village game scouts (VGS) who are responsible for patrolling, monitoring and by-law enforcement according to the RMP.
Contact person	Meleyaki Njuldu
Title	WMA Community Officer
Address	Ngabolo Village (Makame WMA)
Telephone	+255 (0) 68 9708 472
Email	melayekikibo@gmail.com

Organization name	TerraCarbon, LLC
Role in the project	Co-leads project kickoff. Designs and manages forest carbon inventory. Leads baseline development task. Develops project document and advises Carbon Tanzania on various aspects of project development.
Contact person	Mr. David Shoch
Title	Director Forestry & Technical Services

Address	5901 N. Sheridan Rd. Peoria, Illinois 61614, USA
Telephone	001-309-693-9303
Email	david.shoch@terracarbon.com

2.1.5. Project Start Date (G1.9)

The memorandum of understanding (MOU) dated **27th April 2016** between Carbon Tanzania and partners, signed with Kiteto District government (who is responsible for all investments in WMA under the Wildlife Act), is the **project start date** for the Makame Savannah REDD project since it (i) allocates roles and responsibilities between Carbon Tanzania and the Kiteto District government with respect to development of the carbon project, and (ii) marks the start of the educational program and carbon baseline that led up to the contract being signed by the WMA and Carbon Tanzania on 27th May 2017 and to future carbon funding for activities to implement the WMA.

2.1.6. Project Crediting Period (G1.9)

The project crediting period is between April 27th 2016 and April 26, 2046

2.1.7. Project Location

The project is located in the northern part of the Makame Wildlife Management Area (WMA), Kiteto District, northern Tanzania. This project area covers 104,065 hectares of Acacia-Commiphora scrub and Woodland, and is located 120 km due south of Arusha, Tanzania. The whole WMA is a 364,300 hectare area buffered by 102,700 hectares of community land also managed by the same communities. The coordinates for a central area of the project are - 4.665142° 36.654932°

2.1.8. Title and Reference of Methodology

The Makame Savannah REDD project is utilizing the Avoided Deforestation Partners' VCS REDD Methodology, entitled, "VM0007: REDD Methodology Modules (REDD-MF)." The only eligible activity as part of this project is avoiding unplanned deforestation, hence only modules related to unplanned deforestation are required. This project is eligible as an avoiding unplanned deforestation project because the forest land is expected to be converted to non-forest land in the baseline case and the land is not legally authorized and documented to be converted to non-forest or a managed tree plantation. The specific modules applied to the project are listed below.

REDD-MF, REDD Methodology Framework Version 1.5

Carbon Pool Modules:

CP-AB, "VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools," Version 1.1

CP-D, "VMD0002 Estimation of carbon stocks in the dead-wood pool," Version 1.0

Baseline Modules:

BL-UP, "VMD0007 Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation," Version 3.2

Leakage Modules:

LK-ASU, "VMD0010 Estimation of emissions from activity shifting for avoided unplanned deforestation," Version 1.1

Monitoring Module:

M-MON, "VMD0015 Methods for monitoring of greenhouse gas emissions and removals," Version 2.1,

Miscellaneous Modules:

X –STR, "VMD0016 Methods for stratification of the project area," Version 1.1

X-UNC, "VMD0017 Estimation of uncertainty for REDD project activities," Version 2.1

Tools:

T-SIG, CDM tool "Tool for testing significance of GHG emissions in A/R CDM project activities," Version 1.0

T-ADD, "VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities," Version 3.0

T-BAR, "Tool for AFOLU non-permanence risk analysis and buffer determination," Version 3.3

Use of modules, REDD-MF, M-MON, T-ADD, T-BAR, X-UNC, and X–STR, is always mandatory when using the VM0007 methodology. Further use of modules, BL-UP and LK-ASU, is mandatory in the case of projects focusing on unplanned deforestation. Use of the module T-SIG determines whether GHG emissions by sources and/or decreases in carbon pools are insignificant. Finally, CP-AB is mandatory in all cases and while CP-D is optional as the dead wood pool is greater in the project scenario than the baseline scenario, it has been included.

2.1.9. Other Programs (G5.9)

During this verification period GHG emission reductions or removals generated by the project have not been included in an emissions trading program or any other mechanism that includes GHG allowance trading.

During this verification period and since validation the project has not received or sought any other form of environmental credit or become eligible to do so.

During this verification period and since validation the project has not participated or been rejected under any other GHG programs.

2.1.10. Sustainable Development

This project does not aim to specifically contribute to achieving any nationally stated sustainable development priorities, however, is developed in line with national policies such as The Wildlife Policy (1998)¹² and The National Land Policy (1995)¹³. This project does not have any provisions for reporting and monitoring on national policies.

Project Implementation Status

2.1.11. Implementation Schedule (G1.9)

¹² <http://www.tzonline.org/pdf/wildlifepolicy.pdf>

¹³ <http://extwprlegs1.fao.org/docs/pdf/tan169570.pdf>

Date	Milestone(s) in the project's development and implementation
22 nd November 2012	Free prior and informed consent is given by participating communities to create Makame Wildlife Management Area and registered in Kiteto District
April 27th, 2016	Project start date MoU signed between Carbon Tanzania and Kiteto District
August 2016	Consultative meetings with communities – introduction of project aims and requirements
September 2016	Climate change adaptation workshop and presentation of climate change analysis.
May 2017	Contract signed between Carbon Tanzania and Makame WMA
January 2018	Implementation of biodiversity monitoring plan
March 1, 2018	Complete PD
March 2018	Resource Zone Management Plan completed and signed
April 1, 2018	Registration of the project
June, 2019 – June 2020	Validation and Verification of project activities.
July 2020	First request for issuance of VCUs from project
April 26th, 2026	End date of the first REDD baseline period.
April 27th, 2026	Start of second baseline period. The baseline must be renewed every 10 years from the project start date.
April 26th, 2036	End date of the second REDD baseline period.
April 27th, 2036	Start of third baseline period. The baseline must be renewed every 10 years from the project start date.
April 26, 2046	End of project contracting, crediting period and third baseline period.

2.1.12. Methodology Deviations

The following methodology deviations were applied:

1. The similarities of the reference regions (RRD) and leakage belts to project areas were assessed using population density rather than settlement density. This methodological deviation is warranted due to inconsistencies in the available data on the location of settlements within Tanzania. Use of population density data still meets the intent of the methodology as both population and settlement density reflect the relative density of resident populations (and level of pressures associated with those populations).
2. The calculation of leakage outside the leakage belt, parameter TOTFOR has not been "limited to forest areas within 5km of roads and rivers suitable for conversion to agriculture / livestock" as specified in the methodology, for lack of relevant data on suitability. As the resulting TOTFOR value is greater, the AVFOR value is also greater. The PROPLB parameter is therefore smaller

thus resulting in more leakage outside the leakage belt and hence a conservative estimate. This deviation results in conservative accounting of leakage outside the leakage belt.

3. The parameter COLB (equation 4 module LK-ASU) has not been “limited to areas demonstrated to be suitable for agriculture or livestock ranching” as specified in the methodology, for lack of relevant data on suitability.
4. Parameter UP,SS,i,pool# will be monitored at least once every 10 years, on re-measurement of forest carbon stocks. While module X-UNC requires that monitoring of this parameter occur every < 5 years, this requirement is inconsistent with the VM0007 pools modules, which specify that stock estimates (from which uncertainty is calculated) are assumed valid for 10 years. Therefore, a deviation to module X-UNC is applied to permit parameter UP,SS,i,pool# to be monitored every 10 years, putting it into alignment with modules CP-AB and CP-D.
5. For ex ante estimation of leakage outside of the leakage belt, equation 6 of LK-ASU has been revised to

$$\Delta C_{LK-ASU,OLB} = (\Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned}) * LK_{PROP}$$

This corrects the order of the first two terms, ensuring that leakage is returned as a positive value (later subtracted in net emission reduction calculations). This correction has been previously validated on several other REDD projects using VM0007.

2.1.13. Minor Changes to Project Description (Rules 3.5.6)

No minor changes occurred during this monitoring period.

2.1.14. Project Description Deviations (Rules 3.5.7 – 3.5.10)

No project description deviations occurred during this monitoring period.

2.1.15. Grouped Projects

Not a group project.

2.1.16. Risks to the Project (G1.10)

Identify Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions to mitigate the risk	Methods used to assess impacts and risks during this verification period
Poaching	Decrease biodiversity through poaching of target wildlife species	Anti-poaching activities – patrols, increasing awareness of community members about conservation and the rules of the resource plan, strengthening and authenticating land rights.	Biodiversity monitoring results, bi-annual meetings confirm that VGS are not reporting significant poaching
Weak leadership / governance / limited allocation of income	Inability to implement project activities could negatively impact the climate, community and biodiversity; ultimately leading to a	Leadership training and capacity building activities for the WMA leadership and village leadership teams, measures to increase transparency	Confirmation of successful implementation of project activities during this period

	failed project and no income generation from carbon credits	around income and expenditure of funds	
Climate change / drought	Decrease availability of pasture and water for livestock and wildlife. Resulting in livestock deaths causing poverty to pastoralists and their families. Lack of appropriate habitat for wildlife resulting in reduced biodiversity and opportunities for tourism.	Reducing deforestation – reduces carbon emissions and creates a better local ecosystem. Diversification of livelihood sources to reduce reliability on livestock.	Deforestation reduced, see climate section. Bi-annual consultations show no mass livestock death due to drought.
Disregard or misunderstanding of resource plan / environmental destruction	Negative impacts on Climate, Community and Biodiversity are possible as the resource plan is designed to provide climate, community and biodiversity benefits. Poor resource management will affect all citizens and their livestock, create conflict in the community, cause damage to wildlife habitat and create unwanted carbon emissions potentially reducing or removing PES.	Ensure participatory development of the resource plan, enforce management zones, create a conservation awareness campaigns educating community members about the values underlying the resource plan and climate change	RMP completed through participatory process, carbon champion assessment shows significant community awareness
Invasion of WMA land by outsiders	Conversion of land from forest to agriculture will release carbon emissions exacerbating global warming and decreasing available habitat for wildlife or pasture for livestock. Illegal use of Makame WMA resources will create conflicts amongst communities, potentially leading to violence.	Regular patrols, purchasing of more vehicles to conduct patrols, increasing awareness of community members about conservation and the rules of the resource plan, strengthening and authenticating land rights	When prompted during meetings WMA reports no significant invasion of WMA land by outsiders during this period

2.1.17. Benefit Permanence (G1.11)

Carbon Tanzania and its partners have conducted capacity building and training within the communities and WMA entity. In addition, project partners Creating tourism opportunities reframing and reinvigorating the resource plan Community understanding of the potential for forest conservation to create and maintain pasture.

Stakeholder Engagement**2.1.18. Stakeholder Access to Project Documents (G3.1)**

All project documentation is stored with the Makame WMA AA office situated in Makame Village. Project documentation is also translated and available to all five Village governments, and women's forums within those villages. This includes copies of the RMP translated into Swahili and the RMP map in every village that supports awareness. This map contains local Maa names for areas and the REDD project boundaries.

2.1.19. Dissemination of Summary Project Documents (G3.1)

Summary documentation describing the proposed project activities and its requirements have been translated into Swahili and shared with all community groups at all levels of administration through consultative workshops and specific training sessions. Carbon Tanzania has set in place a Carbon Champions program, training young men and women from each of the five villages in climate change and project development. These carbon champions have travelled to all villages and sub-villages to inform people in Maa about this REDD project.

2.1.20. Informational Meetings with Stakeholders (G3.1)

During project development and early stage implementation various informational meetings were held with stakeholders at the local and district level. All these meetings were aimed at increasing stakeholder understanding of the project, including identifying informational gaps to be addressed by later meetings and trainings. Some meetings and trainings were conducted in both Kiswahili, the national language, and Maa, the tribal language, to allow as many stakeholders as possible full access to information. Formal informational meetings with stakeholders were held as follows;

May 2016: Carbon Tanzania representatives were invited to a board meeting of the Makame WMA AA where they introduced the concept of the REDD project.

May 2016: The Carbon Tanzania management attended a Kiteto District Council meeting to Introduce the concepts and requirements of the REDD project.

August 2016: Consultative meetings were held with both members of the Makame WMA committee and representatives of the five participating villages to explain the respective responsibilities of each stakeholder in the proposed REDD project.

May 2017: Meetings with full Makame WMA board (including village representatives) and executives to negotiate the terms of contract which forms the basis of the REDD project activities. Carbon Tanzania then signed this contract with Makame WMA.

July / August 2017: Multiple grassroots led training sessions for representatives of both Makame WMA and village communities in the local language (Maa) to sensitize general community members to the aims and requirements of the REDD project (Carbon Champions program).

November 2017: Carbon Tanzania held a finance meeting and training with the WMA leadership, which led to the development of the project finance guideline which laid out to all stakeholders the process that informed all project financial interactions.

August 2018: Bi-annual project updates and grievance meeting with WMA leadership held at the WMA

March 2019: 6-month workplan meeting and presentation by Honeyguide and Carbon Tanzania with the WMA operational leadership including updates around the increased project activity especially in regard to mobilization and capacity building with the Village Game Scouts

Due to the developmental and early stage meetings as well as other informal methods of information dissemination by Carbon Tanzania and our partners, stakeholders now have a good understanding of the project. This process will continue throughout the project duration as stakeholder understanding of the project has been identified by Carbon Tanzania to be a core component of successful project execution.

2.1.21. Community Costs, Risks, and Benefits (G3.2)

Information about Community Costs, Risks, and Benefits was exchanged and discussed during several points in project development. Specifically, During, sessions in August 2016 focused on how the proposed project would affect the communities and during consultative meetings and contract negotiations in 2017. The Carbon Champions have also done project briefings to many community members more spread out throughout the landscape who wouldn't have attended such sessions. Carbon Tanzania and the WMA also produced a financial guidelines document which again outlines potential risks. The Bi-annual meetings also provide a forum for Carbon Tanzania to convey any new risks and potential benefits and for the community to identify any new risks they feel have arisen.

2.1.22. Information to Stakeholder on Verification Process (G3.3)

During sessions with the WMA through 2016, and contract related consultation and negotiations in 2017, a clear project schedule including validation and verification has been known to leaders and updated when necessary, this is always reinforced at bi-annual meetings. Furthermore, carbon champions have been spreading information at a more grassroots level, specifically informing community members of the community monitoring plan and how it relates to verification. Our partners have also been looped in and providing key resources that verify their engagement in the project. Two months before and then again, a month before verification the leadership will then again be informally (often best direct communication form) informed through mobile messages of the upcoming verification.

2.1.23. Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

As stated above both communities and stakeholders have been aware of the validation and verification process including a potential timeline from early development stages of the project. The community and stakeholders have continuously been presented with updated details both about the process and the timeline, specifically in bi-annual meetings and various communications with the WMA entity. Two months before and then again, a month before verification the leadership where again informally (often best direct communication form) informed through mobile messages of the upcoming verification.

Carbon Tanzania will ensure direct and independent communication between the validation/verification body and communities/stakeholders. This will be achieved by allowing unlimited and open access between the two parties in a process that is open and not unnecessarily facilitated by the project developer, this will include that both parties have direct mobile contact information for one another.

2.1.24. Stakeholder Consultation (G3.4)

The review and amendment of the RMP is the key intervention of the community in terms of the design of the project. The areas protected are defined through this community led process and as such this can be considered to be the foundation of stakeholder engagement in the project process. Methods of protection are also primarily decided by the stakeholders themselves as outlined in the RMP, though they have access to consultation from district government and local experts.

2.1.25. Continued Consultation and Adaptive Management (G3.4)

Carbon Tanzania along with our partners in the landscape such as Honeyguide and UCRT, plays the role of informing continued review, and advising adjustment of the project activities to better deliver the intended outcomes. Carbon Tanzania and partner organizations regular presence in the village council and WMA meetings through bi annual meetings ensures that Carbon Tanzania will receive information and feedback about potential issues with project implementation as they arise. In addition, project partners carry out consultative meetings with both the WMA and Carbon Tanzania such as the development and continued updating of the Business Plan for the WMA.

2.1.26. Stakeholder Consultation Channels (G3.5)

Channels of consultation are multi-leveled. Channels are open between Carbon Tanzania and individual community members, as well as with the community and the leadership of the WMA entity. With-in these levels exist both informal (phone calls, face to face conversations) and formal (bi-annual meetings, appeals committee) mechanisms. The WMA is a legitimate entity based on participation and buy-in from the communities it encompasses, and made up of community members, this legitimizes the consultations and participatory process that Carbon Tanzania engages with. Our partners Honeyguide and UCRT also provide a separate and independent consultation channel available to the community at all levels, and are experts in community engagement including around cultural and gender issues. Carbon Tanzania is satisfied with the level of information sharing that has occurred to date and the first awareness assessment conducted supports this belief.

2.1.27. Stakeholder Participation in Decision-Making and Implementation (G3.6)

The WMA structure is designed specifically to be a participatory entity that encompasses all the stakeholders in the area under WMA supervision. This purpose is once again outlined and cemented by the RMP. The project developer deals directly with the WMA entity and thus ensures stakeholder participation in the decision-making and implementation of the project. Our partner UCRT acts as a secondary insurance method to guarantee true stakeholder participation in decision-making, and implementation are taking place. Their presence in village council, women's forums, and WMA meetings allows us to effectively monitor the functionality of the decision-making process, especially in regard to sensitive cultural and gender aspects that may be involved.

2.1.28. Anti-Discrimination Assurance (G3.7)

Carbon Tanzania has company policies to prevent discrimination and outline a course of action, should it occur, the human resource (HR) policy provides a clear statement on discrimination relating to gender, religion or sexual discrimination. Discrimination is considered a level A misconduct under the HR policy. Where discrimination occurs within the company, partner organisations or within project areas (project participants), actions are outlined in the grievance policy to ensure that any discrimination is dealt with by the senior management. All company employees and field partners sign a code of conduct with CT that includes anti-discrimination.

2.1.29. Grievances (G3.8)

Carbon Tanzania has a clear grievance redress mechanism which is outlined in the company grievance policy. The grievance policy is also part of the files kept at the WMA office. The policy defines a grievance and its scope and outlines both an informal and formal procedure for managing grievances. Under the informal procedure, affected person first discuss with a director or another member of the management team. The director will attempt to resolve the grievance on an informal basis, taking advice if necessary, from other parties. The director and affected person will work together to resolve the problem. If a grievance cannot be resolved via informal discussions, the formal procedure may then be used. The formal procedure requests the grievance to be in written form (or if not possible, by telephone to the director). An investigation is arranged within 1 week (7 days) to gather additional information, followed by a grievance hearing. The hearing should occur within 10 working days of the investigation being completed. Additional details, including the contact numbers of the directors, are included in the grievance policy, available in both English and Swahili.

No grievance either formal or informal have been logged during this reporting period.

2.1.30. Worker Training (G3.9)

Makame WMA RMP is designed to promote sustainable community development and to consistently improve the quality of conservation. Makame WMA is committed to involving the community in its program of work, and to contributing toward sustainable local development. There is a preference for hiring local people. Candidates from the local community who meet a position's requirements are given preference in hiring decisions. It is important to note that there is a lack of individuals with advanced technical or professional studies in the local area and therefore this type of service has to be contracted from outside the communities.

All Makame WMA personnel receive training through the administration and operations program (See RMP) when they are hired, including content related to professional ethics and conduct as part of the institutional culture. Staff evaluations and staff training are part of the RMP (See section 6.1.4. of the RMP). New employees are informed through briefing about their legal rights, anti-discrimination laws and policies and methods of resolving problems and formalizing complaints within the organization. With regards to adherence to host country laws regarding workers' rights, the project proponent, to the best of its knowledge, complies with all relevant national laws, including labor laws. During this period all of these policies which are enshrined in the RMP, and host country laws were followed, this is a WMA responsibility as any deviation would be illegal.

2.1.31. Community Employment Opportunities (G3.10)

Sourcing employees from the community is crucial to Carbon Tanzania as creating local employment is one of our main company goals. All community members regardless of age, sex, gender etc. are given equal opportunity to fill all work positions including management. Positions are not open to non-community members unless it is determined that the capacity does not exist locally and cannot be built immediately. The only barrier is based on job requirements and even here Carbon Tanzania is committed to doing whatever necessary to source all project employees directly from the community, including helping to build capacity of community members to fulfill job requirements that they may not have met at project outset. The community run WMA is tasked with most of the selection of workers however Carbon Tanzania has input, especially on behalf of ensuring women, youth, and any marginalized people are given a fair chance to fill positions for which they are well suited or can be subsequently trained. All employees of the WMA during this period such as the WMA manager and Village Game Scouts were employed from within the five villages that make up the WMA.

2.1.32. Relevant Laws and Regulations Related to Worker's Rights (G3.11)

Tanzania overhauled its employment and labor laws in 2004 when it enacted the Employment and Labor Relations Act, Act No. 6 of 2004 ("the Employment Act") and the Labor Institutions Act, Act No. 7 of 2004 ("Labor Institutions Act"). The Employment Act provides for labor standards, rights and duties, the Labor Institutions Act constitute the governmental instruments charged with administering the laws. In 2007 additional legislation was added to facilitate the enforcement of labor rights and standards stipulated in the Employment Act. One of the most significant of these is the Employment and Labor Relations (Code of Good Practice) Rules, G.N. No. 42 of 2007. Carbon Tanzania is organizationally committed through internal policy to following these laws. All employees receive a briefing on laws and worker's rights in Tanzania and receive a copy of the Carbon Tanzania company policy documents.

2.1.33. Occupational Safety Assessment (G3.12)

Work within Carbon Tanzania and Makame WMA includes low-level risks typically associated with activities conducted in sites with little infrastructure and irregular conditions. The level of risk varies depending on the type of employment in Makame WMA and the associated activities, although none of the work requires undue exposure to risks. Work in the WMA does not require the operation of heavy machinery or vehicles larger than the rangers' pickup trucks. All Carbon Tanzania field staff have first aid training and all vehicles carry first aid kits. Carbon Tanzania through WMA structures provides assistance to injured project participants. Carbon Tanzania policy instructs participants to avoid to the best of their ability situations which pose unnecessary risk to personal safety. As participants live with-in and often traverse the landscape risks like exposure to dangerous animals, snake bites, etc. are unaffected by employment in the WMA. Carbon Tanzania discourages the use of weapons in any project related activities. No occupational safety incidences were reported this monitoring period.

Management Capacity

2.1.34. Required Technical Skills (G4.2)

Project participants			
Key Function	Organization involved	Type of group / organization	Brief description of activities
Project administration	Carbon Tanzania	Project Developer	- Administrative - Reinvestment - Financial planning - Engagement with government of Tanzania - Market research - Project prospecting - Administer funds
Project technical operations	Carbon Tanzania	Project Coordinator	- Ensure project implementation in accordance with contract and PD - Enter into sales contracts for VCUs - Review field data, track project developments - Serve as key actor in dispute resolution - Develop and monitor project cycle to ensure that it is in accordance with approved methodologies - Manage and support technical demands of project - Increase local capacity where possible

Community engagement / participation	Ujamaa Community Resource Team (UCRT)	Community Partner	- Provide legal counsel to communities for the purpose of securing land tenure and governance and contractual development - Provide knowledge of local context to ensure CT is able to carry out the necessary field operations - Organize meetings with ward and district officials - Serve as key actor in dispute resolution
Forest management / monitoring	WMA	Communities recognized by central government as holding land tenure rights in project area	- Develop and implement RMP - Serve as community guards and patrol, monitor and report on natural resource use in violation of the land use plan - Take action against violators in accordance with Wildlife Act, village by-laws and Village Land Act

2.1.35. Management Team Experience (G4.2)

Marc Baker - CEO

Marc Baker is a director and shareholder of CT Ltd. based in Arusha, Tanzania. He has worked in various capacities in conservation and ecotourism since 1998, including consulting for UNDP-GEF cross border biodiversity project from 1998 to 2000 where he worked in forest management in Tanzania and Kenya. Marc has also worked as a consultant for DANIDA, Care International, and the Wildlife Division of Tanzania on biodiversity assessments, wildlife management, and tourism development. Marc founded Carbon Tanzania in 2008 with the specific aim of driving in-country value-added carbon offsets directly to communities, to ensure both biodiversity protection and a community-based understanding of climate change mitigation and adaptation.

Jo Anderson - CFO

Jo Anderson is a director and shareholder of CT Ltd. based in Arusha, Tanzania. His work has ranged from wildlife surveys in remote areas to assessments of tourism resources in potential development sites. He has worked in the forestry, environment, and tourism industries for 16 years in Tanzania, and has built a network of professional contacts, both in the government and non-governmental sectors. He works in policy development with the relevant Ministries and non-governmental organizations, writing briefing papers and editing technical documents.

2.1.36. Project Management Partnerships/Team Development (G4.2)

Partnerships

Ujamaa Community Resource Team (UCRT) works to empower marginalised people in the rangelands of northern Tanzania, to secure rights to their natural resources and land in order to improve their livelihoods and ability to conserve their resources. UCRT assists the community facilitation for Carbon Tanzania in Makame WMA.

HoneyGuide Foundation (HGF) provides capacity training and support to WMAs to. This includes training for Village Game Scouts, specifically on anti-poaching and data collection using SMART.

Maliasili Initiatives is a non-profit organization that supports the growth, development and performance of leading civil society organizations and social enterprises working to advance sustainable natural resource management practices in Africa. Maliasili Initiatives provides Carbon Tanzania with advice and support around its organizational and business development.

The Nature Conservancy (TNC) is a global conservation organization working to protect ecologically important lands and waters for nature and people. To date, the Conservancy and its

more than one million members have been responsible for the protection of more than 15 million acres in the United States and have helped preserve more than 102 million acres in Latin America, the Caribbean, Asia, the Pacific and Africa. TNC provides technical support to Carbon Tanzania.

Team Development

Carbon Tanzania conducts annual strategic planning exercises with consultants to ensure roles and accountabilities are under regular revision. This strategic perspectives approach is suitable for small medium enterprises like CT who are constantly dealing with multiple accountabilities.

2.1.37. Financial Health of Implementing Organization(s) (G4.3)

Carbon Tanzania had received donor funds through USAID as part of the EENT project (2016-2018) to assist with the costs to develop and certify the carbon project under the VCS-CCB standard. Carbon Tanzania has experience marketing REDD credits on the global market and has used this applied experience to form conservative estimates for expected annual credit sales for the Makame Savannah REDD Project. Additionally, the Project Proponent's combined REDD project development experience have contributed to a detailed financial model for the development and management of the Project. Predicted credit sales and an accurate estimated annual budget demonstrate sufficient cash flow from predicted contracted sales to sustain the project through the end of the crediting period. Documents supporting these investments can be produced to the project auditor for inspection. Carbon Tanzania has equity investors and a concise business plan and financial modal that are available on request. The project partners are all well-funded, sufficiently capitalized organizations, and include a major international NGO (The Nature Conservancy), local Tanzanian NGOs with impressive histories of financial sustainability (UCRT, Honeyguide).

2.1.38. Avoidance of Corruption and Other Unethical Behavior (G4.3)

All forms of bribery and corruption are prohibited. Carbon Tanzania will not tolerate any act of bribery or corruption. Any breach of Carbon Tanzania company policy on corruption and unethical behavior or local law could result in disciplinary action being taken. A bribe does not actually have to take place - just promising to give a bribe or agreeing to receive one is prohibited.

2.1.39. Commercially Sensitive Information (Rules 3.5.13 – 3.5.14)

There is no commercially sensitive information in this project description document, itself. Supporting documents which include commercially sensitive information that will not be made publicly available include: the MOU; Contracts with Buyers and Service Providers; and documents related to project financials.

2.1.40. Legal Status and Property Rights

2.1.41. Recognition of Property Rights (G5.1)

Land tenure in Tanzania is governed by the Land Act No. 4 of 1999, and the Village Land Act No. 5 of 1999. These laws classify all land within the boundaries of registered villages as 'village land,' which is held by the resident communities under customary rights of occupancy held in perpetuity. The Village Land Act designates the village councils and village assemblies as the statutory management authorities over these village lands. This land tenure framework, in combination with Tanzania's local government structures, provides for the rights and responsibilities of the village councils and village assemblies and provides a strong foundation for participatory management of communal land and resources such as forests.

2.1.42. Free, Prior and Informed Consent (G5.2)

The project is being undertaken with full consent of the communities, WMA, local and district government. The project will not involve any property or land held privately. Carbon Tanzania representatives were invited to a board meeting of the Makame WMA AA and a Kiteto District Council meeting where they introduced the concept of the REDD project. Later, consultative meetings were held with both members of the Makame WMA committee and representatives of the five participating villages to explain the respective responsibilities of each stakeholder in the proposed REDD project. Subsequently meetings with the full Makame WMA board (including village representatives) and executives were held to negotiate the terms of contract, which was thereafter signed by both parties. The contract forms the basis of the REDD project activities. Multiple grassroots led training sessions were conducted which included representatives of both Makame WMA AA and village communities. These training sessions were conducted in the local language (Maa) to sensitise general community members to the aims and requirements of the REDD project. Furthermore, the project aims to follow and reinforce the RMP which is the community generated document that outlines the communities' own desires for natural resource management within the WMA.

2.1.43. Property Right Protection (G5.3)

This project is based on the Makame WMA RMP, a document developed in a participatory manner to ensure that the rights and resources within the project area are protected. This project follows this RMP and therefore aims to protect the rights of the communities within Makame WMA.

2.1.44. Identification of Illegal Activity (G5.4)

This project is based on the Makame WMA RMP, a document developed in a participatory manner to ensure that the rights and resources within the project area are protected. The RMP is based on laws governing natural resource use in Tanzania and thus no illegal activity will occur (see 2.5.7.).

2.1.45. Ongoing Disputes (G5.5)

There are no known ongoing disputes or conflicts within the project area.

2.1.46. National and Local Laws (G5.6)

National Sector Policies and WMAs

In the late 1990's, Tanzania went through a complete reform of its natural resource policies to deal with critical management issues facing natural resources. These reforms placed greater emphasis on Community Based Management of Natural Resources (CBNRM). Changes included revisions of the Wildlife Policy (1998), the Environment Policy (1997)¹⁴, the Forest Policy (1999)¹⁵, the Tourism Policy (1999)¹⁶, and Beekeeping Policy (1998)¹⁷. Note that the common thread in all of these revisions is: (a) to utilize natural resources efficiently and sustainably, (b), to include local communities in the process, and (c) to increase benefits accruing to local communities. All this adds up to a much stronger people orientation in natural resource management policies and sets the stage for the creation of Wildlife Management Areas (WMAs) and the basis for developing a Resource Management Plan (otherwise known as Resource Management Plan - RMP). Besides

¹⁴ <http://faolex.fao.org/docs/pdf/tan175140.pdf>

¹⁵ <http://faolex.fao.org/docs/pdf/sol18884.pdf>

¹⁶ https://www.tnrf.org/files/E-URT_POLICIES_National_Tourism_Policy_1999_0.pdf

¹⁷ <http://www.tzonline.org/pdf/nationalbeekeepingpolicy.pdf>

the national policy context, the RMP is embedded in the framework of the national development vision, which amongst other things, aspires to graduate Tanzania from a least developed country to a middle-income country by 2025. This development vision aims to promote 'high quality livelihoods, through sustainable and shared growth, free from poverty and gender inequalities, political stability, with leaders and public servants held accountable through good governance, and a strong competitive economy.' The economic benefits to communities from managing WMAs as a means of generating revenue for local development is supported by this vision.

In order to implement the Wildlife Policy (1998), the Tanzanian Government developed and approved several strategies including development and approval of the Wildlife Conservation (Wildlife Management Areas) Regulations in 2012. The WMA Act (2012) aims to guarantee sustainable conservation of wildlife resources in local community lands and safeguard the interests of traditional communities, the Wildlife Conservation (Wildlife Management Areas) Regulations 2012¹⁸ calls for the development of a Resource Management Plan (RMP) of a WMA. The RMP, updated in 2017 for this REDD project is a result of the workshops organised by the AA and review workshops to accord the RMP with Wildlife Conservation Act no. 5 of 2009¹⁹. The RMP is a document that sets the basic management and development philosophy of MWMA, provides the current image of reality, defines the desired future of the MWMA and provides for the means of changing the negative situation and achieving the desired future over a period of 5 years (2017-2022).

Local Government Policy

The Local Government Act of 1982²⁰, empowers District Councils to implement economic activities and ensure economic growth and development in a District. Responsibility is delegated to the Village Government, as the grassroots organ. People must be involved in planning, decision making, implementation and M&E, on all matters pertaining to development. WMAs conform well to this policy, and MWMA is charged with local development responsibility on behalf of the members.

Benefit Sharing

Once User Rights are obtained, the RMP assumes that the AA will enter into agreements for the specified commercial operations of the WMA, subject to approval by the Director of Wildlife. Anticipated is that the Director shall collect normal fees for such operations as pertains to Hunting Block Fees, Permit Fees, Conservation Fees, Trophy Fees, Trophy Handling Fees, photographic tourism, etc. (as in the Tourist Hunting Regulations, 2010). The 1995 Management Plan for Tourism Hunting suggested a scheme whereby 50% of revenues go back to the community for development projects.

MWMA Benefit Sharing Guidelines

In line with the MWMA Constitution of 2017 the following guidelines shall prevail: The benefit sharing from a WMA shall comply with mechanisms of equitable distribution of costs and benefits, distributed equally for the benefit of Village Members irrespective of size of land or population. Targeted shall be economic development and poverty reduction.

¹⁸ <https://tnrf.org/files/WMA%20regulations%202012.pdf>

¹⁹

https://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/pdfpreview/wildlife_conservation_act_2009_tanzania_0.pdf

²⁰ <https://www.policyforum-tz.org/sites/default/files/LocalGovtDistrictAuthoritiesAct71982.pdf>

3. CLIMATE

Monitoring GHG Emission Reductions and Removals

3.1.1. Data and Parameters Available at Validation

Data / Parameter:	$\Delta C_{BSL,PA,unplanned}$
Data unit:	t CO ₂ -e
Description:	Net CO ₂ emissions in the baseline from unplanned deforestation in the project area
Source of data:	Derived in Section 3.2 of PD
Value applied:	Set at start of baseline period
Justification of choice of data or description of measurement methods and procedures applied:	Derived and justified in Section 3.2 of PD in which baseline is set
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter:	$\Delta C_{BSL,LK,unplanned}$
Data unit:	t CO ₂ -e
Description:	Net CO ₂ emissions in the baseline from unplanned deforestation in the leakage belt
Source of data:	Derived in Section 3.2 of PD
Value applied:	Set at start of baseline period
Justification of choice of data or description of measurement methods and procedures applied:	Derived and justified in Section 3.2 of PD in which baseline is set
Purpose of Data	Calculation of leakage
Comments	

Data / Parameter:	CF
Data unit:	t C t ⁻¹ d.m.
Description:	Carbon fraction of biomass
Source of data:	IPCC 2006GL
Value applied:	0.47
Justification of choice of data or description of measurement methods and procedures applied:	Global default
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter:	C _{OLB}
Data unit:	t CO ₂ -e ha ⁻¹
Description:	Average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt
Source of data:	Values transformed from NAFORMA data. p48 NAFORMA, Ministry of Natural Resources and Tourism, Tanzania Forest Services Agency, Government of Finland, AND FAO. 2015. NAFORMA - National Forest Resources Monitoring and Assessment of Tanzania Mainland - Main Results.
Value applied:	54.7 t CO ₂ -e ha ⁻¹
Justification of choice of data or description of measurement methods and procedures applied:	Derived above in Section 3.2 of the PD
Purpose of Data	Calculation of leakage
Comments	

Data / Parameter:	f _j (X,Y)
Data unit:	kg d.m. tree-1
Description:	Allometric equation for species j linking measured tree variable(s) to aboveground biomass of living trees.
Source of data:	Data resulting from the forest inventory.
Value applied:	See forest inventory excel workbook.
Justification of choice of data or description of measurement methods and procedures applied:	Mugasha, A. W., Zahabu, E., Mathias, A., Luganga, H., Maliondo, S. M. S., & Malimbwi, R. E. 2016. Chapter 7 Allometric Biomass and Volume Models for Acacia-Commiphora Woodlands. Allometric Tree Biomass and Volume Models in Tanzania, 67.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	

Data / Parameter:	R
Data unit:	t root d.m. t ⁻¹ shoot d.m.
Description:	Root to shoot ratio appropriate to species or forest type / biome
Source of data:	Data resulting from the forest inventory.
Value applied:	0.28
Justification of choice of data or description of measurement methods and procedures applied:	Root biomass density was calculated using an IPCC root to shoot ratio of 0.28 for dry tropical forest, as found in the VM-0007 module CP-AB, "Estimation of carbon stocks in the above- and

	belowground biomass in live tree and non-tree pools”.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	Value documented in VMD0001

3.1.2. Data and Parameters Monitored

Data / Parameter:	$\Delta C_{P,Def,i,t}$								
Data unit:	t CO ₂ -e								
Description:	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t								
Source of data:	Calculated								
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.								
Frequency of monitoring/recording:	Every ≤ 5 years								
Value applied:	<table border="1"> <thead> <tr> <th>Year</th><th>$\Delta C_{P,DefPA,i,t}$ (t CO₂-e)</th></tr> </thead> <tbody> <tr> <td>2017</td><td>5,917</td></tr> <tr> <td>2018</td><td>5,917</td></tr> <tr> <td>2019</td><td>5,917</td></tr> </tbody> </table>	Year	$\Delta C_{P,DefPA,i,t}$ (t CO ₂ -e)	2017	5,917	2018	5,917	2019	5,917
Year	$\Delta C_{P,DefPA,i,t}$ (t CO ₂ -e)								
2017	5,917								
2018	5,917								
2019	5,917								
Monitoring equipment:	None.								
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.								
Purpose of data	Calculation of project emissions								
Calculation method:	Equation 3, VMD0015								
Comments	None								

Data / Parameter:	$\Delta C_{P,DefLB,i,t}$
Data unit:	t CO ₂ -e
Description:	Net carbon stock change as a result of deforestation in the project case in the leakage belt in stratum i at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted.

	Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Every ≤ 5 years	
Value applied:	Year	$\Delta CP, DefLB, i, t$ (t CO ₂ -e)
	2017	26,489
	2018	26,489
	2019	26,489
Monitoring equipment:	None.	
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.	
Purpose of data	Calculation of leakage	
Calculation method:	Equation 4, VMD0015	
Comments	None	

Data / Parameter:	$\Delta CP, DistPA, i, t$	
Data unit:	t CO ₂ -e	
Description:	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i at time t	
Source of data:	Calculated	
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Every ≤ 5 years	
Value applied:	Year	$\Delta CP, DistPA, i, t$ (t CO ₂ -e)
	2017	0
	2018	0
	2019	0
Monitoring equipment:	None.	
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.	
Purpose of data	Calculation of project emissions	
Calculation method:	Equation 20, VMD0015	
Comments	None	

Data / Parameter:	$A_{DefPA, u, i, t}$	
Data unit:	Ha	
Description:	Area of recorded deforestation in the project area stratum i converted to land use u at time t	
Source of data:	Monitored at each monitoring/verification event through the use of classified satellite imagery	

Description of measurement methods and procedures to be applied:	Detailed procedures are provided under monitoring plan description. Monitoring responsibilities are listed in section 3.3.		
Frequency of monitoring/recording:	Every ≤ 5 years		
Value applied:	Year	ADefPA,u,i,t (ha) MAS	ADefPA,u,i,t (ha) MFW
	2017	105.2	1.7
	2018	105.2	1.7
	2019	105.2	1.7
Monitoring equipment:	ArcGIS		
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description		
Purpose of data	Calculation of project emissions		
Calculation method:	Not relevant		
Comments	None		

Data / Parameter:	ADefLB,u,i,t		
Data unit:	Ha		
Description:	Area of recorded deforestation in the leakage belt stratum i converted to land use u at time t		
Source of data:	Monitored at each monitoring/verification event through the use of classified satellite imagery		
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description. Monitoring responsibilities are listed in section 3.3.		
Frequency of monitoring/recording:	Every ≤ 5 years		
Value applied:	Year	ADefLB,u,i,t (ha) MAS	ADefLB,u,i,t (ha) MFW
	2017	22	255
	2018	22	255
	2019	22	255
Monitoring equipment:	ArcGIS		
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description		
Purpose of data	Calculation of leakage		
Calculation method:	Not relevant		
Comments	None		

Data / Parameter:	ADistPA,q,i,t		
Data unit:	ha		
Description:	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, at time t		

Source of data:	Monitored at each monitoring/verification event through the use of classified satellite imagery										
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description. Monitoring responsibilities are listed in section 3.3.										
Frequency of monitoring/recording:	Every ≤ 5 years										
Value applied:	<table><tr><td></td><td>$A_{DistPA,q,i,t}$</td></tr><tr><td>2017</td><td>0</td></tr><tr><td>2018</td><td>0</td></tr><tr><td>2019</td><td>0</td></tr></table>		$A_{DistPA,q,i,t}$	2017	0	2018	0	2019	0		
	$A_{DistPA,q,i,t}$										
2017	0										
2018	0										
2019	0										
Monitoring equipment:	ArcGIS										
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description										
Purpose of data	Calculation of project emissions										
Calculation method:	Not relevant										
Comments	None										

Data / Parameter:	C _{BSL,i}							
Data unit:	t CO ₂ -e ha ⁻¹							
Description:	Carbon stock in all pools in the baseline case in stratum i							
Source of data:	Estimated from forest carbon inventory.							
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description Monitoring responsibilities are listed in section 3.3.							
Frequency of monitoring/recording:	Every ≤ 10 years.							
Value applied:	<table><tr><td>Strata</td><td>C_{BSL,i} (t CO₂-e ha⁻¹)</td></tr><tr><td>MAS</td><td>54.6</td></tr><tr><td>MWF</td><td>99.0</td></tr></table>		Strata	C _{BSL,i} (t CO ₂ -e ha ⁻¹)	MAS	54.6	MWF	99.0
Strata	C _{BSL,i} (t CO ₂ -e ha ⁻¹)							
MAS	54.6							
MWF	99.0							
Monitoring equipment:	dbh tape, measuring tape, GPS, clinometer							
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description							
Purpose of data	Calculation of baseline emissions Calculation of project emissions							
Calculation method:	Use equations as stated in the forest inventory and section 3.3 of the PD.							
Comments	None							

Data / Parameter:	$\Delta C_{pools,Def,u,i,t}$
Data unit:	$t\ CO_2-e\ ha^{-1}$

Description:	Carbon stock in all pools in post-deforestation land use u in stratum i
Source of data:	Calculated.
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 10 years.
Value applied:	0.0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Equation 5, VMD0015
Comments	None

Data / Parameter:	$A_{DegW,i,t}$
Data unit:	ha
Description:	Area potentially impacted by degradation processes in stratum i
Source of data:	Delineated based on survey results indicating general area of project potentially accessed and typical depth of penetration of illegal harvest activities from points of access
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Repeated each time the PRA indicates a potential for degradation. PRA conducted every ≤ 2 years
Value applied:	0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description.
Purpose of data	Calculation of project emissions
Calculation method:	Not relevant
Comments	PRAs indicated no degradation

Data / Parameter:	$C_{DegW,i,t}$
Data unit:	t CO ₂ -e
Description:	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i at time t

Source of data:	Estimated from diameter measurements of cut stumps in sample plots
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	0
Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description.
Purpose of data	Calculation of project emissions
Calculation method:	Equation 8, VMD0015
Comments	PRAs indicated no degradation

Data / Parameter:	AP_i
Data unit:	ha
Description:	Total area of degradation sample plots in stratum i
Source of data:	Calculated as 3% of $A_{DegW,i,t}$
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	0
Monitoring equipment:	ArcGIS
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description.
Purpose of data	Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data / Parameter:	$\Delta C_{P,DegW,i,t}$
Data unit:	t CO ₂ -e
Description:	Net carbon stock changes as a result of degradation in stratum i in the project area at time t
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted.

	Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	0
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of project emissions
Calculation method:	Equation 8, VMD0015
Comments	PRAs indicated no degradation

Data / Parameter:	PROP _{IMM}
Data unit:	Proportion
Description:	Estimated proportion of baseline deforestation caused by immigrating population
Source of data:	Calculated based on results of survey of communities in the area around the project.
Description of measurement methods and procedures to be applied:	Detailed procedures provided under the monitoring plan description. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	0.091
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of leakage
Calculation method:	Not relevant
Comments	None

Data / Parameter:	TOTFOR
Data unit:	ha
Description:	Total available national forest area
Source of data:	Official data, peer reviewed publications, remotely sensed imagery (coarse scale imagery is appropriate) or cadastral Maps and other verifiable sources
Description of measurement methods and procedures to be applied:	Procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 3.3.

Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	48,090,703
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of leakage
Calculation method:	Not relevant
Comments	Ministry of Natural Resources and Tourism, Tanzania Forest Services Agency, Government of Finland, AND FAO. 2015. NAFORMA - National Forest Resources Monitoring and Assessment of Tanzania Mainland - Main Results.

Data / Parameter:	PROTFOR
Data unit:	ha
Description:	Total area of fully protected forests nationally
Source of data:	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	Procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	0
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of leakage
Calculation method:	Not relevant
Comments	None

Data / Parameter:	MANFOR
Data unit:	ha
Description:	Total area of forests under active management nationally
Source of data:	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	Procedures provided below under monitoring plan description. Monitoring responsibilities are listed in section 3.3.

Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.
Value applied:	0
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of leakage
Calculation method:	Not relevant
Comments	None

Data / Parameter:	ARRL,forest,t	
Data unit:	ha	
Description:	Remaining area of forest in RRL at time t	
Source of data:	Calculated	
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.	
Value applied:	ARRL,Forest2005	3,126,053
	ARRL,Forest2015	2,747,978
Monitoring equipment:	ArcGIS	
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.	
Purpose of data	Calculation of project emissions	
Calculation method:	Calculated as the total area of the RRL minus all nonforested areas.	
Comments	None	

Data / Parameter:	Aburn,q,i,t.	
Data unit:	ha	
Description:	Area burnt in post-natural disturbance stratum q in stratum i, at time t;	
Source of data:	See parameter A _{DistPA,q,i,t}	
Description of measurement methods and procedures to be applied:	Monitored as part of A _{DistPA,q,i,t} Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Every ≤ 5 years	
Value applied:	Year	Aburn,q,i,t. (ha)
	2017	0
	2018	0
	2019	0

Monitoring equipment:	None.
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of project emissions
Calculation method:	$Aburn,q,i,t = A_{DistPA,q,i,t}$ (area burnt in natural disturbance)
Comments	None

Data / Parameter:	dbh
Data unit:	cm
Description:	diameter at breast height
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in the SOPs. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	See forest inventory excel sheet.
Monitoring equipment:	dbh tape, measuring tape,
QA/QC procedures to be applied:	Detailed procedures are provided under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data / Parameter:	dbasal
Data unit:	cm
Description:	Basal diameter
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in the SOPs. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	See forest inventory excel sheet.
Monitoring equipment:	dbh tape, measuring tape,
QA/QC procedures to be applied:	Detailed procedures are provided under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	Dbh may be used as a conservative estimate of dbasal

Data / Parameter:	U _{P,SS,i,pool#}
Data unit:	%
Description:	Percentage uncertainty (expressed as 95% confidence interval as a percentage of the mean where appropriate) for carbon stocks and greenhouse gas sources in the with-project case (1,2...n represent different carbon pools and/or GHG sources)
Source of data:	Calculations arising from field measurement data
Description of measurement methods and procedures to be applied:	Uncertainty in pools derived from field measurement with 95% confidence interval calculated as the standard error of the averaged plot measurements in each stratum multiplied by the t value for the 95% confidence level. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Monitored at least once every 10 years (on re-measurement of forest carbon stocks)
Value applied:	Same as UBSL,SS,i,pool# values below.
Monitoring equipment:	None
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	Same as UBSL,SS,i,pool# values below as forest carbon stock growth was not tracked.

Data / Parameter:	EBSL SS,i, pool#			
Data unit:	t CO2-e			
Description:	Carbon stock or GHG sources (e.g. trees, dead wood, soil organic carbon, emission from fertilizer addition, emission from biomass burning etc.) in the baseline case			
Source of data:	Calculated			
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.			
Frequency of monitoring/recording:	Every ≤ 10 years.			
Value applied:	Strata	Live aboveground tree biomass	Belowground biomass	Standing dead wood
	MAS	3.062.053	857.375	11.415

	MWF	2,446,006	684,882	44,024	
Monitoring equipment:	None				
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.				
Purpose of data	Calculation of baseline emissions Calculation of project emissions				
Calculation method:	Not relevant				
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period				

Data / Parameter:	UBSL,SS,i,pool#			
Data unit:	%			
Description:	Percentage uncertainty (expressed as 95% confidence interval as a percentage of the mean where appropriate) for carbon stocks and greenhouse gas sources in the baseline case (1,2...n represent different carbon pools and/or GHG sources)			
Source of data:	Calculated			
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.			
Frequency of monitoring/recording:	Every ≤ 10 years.			
Value applied:	Strata	Live aboveground tree biomass	Belowground biomass	Standing dead wood
	MAS	35.5%	35.5%	82.3%
	MWF	45.0%	45.0%	115.4%
Monitoring equipment:	None			
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.			
Purpose of data	Calculation of baseline emissions Calculation of project emissions			
Calculation method:	See equation 5 in the X-UNC module.			
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period			

Data / Parameter:	EBSL SS,i
Data unit:	t CO ₂ -e
Description:	Sum of combined carbon stocks and GHG sources in stratum i multiplied by the area of stratum i (A _i) in the baseline case
Source of data:	Calculated

Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Every ≤ 10 years.	
Value applied:	Strata	EBSL,SS,t,l (tCO ₂ e)
	MAS	3,930,843
	MWF	3,174,912
Monitoring equipment:	None	
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.	
Purpose of data	Calculation of baseline emissions Calculation of project emissions	
Calculation method:	Not relevant	
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period	

Data / Parameter:	UBSL,SS,i	
Data unit:	%	
Description:	Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum i in the baseline case	
Source of data:	Calculated	
Description of measurement methods and procedures to be applied:	As this parameter was calculated rather than measured, no measurements methods are noted. Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Every ≤ 10 years.	
Value applied:	Strata	UncertaintyBSL,SS,l (%)
	MAS	28.7%
	MWF	36.1%
Monitoring equipment:	None	
QA/QC procedures to be applied:	Neither QA/QC procedures nor calibration are relevant for this calculated parameter.	
Purpose of data	Calculation of baseline emissions Calculation of project emissions	
Calculation method:	See equation 5 in the X-UNC module.	
Comments	Baseline stocks and sources are estimated ex-ante for each baseline period	

Data / Parameter:	Bi,t
Data unit:	tonnes d. m. ha-1

Description:	Average aboveground biomass stock before burning stratum i, time t	
Source of data:	Calculated using forest inventory data	
Description of measurement methods and procedures to be applied:	Detailed forest inventory procedures are provided in the SOPs. Monitoring responsibilities are listed in section 3.3.	
Frequency of monitoring/recording:	Every ≤ 10 years	
Value applied:	Bi,t (tonnes d.m./ha) Ex-ante Project Area	31.0
	Bi,t (tonnes d.m./ha) Ex-ante Leakage Belt	31.0
Monitoring equipment:	None	
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.	
Purpose of data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage	
Calculation method:	Use equations in the forest inventory.	
Comments	Ex-ante Bi,t is the weighted average across all strata	

Data / Parameter:	AGB
Data unit:	tonnes d. m. ha-1
Description:	Aboveground biomass density
Source of data:	Calculated using forest inventory data
Description of measurement methods and procedures to be applied:	Detailed forest inventory procedures are provided in the SOPs. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	Plot level values can be found in the Forest Inventory Report
Monitoring equipment:	None
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Use equations as stated in the forest inventory.
Comments	None

Data / Parameter:	Asp
Data unit:	ha
Description:	Area of sample plots in ha
Source of data:	Recording and archiving of number and size of sample plots

Description of measurement methods and procedures to be applied:	Detailed forest inventory procedures are provided in the SOPs. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	See forest inventory report.
Monitoring equipment:	m
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data / Parameter:	Hsdw
Data unit:	m
Description:	Height of standing dead tree in m
Source of data:	Monitored during the course of each forest inventory
Description of measurement methods and procedures to be applied:	Detailed procedures provided below in the SOPs. Monitoring responsibilities are listed in section 3.3.
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	See forest inventory excel workbook.
Monitoring equipment:	measuring tape, clinometer
QA/QC procedures to be applied:	Detailed procedures are provided below under monitoring plan description.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Calculation method:	Not relevant
Comments	None

Data / Parameter:	CP,Dist,q,i		
Data unit:	t CO ₂ -e ha ⁻¹		
Description:	Carbon stock in all pools in post-natural disturbance q in baseline stratum i		
Source of data:	Monitored		
Description of measurement methods and procedures to be applied:	Procedures provided in section 3.3 of the PD. Monitoring responsibilities are listed in section 3.3.		
Frequency of monitoring/recording:	Prior to each verification event and at least every 5 years.		
Value applied:	<table border="1"> <tr> <td>Year</td><td>CP,Dist,q,i (t CO₂-e)</td></tr> </table>	Year	CP,Dist,q,i (t CO ₂ -e)
Year	CP,Dist,q,i (t CO ₂ -e)		

	2017	0	
	2018	0	
	2019	0	
Monitoring equipment:	dbh tape, measuring tape, GPS, clinometer		
QA/QC procedures to be applied:	Detailed procedures provided under the monitoring plan description		
Purpose of data	Calculation of project emissions		
Calculation method:	None		
Comments	It can be conservatively assumed that a post-natural disturbance live and dead vegetation stock is equal to zero		

3.1.3. Monitoring Plan

This monitoring plan has been developed to be consistent with module VMD0015 of the REDD Methodological Module, “Methods for monitoring of greenhouse gas emissions and removals (M-MON).” This section focuses on establishing procedures for monitoring deforestation, illegal degradation, natural disturbance, and project emissions ex-post in the project area and leakage belt.

For accounting purposes, the project conservatively assumes stable stocks and no biomass monitoring is conducted in areas undergoing carbon stock enhancement, as permitted in the methodology monitoring module VMD0015, hence $\Delta C_{P,Enh,i,t}$ is set to 0.

Further, as no commercial harvest of timber (including FSC selective logging) occurs in the baseline or with project case, the degradation due to harvest of timber will not be monitored, thus parameter $\Delta C_{P,SelLog,i,t}$ is set to 0.

A separate section on quality assurance/quality control and data archiving procedures covers all monitoring tasks.

Organizations responsible for monitoring are listed below in Table 3.6. These organizations are responsible for implementing all aspects of a particular monitoring task, as described in the monitoring sub-sections below.

Estimation of ex-post net carbon stock changes and greenhouse gas emissions

Ex-post net carbon stock changes and greenhouse gas emissions can only be calculated after monitoring:

- The net carbon stock change as a result of deforestation in the project area;
- The net carbon stock change as a result of degradation in the project area;
- The net carbon stock change as a result of natural disturbance in the project area; and
- The greenhouse gas emissions as a result of deforestation and degradation activities within the project area.

Monitoring Deforestation and Natural Disturbance

Forest cover change due to deforestation and natural disturbance is monitored through periodic assessment of classified satellite imagery, see below, covering the project area. Emissions ($\Delta C_{P,Def,i,t}$ and $\Delta C_{P,DistPA,i,t}$ for deforestation and natural disturbance, respectively) are estimated by the multiplying areas $A_{DefPA,u,i,t}$ and $A_{DistPA,q,i,t}$, for deforestation and natural disturbance, respectively, by average forest carbon stock per unit area. Note that $A_{DistPA,q,i,t}$ is limited to the area where credits have been issued and is identified as the overlap between the delineated area

of the disturbance and the summed area of unplanned deforestation in the project area to the year in which the disturbance occurred. Stock estimates from the initial field inventory completed in 2017, are valid for 10 years (per VM0007). Table 3.1 shows the data and parameters monitored.

Table 3.1. Data and Parameters for Monitoring Deforestation and Natural Disturbance.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
$\Delta C_{P,Def,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t	t CO ₂ e	Calculated
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i at time t	t CO ₂ e	Calculated
$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum i converted to land use u at time t	Ha	Monitored for each verification event
$A_{DistPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i , at time t	Ha	Monitored for each verification event
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i	t CO ₂ e ha ⁻¹	Estimated from the forest carbon inventory
$A_{RRL,forest,t}$	Remaining area of forest in RRL at time t	Ha	Updated prior to each verification event

Changes in forest cover ($A_{DefPA,u,i,t}$ and $A_{DistPA,q,i,t}$) are monitored using classified Landsat imagery. Landsat 1G imagery products which are both radiometrically and geometrically corrected are used and converted to reflectance using the solar elevation angle parameter in the MTL text file and DN Haze parameter which is calculated from the raw imagery. Each image is then processed separately using hard classification techniques with a combination of supervised and clustering approaches. Areas of known land cover types (forest, bushlands, grasslands, agriculture) are used to develop training sites for a supervised classification. To reduce cloud and shadow coverage, multiple images from each scene are combined. When multiple images are used, a clustering algorithm is used to distinguish clusters of forest, non-forest, clouds, shadow and water. The forest and non-forest classes are used to fill any gaps from other images. All land cover types are combined into forest and non-forest groups for each Landsat scene, and then all scenes are combined to complete coverage of the full reference region. Once all scenes are combined, a mode filtering procedure is used whereby, a 3 x 3 pixel filter will be used to increase the minimum mapping unit to 0.81 ha. (90m x 90m).

The project area (and leakage belt boundary), as set in the PD, serves as the initial “forest cover benchmark map” against which changes in forest cover are assessed over the interval of the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting period. For this monitoring period, change in forest cover is assessed against the preceding classified forest cover map marking the beginning of the monitoring interval. The area of remaining forest in the RRL ($A_{RRL,forest,t}$) is derived by subtracting

the non-forested area within the RRL, as found in the forest benchmark map from the total area of the RRL.

Monitoring Illegal Degradation

Emissions due to illegal logging is tracked by conducting surveys in the surrounding areas every two years. Locations surveyed include:

- Families residing in the WMA directly adjacent to the project area; and
- Nearby villages and rural lands, outside of the WMA approaching the project area.

The surveys produce information on wood consumers (fuel wood, wood for construction, and charcoal production) in the surroundings areas, as well as a general indication of the areas where wood is sourced and maximum depth of penetration of harvest activities from access points.

The most recent surveys, conducted as part of community meetings with local villages in interviews with community members, indicate that illegal logging is below the threshold to warrant further investigation of degradation from illegal logging in the project area. Therefore $A_{DegW,i,t}$ is set to 0 in this monitoring period. The parameters for monitoring illegal degradation are listed in Table 3.2 below.

Table 3.2. Data and Parameters for Monitoring Illegal Degradation.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
$A_{DegW,i,t}$	Area potentially impacted by degradation processes in stratum i	Ha	Delineated based on survey results indicating general area of project potentially accessed and typical depth of penetration of illegal harvest activities from points of access
$C_{DegW,i,t}$	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i at time t	t CO ₂ e	Estimated from diameter measurements of cut stumps in sample plots
A_{Pi}	Total area of degradation sample plots in stratum i	Ha	Calculated as 3% of $A_{DegW,i,t}$
$\Delta C_{P,DegW,i,t}$	Net carbon stock changes as a result of degradation in stratum i in the project area at time t	t CO ₂ e	Calculated

Monitoring Project Emissions

With-project emissions are calculated as the sum of emissions from fossil fuel combustion ($E_{FC,i,t}$) + non-CO₂ emissions due to biomass burning ($E_{BiomassBurn,i,t}$) + direct N₂O emissions as a result of nitrogen application ($N_{2Odirect-N,i,t}$). As stipulated in the methodology, fossil fuel combustion in all

situations is an optional emission source. Further, no nitrogen is applied on alternative land uses in the with-project case and hence project emissions therefore equal $E_{\text{BiomassBurn}}$ and are calculated using the VMD0013, "Estimation of greenhouse gas emissions from biomass burning (E-BB)" of the AD Partners modular REDD Methodology.

Non- CO_2 emissions from biomass burning in the project case include emissions from burning associated with deforestation and burning associated with natural disturbance, i.e. forest fire. It is conservatively assumed that the total area burnt during the deforestation process is equal to the area deforested, $A_{\text{DefPA},u,i,t}$. Thus, the area used when calculating E-BB is equal to $A_{\text{burn},i,t}$ (area burnt) = $A_{\text{burn},q,i,t}$ (area burnt in natural disturbance) + $A_{\text{DefPA},u,i,t}$ (area burnt via deforestation in project ex-post)."

Table 3.3. Data and Parameters for Monitoring Emissions from Biomass Burning.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
$E_{\text{BiomassBurn},t}$	Greenhouse emissions due to biomass burning as part of deforestation activities in stratum i in year t	tCO ₂ e of each GHG (CH ₄ , N ₂ O)	Calculated
$A_{\text{burn},i,t}$	Area burnt for stratum i at time t	Ha	Monitored for each verification event
$B_{i,t}$	Average aboveground biomass stock before burning stratum i , time t	tonnes d. m. ha ⁻¹	Conservatively assumed to be the carbon stock in all pools in the baseline case (C _{BSL,i}).
COMF i	Combustion factor for stratum i ; dimensionless	dimensionless	0.45 for primary open tropical forest. Derived from Table 2.6 of IPCC, 2006.
G _{g,i}	Emission factor for stratum i for gas g	kg t ⁻¹ dry matter burnt	GCH ₄ = 6.8 g kg ⁻¹ and GN ₂ O = 0.2 g kg ⁻¹ . Derived from Table 2.5 of IPCC, 2006.
GWP _g	Global warming potential for gas g	t CO ₂ /t gas g	Default values from IPCC SAR: CH ₄ = 21; N ₂ O = 310).

Monitoring of leakage carbon stock changes and greenhouse gas emissions

Leakage by local agents of deforestation is quantified in the leakage belt. The area deforested in the leakage belt ($A_{\text{DefLB},i,t}$) is estimated in the same manner as the area deforested in the with-project case ($A_{\text{DefPA},u,i,t}$) using the procedures outlined above in the monitoring deforestation section. Activity-shifting leakage within the leakage belt ($\Delta C_{\text{LK-ASU-LB}}$) is then calculated as the with-project emissions in the leakage belt ($\Delta C_{\text{P,LB}}$) minus the baseline emissions in the leakage belt ($\Delta C_{\text{BSL,LK,unplanned}}$).

Table 3.4. Data and Parameters for Monitoring Activity Shifting Leakage.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
$\Delta C_{P, LB}$	Net greenhouse gas emissions within the leakage belt in the project case	t CO ₂ e	Calculated
$A_{DefLB, i, t}$	Area of recorded deforestation in the leakage belt at time t	ha	Monitored for each verification event
$\Delta C_{P, Def, i, t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t	t CO ₂ e	Calculated

Immigrant leakage is calculated using a series of equations found in the LK-ASU module. Most of the data for calculating immigrant leakage has been derived for the ex-ante estimates (including $\Delta C_{BSL, LK, unplanned}$; AVFOR; TOTFOR; PROTFOR; MANFOR; PROPLB; LBFOR; COLB; CLB; PROPCS; and $A_{BSL, PA, unplanned, t}$) or gathered in the course of monitoring activity shifting leakage within the leakage belt and deforestation in the project area (including A_{DefPA} ; $A_{DefLB, i, t}$; and $\Delta C_{P, LB}$).

The monitoring parameters MANFOR, PROTFOR, TOTFOR are sourced from the NAFORMA Report²¹ and will be reevaluated after 5 years. Demonstration that managed and protected forests are protected against deforestation is demonstrated in the monitoring report, above, as stipulated in the LK-ASU module. Leakage caused by immigration is estimated using the parameters listed in Table 3.5.

Monitoring immigrant leakage, based on M-MON, consists of implementing surveys in communities living within 2 kilometers of the boundaries of the leakage belt and project area to determine what proportion of the agents of deforestation have been resident in and around the leakage belt and project area for ≥ 5 years (PROPRES) and the proportion of area deforested by population that has migrated into the area in the last 5 years (PROPIMM). As it is extremely sensitive to ask explicit questions regarding responsibility for deforestation, “the proportion of area deforested by population that has migrated into the area in the last 5 years” is assumed to be equal to the percentage of recent immigrants among local population with potential access to the project area (i.e. without directly asking if they are deforestation agents). Similarly, the “proportion of baseline deforestation caused by population that has been resident for ≥ 5 years” is assumed to be equal to the percentage of the local population residing in the area longer than 5 years with potential access to the project area.

Table 3.5. Data and Parameters for Monitoring Immigrant Leakage.

Parameter	Description	Units	Source/ Justification of Choice of Data or Description of Measurement Methods
PROP _{IMM}	Proportion of area deforested by immigrant agents in the	proportion	Monitored prior to each verification event and at least every 5 years

²¹ NAFORMA, Ministry of Natural Resources and Tourism, Tanzania Forest Services Agency, Government of Finland, AND FAO. 2015. NAFORMA - National Forest Resources Monitoring and Assessment of Tanzania Mainland - Main Results.

	leakage belt and project area		
PROP _{RES}	Proportion of baseline deforestation caused by population that has been resident for ≥5 years	proportion	Monitored prior to each verification event and at least every 5 years
TOTFOR	Total available national forest area	ha	Monitored prior to each verification event and at least every 5 years
PROTFOR	Total area of fully protected forests nationally	ha	Monitored prior to each verification event and at least every 5 years
MANFOR	Total area of forests under active management nationally	ha	Monitored prior to each verification event and at least every 5 years

Monitoring of actual carbon stock changes and greenhouse gas emissions

Forest carbon stock estimates will be derived from field measurements less than or equal to 10 years old. Aboveground and belowground live tree and dead wood stocks will be re-assessed on or before November 2026. Carbon stocks and baseline greenhouse gas emissions are based on estimates from the initial inventory conducted in 2016 and detailed in the Makame Project Document.

Quality Assurance/Quality Control and Data Archiving Procedures

Monitoring Deforestation, Natural Disturbance, and Leakage

To ensure consistency and quality results, spatial analysts carrying out the imagery processing, interpretation, and change detection procedures strictly adhered to best practices and good practice guidelines, when using the alternative method for quantifying deforestation. All data sources and analytical procedures are documented and archived (detailed under data archiving below).

Accuracy of the classification is assessed by comparing the classification with ground-truth points or samples of high-resolution imagery (See Appendix 2). Any data collected from ground-truth points is recorded (including GPS coordinates, identified land-use class, and supporting photographic evidence) and archived. Any sample points of high-resolution imagery used to assess classification accuracy will also be archived. Samples used to assess classification accuracy are well-distributed throughout the project area (as far as is possible considering availability of high-resolution imagery and/or logistics of acquiring ground-truth data), with a minimum sampling intensity of 50 points each for the forest and non-forest classes.

The classification is only used in the forest cover change detection step if the overall classification accuracy, calculated as the total number of correct samples / the total number of samples, is equal to or exceeds 90%. The classification accuracy for this monitoring period is >90%.

All data sources and processing, classification and change detection procedures are documented and stored in a dedicated long-term electronic archive.

Information related to monitoring deforestation maintained in the archive include:

- Forest / non-forest maps;

- Documentation of software type and procedures applied (including all pre-processing steps and corrections, spectral bands used in final classifications, and classification methodologies and algorithms applied); and
- Data used in accuracy assessment - ground-truth points (including GPS coordinates, identified land-use class, and supporting photographic evidence) and/or sample points of high-resolution imagery.

Forest Carbon Stocks and Degradation

Field sampling was not required in this monitoring period.

Quality control procedures related to monitoring leakage include conducting a review of the current literature at least every 5 years to source information on the area of the monitoring parameters MANFOR, PROTFOR, and TOTFOR. Further, participatory rural appraisals used to assess the length of time people have been living in the project area and leakage belt will be implemented by personnel with experience conducting community surveys.

Data Archiving

Data archived will be maintained through at least two years beyond the end of the project crediting period. All project records are secure and retrievable. This includes project documents saved on the desktop of the Director of Carbon Tanzania and stored in the Director's file cabinets (based in Arusha, Tanzania). An identical version of the project documents is remotely saved on an external hard drive and in the cloud via DropBox. Furthermore, many project documents (e.g., VCS Project Description, Monitoring Reports, CCBS Project Design Document, Project Implementation Reports, Validation and Verification Reports, etc.) are publicly available and stored on both the Standards' website and on the Markit Environmental Registry. Given the extended time frame and the pace of production of updated versions of software and new hardware for storing data, electronic files will be updated periodically or converted to a format accessible to future software applications, as needed.

Organization, Responsibilities, and Monitoring Frequency

For all aspects of project monitoring, project staff will ensure that data collection, processing, analysis, management and archiving are conducted in accordance with the monitoring plan.

Table 3.6. Type of Monitoring and Party Responsible for Monitoring.

Variables to be monitored	Responsible	Frequency
Monitoring deforestation and natural disturbance	Carbon Tanzania	Prior to each verification
Monitoring illegal degradation	Carbon Tanzania	Every two years
Monitoring project emissions	Carbon Tanzania	Prior to each verification
Activity shifting immigrant leakage assessment	Carbon Tanzania	Prior to each verification event and at least every 5 years.
Updating forest carbon stocks estimates	Carbon Tanzania	At least every 10 years.
Revision of the baseline	Carbon Tanzania	At least every 10 years.

3.1.4. Dissemination of Monitoring Plan and Results (CL4.2)

Carbon Tanzania has shared a summary of the monitoring plan and results with the communities through the WMA. These documents also will be made publicly available on the internet for the communities, other stakeholders, and all those concerned. Summaries are kept at the WMA office where communities can access them. In addition, Carbon Tanzania is holding sessions with our partners in the landscape to explain the monitoring plan and any results and further explain how they may affect their roles and responsibilities vis-a-vis the project.

Quantification of GHG Emission Reductions and Removals

3.1.5. Baseline Emissions

The calculation of baseline emissions is detailed in the Quantification of GHG Emission Reductions and Removals section of the Makame Project Document titled, "Makame_REDD_PD_April19_1stUpload.docx". The calculations for baseline emissions are included in "Makame REDD Project_Monitoring2019_Calcs.xlsx".

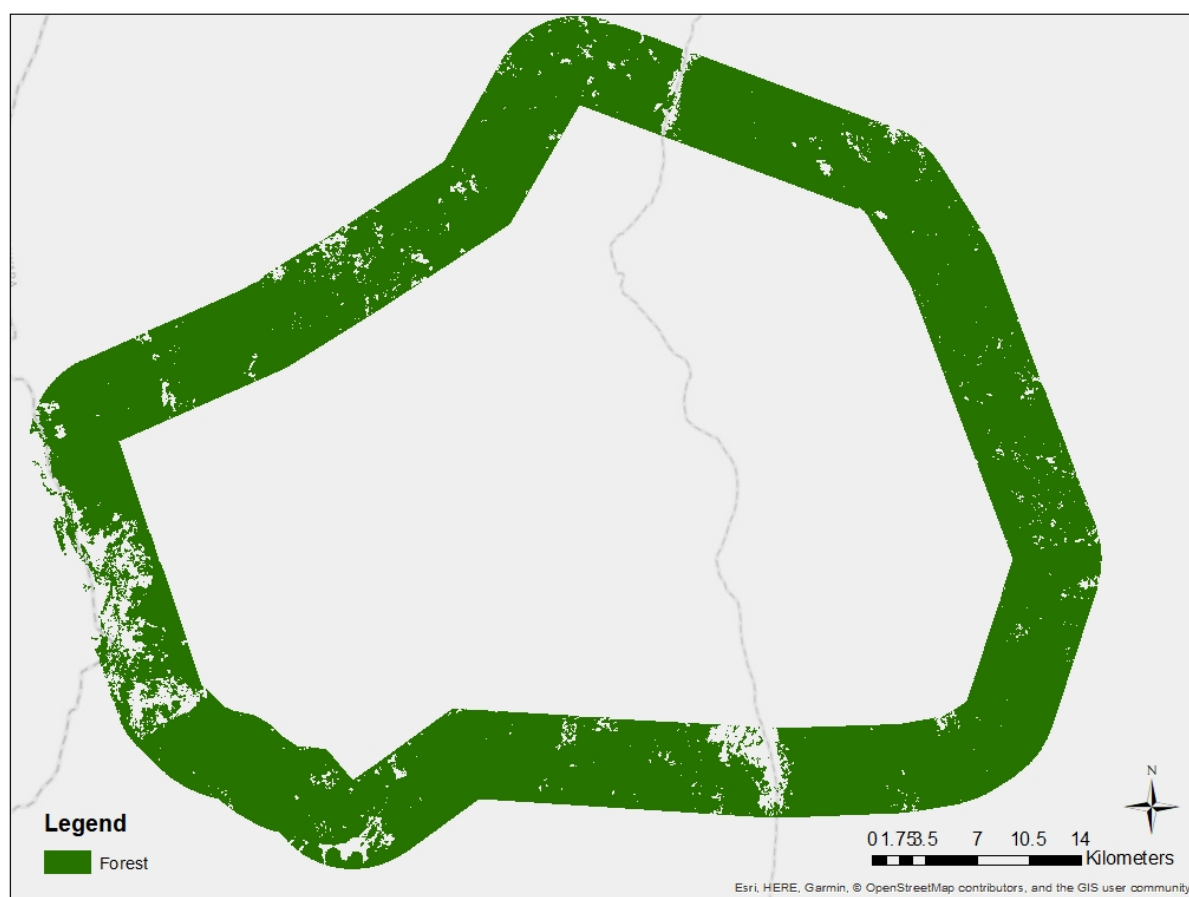
3.1.6. Project Emissions

Estimated project emissions are calculated ex-post and apply Equation 1 as found in module M-MON (VMD0015) of Methodology VM0007. Values for individual parameters are justified in Table 3.7 or derived in Tables 3.8, Table 3.10, and Table 3.11. Benchmark maps of the project area and the leakage belt show forest cover conditions at the end of the monitoring period in 2019, derived using the methods described above, see Figure 3.1 and Figure 3.2. A small wildfire is evident in the northwest region of Makame, that covered about 46 ha. We are assuming zero emissions from included pools from this fire as it appears to have been a grass fire with no loss in forest biomass stocks. See Appendix 3, for an aerial image of the site post-burn that demonstrates minimal land cover change. Forest cover loss, amounting to 0.3% of the area of estimated unplanned deforestation in the without-project scenario is lower than the uncertainty in imagery classification (~9.0%, see Appendix 2), and cannot, therefore, be definitively attributed to human-caused deforestation. Conservatively, all forest cover loss detected is attributed to anthropogenic deforestation.

Figure 3.1. A benchmark map of the project area showing forested area at the end of the monitoring period in 2019, derived using Landsat imagery, containing 103,744 ha of forest cover.



Figure 3.2. Benchmark map of the leakage belt showing forested area at the end of the monitoring period in 2019, derived using Landsat imagery, with 103,183 ha of forest cover.



Equation 1. Equation for Calculating the Net GHG emissions within the Project Area under the Project Scenario.

Table 3.7. Parameters and Values used to Calculate Annual Ex Post Project Emissions.

Parameter	Description	Value	Justification
ΔC_P	Net greenhouse gas emissions within the project area under the project scenario; t CO ₂ e	See table below for calculations.	
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum i at time t; t CO ₂ e	See table below for calculations.	

$\Delta C_{P,Deg,i,t}$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i at time t; t CO ₂ e	$\Delta C_{P,Deg,i,t} = 0$	No emissions from degradation were detected. Ample fuelwood resources remain outside the project area and ongoing forest patrols have deterred degradation activities. Emissions resulting from degradation due to selective logging of FSC certified areas (parameter $\Delta C_{P,SelLog,i,t}$) equates to zero as no selective FSC logging occurs in either the baseline or with-project case.
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum i at time t; t CO ₂ e	$\Delta C_{P,DistPA,i,t} = 0$	No significant natural disturbances resulting in emissions from included pools have been detected during the period.
$GHG_{P-E,i,t}$	Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum i in year t; t CO ₂ e	See table below for calculations.	
$\Delta C_{P,Enh,i,t}$	Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in stratum i at time t; t CO ₂ e	$\Delta C_{P,Enh,i,t} = 0$	Conservative to exclude.

Table 3.8. Data used to Calculate ΔC_P .

Year	$\Delta C_{P,DefPA,i,t}$ (t CO ₂ -e)	$\Delta C_{P,Deg,i,t}$ (t CO ₂ -e)	$\Delta C_{P,DistPA,i,t}$ (t CO ₂ -e)	$GHG_{P-E,i,t}$ (t CO ₂ -e)	$\Delta C_{P,Enh,i,t}$ (t CO ₂ -e)	ΔC_P (t CO ₂ -e)
2017	5,917	0	0	301	0	6,218
2018	5,917	0	0	301	0	6,218
2019	5,917	0	0	301	0	6,218

Deforestation in the With-Project Case

Table 3.9. Parameters and Values used to Calculate Annual Ex Post Deforestation Emissions.

Parameter	Description	Value	Justification
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t; t CO ₂ e	See table below for calculations.	See table below for calculations.

$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum i converted to land use u at time t; ha	See table below for calculations.	See table below for calculations.
$\Delta C_{pools,Def,u,i,t}$	Net carbon stock changes in all pools in the project case in land use u in stratum i at time t; t CO ₂ e ha ⁻¹	$\Delta C_{pools,Def,u,i,t} = 68.3$	This value is the strata area weighted mean. See the forest inventory report for more information on the derivation of this value.

Table 3.10. Data Used to Calculate $\Delta C_{P,DefPA,i,t}$.

Year	$A_{DefPA,u,i,t}$ (ha) MAS	$A_{DefPA,u,i,t}$ (ha) MFW	$\Delta C_{pools,Def,u,i,t}$ (t CO ₂ -e/ha) MAS	$\Delta C_{pools,Def,u,i,t}$ (t CO ₂ -e/ha) MFW	$\Delta C_{P,DefPA,i,t}$ (t CO ₂ -e)
2017	105.2	1.7	54.6	99.0	5,917
2018	105.2	1.7	54.6	99.0	5,917
2019	105.2	1.7	54.6	99.0	5,917

GHG Emissions

Greenhouse gas emissions as a result of deforestation activities within the project area ($GHG_{P,E,i,t}$) are calculated in Table 3.12 using Equation 30. Parameters are found in Table 3.10.

Equation 30. Equation for Calculating GHG Emissions as a Result of Deforestation Activities within the Project Area in the Project Case.

$$GHG_{P-E,i,t} = E_{BiomassBurn,i,t} = A_{burn,i,t} * B_{i,t} * COMF_i * G_{g,i} * 10^{-3} * GWP_g$$

Table 3.11. Parameters and Values Used to Calculate Annual Ex-Ante GHG Emissions.

Parameter	Description	Value	Justification
$GHG_{P,E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project area in the project case in stratum i in year t; t CO ₂ e	See table below for calculations.	
$E_{BiomassBurn,i,t}$	Non-CO ₂ emissions due to biomass burning in stratum i in year t; t CO ₂ e	See table below for calculations.	Biomass burning is expected to occur in the with-project case.

Table 3.12 Calculation of $E_{BiomassBurn,i,t}$ for the project area.

Year	$A_{DefPA,u,i,t}$ (ha)	COMF	E-N ₂ O Biomass Burning (tCO ₂ e)	E-CH ₄ Biomass Burning (tCO ₂ e)	E-Biomass Burning (tCO ₂ e)	$GHG_{P-E,i,t}$ (t CO ₂ -e)
2017	105.2	0.45	91.1	209.7	300.8	300.8
2018	105.2	0.45	91.1	209.7	300.8	300.8
2019	105.2	0.45	91.1	209.7	300.8	300.8

3.1.7. Leakage

Leakage emissions from displacement of unplanned deforestation are estimated in conformance with the VCS modular REDD methodology VM0007, specifically the LK-ASU module. This

module provides for accounting for activity shifting leakage resulting from both local and immigrant deforestation agents.

Leakage due to market effects results from market responses due to project activity impacts on market supply of commercial timber and fuelwood. Agents of deforestation in the project area are mainly pastoralists, not loggers, who would not have the capacity to haul and commercialize any timber recovered in the process of land clearing activities. Instead, timber and fuelwood are used locally for subsistence use. Additionally, timber markets in Tanzania exist predominantly in coastal regions due to easier access to markets through ports and roads. Therefore, this project does not produce market effects leakage related to timber production. Fuelwood in the project region is predominately collected for subsistence purposes, and not commercially harvested, thus any reductions in fuelwood produce no market effects (beyond activity displacement, treated below).

Estimation of Baseline Carbon Stock Changes and Greenhouse Gas Emissions in the Leakage Belt

Activity shifting leakage due to displacement of unplanned deforestation was assessed using a baseline specific to the leakage belt developed following procedures detailed in the Module BL-UP and documented in the PD. Table 3.13 below details the baseline estimates for the leakage belt, against which with-project deforestation in the leakage belt will be measured.

Table 3.13. Estimation of Baseline Carbon Stock Changes and Greenhouse Gas Emissions in the Leakage Belt.

Year	$\Delta CTOT$ (t CO ₂ -e)
2017	98,706
2018	158,341
2019	217,794

Leakage in the leakage belt is calculated based on total area deforested in the leakage over the monitoring period. Leakage is then calculated as the difference between project and baseline carbon stock changes and greenhouse gas emissions in the leakage belt, as outlined in Equation 1 in LK-ASU VMD0010. The parameters for monitoring leakage in the project case are listed in Table 3.14. Net CO₂ emissions due to unplanned deforestation displaced from the project area to the leakage belt are calculated for each year in the baseline period in Table 3.15.

Table 3.14. Calculation of $E_{BiomassBurn,i,t}$ for the leakage belt.

Year	$A_{DefLB,u,i,t}$ (ha)	COMF	E-N ₂ O Biomass Burning (tCO ₂ e)	E-CH ₄ Biomass Burning (tCO ₂ e)	E-Biomass Burning LB (tCO ₂ e)
2017	277.5	0.45	240.2	553.3	793.5
2018	277.5	0.45	240.2	553.3	793.5
2019	277.5	0.45	240.2	553.3	793.5

Table 3.15. Estimates of the Net CO₂ Emissions due to Unplanned Deforestation Displaced from the Project Area to the Leakage Belt.

Year	ΔCBSL _{PA,unplanned} (t CO ₂ -e)	ADefLB _{u,i,t} (ha) MAS	ADefLB _{u,i,t} (ha) MFW	ΔCP _{DefLB,i,t} (t CO ₂ -e)	E-Biomass Burning LB (tCO ₂ e)	ΔCP _{LB} (t CO ₂ - e)	ΔCBSL _{LK,unplanned} (t CO ₂ -e)	ΔCLK- ASU- LB (t CO ₂ - e)
2017	8,283	22	255	26,489	794	27,283	98,706	0
2018	67,247	22	255	26,489	794	27,283	158,341	0
2019	176,183	22	255	26,489	794	27,283	217,794	0

Estimation of Unplanned Deforestation Displaced from the Project Area to Outside the Leakage Belt

The total available national forest area for unplanned deforestation was calculated using Equation 2 in module LK-ASU VMD0010 and the values found in Table 3.16. AVFOR, was calculated to be 48,090,703 ha.

Table 3.16. Parameters and Values used to Calculate the Total Available National Forest Area for Unplanned Deforestation.

Parameter	Description	Value	Justification/Source
AVFOR	Total available national forest area for unplanned deforestation; ha	48,090,703	
TOTFOR	Total available national forest area; ha	48,090,703	page 33 NAFORMA Report
PROTFOR	Total area of fully protected forests nationally; ha	0	Conservatively set to zero
MANFOR	Total area of forests under active management nationally; ha	0	Conservatively set to zero
Ministry of Natural Resources and Tourism, Tanzania Forest Services Agency, Government of Finland, AND FAO. 2015. NAFORMA - National Forest Resources Monitoring and Assessment of Tanzania Mainland - Main Results.			

Next, the ratio (PROPLB) of the forested area of the leakage belt (LBFOR) to the total available national forest area (AVFOR) was calculated. PROPLB = 104,015 ha / 48,090,699 ha = 0.0036751.

The live aboveground tree carbon stock (C_{OLB}) was conservatively determined to be the average stock for Tanzanian forest using data from NAFORMA²² as found in Table 3.17. C_{OLB} = 54.7 t CO₂-e ha⁻¹.

Table 3.17. Live Aboveground Biomass Carbon Stocks in Tanzanian Forests.

Vegetation Type	AGB ¹ t CO ₂ /ha
Forest	111.8
Woodland	55.1
Bushland	21.8
Average	54.7

²² Values transformed from NAFORMA data. p48 NAFORMA, Ministry of Natural Resources and Tourism, Tanzania Forest Services Agency, Government of Finland, AND FAO. 2015. NAFORMA - National Forest Resources Monitoring and Assessment of Tanzania Mainland - Main Results.

The 2015 NAFORMA - National Forest Resources Monitoring and Assessment of Tanzania Mainland was the source of information for the area of AVFOR, the forest strata, and the stocks of aboveground biomass carbon present in each stratum.

The area weighted average aboveground tree carbon stock for forests available for unplanned deforestation inside the leakage belt (C_{LB}) was calculated using data found in Section 3.11.

$$C_{LB} = 68.3 \text{ t CO}_2\text{e ha}^{-1}.$$

The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the leakage belt (PROPCS) was calculated as $\text{PROPCS} = 54.7 \text{ t CO}_2\text{-e ha}^{-1} / 68.3 \text{ t CO}_2\text{e ha}^{-1} = 0.800$.

The proportional leakage for areas with immigrating populations was calculated using Equation 5 in module LK-ASU VMD0010. The values for the parameters used in this equation can be found in Table 3.18.

Table 3.18. Parameters and Values used to Calculate the Proportional Leakage for Areas with Immigrating Populations.

Parameter	Description	Value	Justification/Source
LKPROP	Proportional leakage for areas with immigrating populations; proportion	0.073	
PROIMM	Estimated proportion of baseline deforestation caused by immigrating population; proportion	0.091	Estimated above
PROPLB	Area of forest available for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion	0.0036751	Calculated above
PROPCS	The proportional difference in stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion	0.800	Calculated above

Estimation of the Proportions of Area Deforested by Immigrant and Local Deforestation Agents in the Baseline

Results of the community surveys, implemented in the fall of 2016, indicated that only 2 of the 22 communities have migrated to the area within the last five years.²³

PROP_{RES} = the proportion of area deforested by the population that has been resident in and around the leakage belt and project area for ≥ 5 years = 0.909; and

²³ ibid

$PROP_{IMM}$ = the proportion of area deforested by population that has migrated into the area in the last 5 years = 0.091.

Table 3.19. Parameters and Values used to Calculate Annual Ex-Ante GHG Emissions in the Leakage Belt.

Parameter	Description	Value	Justification
$\Delta C_{LK-ASU-LB}$	Net CO ₂ emissions due to unplanned deforestation displaced from the project area to the leakage belt; t CO ₂ e	See Table 3.15.	Calculated.
$\Delta C_{BSL,LK,unplanned}$	Net CO ₂ emissions in the baseline from unplanned deforestation in the leakage belt; t CO ₂ e	See Table 3.13.	Derived in Section 3.1.
$\Delta C_{P,LB}$	Net greenhouse gas emissions within the leakage belt in the project case t CO ₂ e	See Table 3.15.	Ex-post estimates of emissions within the leakage belt are calculated by multiplying the area deforested in the leakage belt by carbon stocks in the leakages belt by strata.

The net leakage outside the leakage belt ($\Delta C_{LK-ASU,OLB}$) is calculated ex-post using Equation 11 in module LK-ASU VMD0010. The values for the parameters used in this equation can be found in Table 3.20. Annual values for $\Delta C_{LK-ASU,OLB}$ were calculated in Table 3.20.

Table 3.20. Parameters and Values used to Calculate the Net CO₂ Emissions due to Unplanned Deforestation Displaced Outside the Leakage Belt.

Parameter	Description	Value	Justification/Source
$\Delta C_{LK-ASU,OLB}$	Net CO ₂ emissions due to unplanned deforestation displaced outside the leakage belt; t CO ₂ e	Calculated in Table 3.20, below.	
$PROP_{IMM}$	Proportion of area deforested by immigrant agents in the leakage belt and project area (proportion)	0.091	Calculated above
$A_{DefPA,i,t}$	Area of recorded deforestation in the project area in the project case in stratum i in year t (ha)	See Table 3.20.	Calculated above
$A_{DefLB,i,t}$	Area of recorded deforestation in the leakage belt in the project case in stratum i in year t (ha)	See Table 3.20	Calculated above

ALK-OLB,t	Area deforested by immigrants outside the Leakage Belt and project area under the project scenario in year t (ha)	See Table 3.20	Calculated above
ALK-IMM,t	Total area deforested by immigrant agents in the baseline and project scenario in year t (ha)	See Table 3.20	Calculated above
ALK-ACT-IMM,t	Area deforested by immigrants in the project area and Leakage Belt under the project scenario in year t (ha)	See Table 3.20	Calculated above
COLB	Area-weighted average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt (t CO ₂ -e ha ⁻¹)	54.7 t CO ₂ /ha	NAFORMA Report

Table 3.21. Calculation of Net CO₂ Emissions due to Unplanned Deforestation Displaced Outside the Leakage Belt.

Year	PROPIIMM	ALK-IMM,t	ALK-ACT-IMM,t	ALK-OLB,t	ΔCLK-ASU,OLB (t CO ₂ -e)
2017	0.091	16	35	-19	0
2018	0.091	134	35	99	5,438
2019	0.091	343	35	308	16,853

Emissions from Leakage Prevention Activities

Leakage prevention measures do not include the use of fertilizers or the burning of biomass. As such, greenhouse gas emissions as a result of leakage of avoided deforestation activities (GHG_{LK,E}) are assumed to be zero.

Estimation of Total Leakage due to the Displacement of Unplanned Deforestation

The total leakage due to the displacement of unplanned deforestation is estimated in Table 3.22 using Equation 16 in module LK-ASU VMD0010. GHG emissions are not included in the project boundary.

Table 3.22. Parameters and Values used to Estimate Total Leakage due to the Displacement of Unplanned Deforestation.

Parameter	Description	Value	Justification
ΔCLK-AS,unplanned	Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation Net CO ₂ emissions; t CO ₂ e	See Table 3.37	Calculated

$\Delta C_{LK-ASU-OLB}$	Net CO ₂ emissions due to unplanned deforestation displaced outside the leakage belt; t CO ₂ e	See Table 3.35.	Calculated
$\Delta C_{LK-ASU-LB}$	Net CO ₂ emissions due to unplanned deforestation displaced from the project area to the leakage belt; t CO ₂ e	See Table 3.30.	Calculated.

Table 3.23. Calculation of the Total Leakage due to the Displacement of Unplanned Deforestation.

Year	$\Delta C_{LK-ASU-OLB}$ (t CO ₂ -e)	$\Delta C_{LK-ASU-LB}$ (t CO ₂ -e)	GHGLK,E (t CO ₂ -e)	$\Delta C_{LK-AS,unplanned}$ (t CO ₂ -e)	ΔC_{LK-ME} (t CO ₂ -e)	$\Delta C_{LK-REDD}$ (t CO ₂ -e)
2017	0	0	0	0	0	0
2018	5,438	0	0	0	5,438	5,438
2019	16,853	0	0	0	16,853	16,853

3.1.8. Net GHG Emission Reductions and Removals

Uncertainty was assessed applying module X-UNC.

Uncertainty in the baseline rate, parameter $Uncertainty_{BSL,RATE}$, is equal to zero. Per the X-UNC module, “It is here assumed that there is zero uncertainty in baseline rate of deforestation or degradation where numbers are equal to a long-term average (BL-UP)” as they are for this project.

Total uncertainty in carbon stocks in forest (parameter $Uncertainty_{BSL,SS}$) is equal to combined uncertainty of forest carbon pool stock estimates, calculated using propagation of errors (equation 4 of VM0007 module X-UNC). Parameter $Uncertainty_{BSL,SS}$ is thus calculated to be 22.6% at the 95% confidence level (calculations detailed in “Makame Inventory Calcs 2017.08.17-2.xlsx”) for the initial forest inventory.

$Uncertainty_{WRC_BSL,t}$ is zero as this is not a WRC project. Further, $Uncertainty_{REDD_WPS}$ is zero as no ex post estimates of carbon pools or sources will be made. $NER_{REDDERROR,t*}$ is therefore limited to $Uncertainty_{BSL,SS}$. The results of overall uncertainty calculations are presented below in Table 3.24.

Table 3.24. Summary of uncertainty calculations.

X-UNC Equation Number	5	Part 1, Step 1	6	10
Parameter	$Uncertainty_{BSL,SS}$	$Uncertainty_{BSL,RATE}$	$Uncertainty_{BSL,t*}$	$NER_{REDDERROR,t*}$
Value	22.6%	0.0%	22.6%	22.6%

Estimates of GHG credits eligible for issuance as VCUs were calculated in Table 3.26, below; where

Estimated GHG emission reduction credits =
 Baseline emissions, fixed for 10 years at validation minus
 Project emissions minus
 Leakage minus
 Non-permanence Risk Buffer withholding (calculated as a percent of net change in carbon stocks prior to deduction of leakage, see risk report).
 Uncertainty deduction (applied to produce *Adjusted NER REDD*).

Table 3.26. Ex-Ante Estimated of Net Emission Reduction Credits.

Years	Estimated baseline emissions or removals (tCO _{2e})	Estimated project emissions or removals (tCO _{2e})	Estimated leakage emissions (tCO _{2e})	Risk buffer (%)	Deductions for AFOLU pooled buffer account (tCO _{2e})	NER REDD	Adjusted NER REDD	GHG credits eligible for issuance as VCUs (tCO _{2e})
2017	8,283	6,218	0	19%	392	2,066	1,908	1,516
2018	67,247	6,218	5,438	19%	11,596	55,591	51,354	39,759
2019	176,183	6,218	16,853	19%	32,293	153,112	141,444	109,150
	251,714	18,654	22,291	19%	44,281	210,769	194,706	150,425

Over the 3-year monitoring period the project area resulted in 233,060 tons t CO_{2e} reductions with a buffer pool contribution of 44,281 t CO_{2e} and a total estimated emission reduction of 150,425 t CO_{2e} after accounting for leakage (22,291 t CO_{2e}).

Optional Criterion: Climate Change Adaptation Benefits

3.1.9. Activities and/or processes implemented for Adaptation (GL1.3)

Carbon Tanzania, in partnership with The Nature Conservancy, conducted a detailed analysis of climate change scenarios and impacts within the northern Tanzania region as well as specifically to Makame WMA. This research allows us to predict a range of climatic change scenarios, helping us to inform communities and improve resilience, which in this context means adapting and reorganizing specific threats to pastoralist communities and ensuring these communities are better prepared for future climate change impacts. Increasing climate resilience involves improving governance, land and natural resource management, livelihoods practices and critically for the pastoralist Masai and wildlife, mobility across the landscape. In this context, mobility for both grazing and access to water for cattle and wildlife during the dry season. A community analysis of climate change impacts aims at increased awareness of district staff, village governments, community members and Non-Governmental Organization (NGO) staff - on projected climate change impacts in Northern Tanzania. This analysis identifies immediate threats and aims to identify and rank observed threats based on climate change information and therefore implement realistic adaptation strategies.

The results of these climate change models were presented to the communities at the community climate change workshop scheduled for September 2016 (see G1.8 in the Project Document). Combined with the identified threats by communities, the data is used to inform the Makame WMA resource Zone Management Plan. This plan is designed to provide for planned seasonal grazing in Makame WMA. Development of dams for water storage for both livestock and wildlife. In addition, protecting indigenous habitat and rangeland is recognised as a strategic objective in the National Climate Change Strategy⁶².

4. COMMUNITY

Net Positive Community Impacts

4.1.1. Community Impacts (CM2.1)

Impacts Table Based on Project Theory of Change/ Community Monitoring Plan

Community Group	ALL GROUPS
Impact	Increased transparency of community income and expenditure
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Improved confidence in leadership and the dissemination of community funds; empowerment of community members over community finances; increased efficiency in community development projects and improved service provision leading to improved quality of life and well-being, greater community cohesion, resilience and stability
Impact	Strengthened governance, resource management plan and land rights
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Overall better management of society and resource/land use leading to improved service provision; greater trust and confidence in the government; security in land rights; successful implementation of the land use plan leading to improved livelihoods
Impact	Increased resilience of the landscape/resource
Type of Benefit/Cost/Risk	Predicted, direct benefit
Change in Well-being	Enhanced security and resilience of livelihoods in the face of climate change
Impact	Improvements to community infrastructure including roads, water sources, education facilities and health care centres
Type of Benefit/Cost/Risk	Predicted, direct benefit
Change in Well-being	Increased ease of access to crucial services; decreased time spent fetching water or traveling to places; improved well-being; heightened level of education throughout the community
Impact	Increased awareness of conservation and the environment
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Better productivity and condition of the forest resource and ecosystem services it provides (medicinal plants, reduced dust levels, reduced erosion, prevention of siltation of water holes and dams, sustainability of resources creates security in livelihoods)
Impact	Development of tourism industry

Type of Benefit/Cost/Risk	Predicted, direct/indirect benefit
Change in Well-being	Increased employment/business opportunities; diversification of income sources; increased community resilience; source of revenue for community development enhancing well-being; improved provision of ecosystem services
Impact	Sustainability of natural resource
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Enhanced security of, and confidence in, the future of their society and livelihoods
Impact	Increased frequency of human-wildlife conflicts
Type of Benefit/Cost/Risk	Predicted, direct risk
Change in Well-being	Increased negative attitudes toward wildlife; increased insecurity of people in the landscape
Community Group	Women
Impact	Improvements to village water sources
Type of Benefit/Cost/Risk	Predicted, direct benefit
Change in Well-being	Availability of more time in the day when they are walking less distance to fetch water; less physical strain when they are carrying the water home themselves
Impact	Improved access to and quality of education services
Type of Benefit/Cost/Risk	Predicted, direct benefit
Change in Well-being	Receiving quality education can empower young women to have more choice about their future, rather than accepting their traditional role in society; increased opportunity to be employed, to continue studies at a higher level or to create their own business opportunities
Impact	Improved pasture for livestock
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Improved quality and quantity of produce from livestock; improved food security; more opportunities for income by selling milk or meat; greater potential to own more cows
Impact	Incorporation of women into leadership positions
Type of Benefit/Cost/Risk	Actual, direct/indirect benefit
Change in Well-being	Consideration of female views into decision making; empowerment of women and increased gender equality throughout the community
Community Group	Children / Youth

Impact	Improved access to and quality of education services
Type of Benefit/Cost/Risk	Predicted, direct benefit
Change in Well-being	Empowerment of children and youth to have more choice about their future, rather than accepting their traditional role in society; increased opportunities to be employed, to continue studies at a higher level or to create their own business opportunities
Impact	Improved pasture for livestock
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Improved quality and quantity of produce from livestock, ensuring greater food security; easier access to pasture and reduced tension/conflict when herding livestock
Community Group	Warriors (Young Men)
Impact	Improved pasture for livestock
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Improved quality and quantity of produce from livestock, ensuring greater food security and income for themselves and their families; easier access to pasture and reduced tension/conflict when herding livestock; greater potential to own more cows
Impact	Increased wildlife
Type of Benefit/Cost/Risk	Predicted, direct cost/risk
Change in Well-being	As it is the warriors' responsibility to defend against wildlife attacks, it is this sub-group that takes on the risk of facing potentially fatal interactions with wild animals; increased negative attitudes toward wildlife
Community Group	Male Elders
Impact	Improved pasture for livestock
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Improved quality and quantity of produce from livestock, ensuring greater food security and income for themselves and their families; easier access to pasture and reduced tension/conflict when herding livestock; greater potential to own more cows
Community Group	Pastoralists
Impact	Increased attacks on livestock from wildlife
Type of Benefit/Cost/Risk	Predicted, indirect cost/risk
Change in Well-being	Loss of livestock results in decreased produce and assets, costing the pastoralist financially; additional emotional costs as Masai can hold

	particular cows to be extremely important, treating them like pets who are part of the family; food insecurity; increased negative attitudes toward wildlife
Impact	Increased sustainability and resilience of pastoralism
Type of Benefit/Cost/Risk	Predicted, direct benefit
Change in Well-being	Increased security in livelihood; increased food security; improved well-being
Impact	Improved water quality for livestock
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Healthier livestock ensure enhanced psychological well-being; increased food security; increased security in livelihood
Impact	Improved pasture for livestock
Type of Benefit/Cost/Risk	Predicted, indirect benefit
Change in Well-being	Improved quality and quantity of produce from livestock, ensuring greater food security and income for themselves and their families; easier access to pasture and reduced tension/conflict when herding livestock; greater potential to own more cows
Community Group	Agriculturalists (Non-Masai)
Impact	Increased crop damage from wildlife
Type of Benefit/Cost/Risk	Predicted, indirect cost
Change in Well-being	Financial losses; food insecurity; decreased resilience; reduced confidence in livelihoods; increased negative attitudes toward wildlife
Impact	Reduced land availability for agriculture
Type of Benefit/Cost/Risk	Actual, indirect cost
Change in Well-being	Reduced possibility to expand agriculture

4.1.2. Negative Community Impact Mitigation (CM2.2)

Regarding the risk of increased damage to crops for the agriculturalists of Makame WMA, the project partners will collaborate with an experienced local NGO, Honeyguide. This organisation specialises in helping communities to deter wildlife from damaging crops, and from returning in the future, through chili fences and using spotlights, bullhorns, and roman candles. They are effectively teaching community members to conditioning elephants and other wildlife to stay out of their farmlands by creating negative associations. This effort complements a well-crafted resource management plan that deliberately endeavours to separate wildlife from agricultural areas. The plan requires farmlands to be located around human settlements, away from the regions where wildlife is known to frequent.

In terms of the reduced land availability for agriculture, the renewed resource management plan has specifically ensured that there is ample land available within the Human-Settlement/Agriculture Zone (Makazi) for agricultural expansion. The conservation of the project area will have no negative impact on agricultural expansion in the Makame WMA. The implementation of the RMP and setting aside of different land types aims to prevent any perceived land-use change, land grabbing, and land conflict that could arise during the course of the project. The RMP also ensures the protection of the HCV grazing land, which are crucial for the Masai pastoralist lifestyle as well as for wildlife populations.

These efforts are designed to be consistent with the precautionary principle, as they proactively aim to prevent negative impacts on the community that might occur as a result of the project.

4.1.3. Net Positive Community Well-Being (CM2.3, GL1.4)

The main goal of this project is to assist the community in the implementation of the resource management plan that they themselves developed, in order to formalise their traditional land management techniques. This, along with the use of the revenue generated from the climate benefits created through the project, has been designed to generate social and economic benefits for the whole community, including marginalised or vulnerable groups. Based on the costs and risks identified as opposed to the numerous benefits to all community groups outlined in the theory of change given the implementation of the project it is confidently anticipated that the project will provide net positive well-being impacts for all identified community groups.

Climate change creates a major threat and will add to the challenge of ensuring healthy socio-economic and ecological systems in the northern Tanzanian by threatening the landscape's ability to continue to provide integrated grazing lands for pastoralists and seasonal habitat for wildlife. Carbon Tanzania in partnership with The Nature Conservancy conducted a detailed analysis of climate change scenarios and impacts within the northern Tanzania region as well as specifically to Makame WMA. We helped to inform communities of the results, which in this context means adapting and ensuring these communities are better prepared for future climate change impacts. This analysis as well as a community led effort identified and ranked threats and identified adaptation strategies. The results of these works were presented to the communities and used to inform the renewed Makame WMA resource Zone Management Plan. This plan was designed to provide for planned seasonal grazing in Makame WMA and the potential development of dams for water storage for both livestock and wildlife. In addition, on a larger scale protecting indigenous habitat and rangeland is recognised as a strategic objective in the National Climate Change Strategy²⁴

Furthermore, the following specific elements of the project assist community adaptation to climate change impacts:

- Tourism: creates an income source that is not directly dependent on climate. If there is a year of particularly unusual weather cycles that seriously damage crops or wildlife, income may still be generated from tourism activities.
- Protection/conservation of natural resources: By protecting the forest this project is maintaining the health of the ecosystem which contributes to rangeland health, connectivity of landscape, ecosystem resilience and adaptive capacity. As this resource is fundamental to pastoralism, it is essential to maintain its health so that it may withstand the pressures of climate variability.
- Supporting traditional grazing practices & implementation of resource management plan: channel indigenous community land practices to achieve the above results (underpinned by good governance and secure land rights)

²⁴<http://tanzania.um.dk/en/~media/Tanzania/Documents/Environment/TANZANIA%20CLIMATE%20CHANGE%20STRATEGY/TANZANIA%20CLIMATE%20CHANGE%20STRATEGY.pdf>

4.1.4. Protection of High Conservation Values (CM2.4)

The main goal of this project is to assist the community in the implementation of the resource management plan which formalises their traditional land management techniques and customs. Therefore, the project has not and is unlikely in the future to have a negative impact on any of the project area's High Conservation Values. The project is designed to protect and conserve these areas from misuse, enhance community understanding of their value and to improve overall community well-being through the development and implementation of the RMP (see section Community Monitoring Plan 4.1.7 for results of monitoring).

Other Stakeholder Impacts

4.1.5. Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

The project has yet to have any negative impacts on other stakeholders, furthermore, is not anticipated that the project will have any future negative impacts on the well-being of the other stakeholders. The project was designed with input from all stakeholders including district government and aims to support the implementation of the resource management plan which also incorporated the needs of other stakeholders.

4.1.6. Net Impacts on Other Stakeholders (CM3.3)

As the project has positive impacts on other stakeholders including;

- increased capacity of local government in relation to conflict resolution, participatory forest and wildlife conservation, village land use planning, conservation agriculture and environmental education
- increased awareness on issues ranging from forest conservation, agriculture, land tenure and improving village governance as a result of awareness raising activities
- percentage revenue from carbon sales and an understanding of Payments for Environmental Services or specifically REDD projects

And as it is stated in 4.2.1 there are no perceived or actual negative impacts on other stakeholders the net impact on other stakeholders is positive.

Community Impact Monitoring

4.1.7. Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

Objective	Activities	Term	Indicator/ Output	Data Collection Method/Tool	Results
Increase community understanding of natural resource management and the project	Carbon Champions Program	2017-	# People reached # People tested for knowledge	Records of meetings/ interactions Testing results	507 People Reached 71 followed up and tested for knowledge 90% deemed "adequately" aware of the project
Increased education opportunities in the WMA	Increased education budget	2020-	Funds available for education	Financial details	N/A for this period

Improved management of WMA	Train WMA leaders in good governance	2016-	# trainings # people trained	Meeting records	82 trained (75 AA members and 7 board members)
	Train local government leaders in good governance	2016-	# trainings # people trained	Meeting records	Total trainees were 205 (125 village council members, 20 Traditional leaders, 25 Women rights and leadership forums members and 35 Village land tribunals).
	Implementation and awareness training for resource management plan and business plan	2018 2023 2028	Did training happen? # trained	Training records	266 (125 village council members 100 AA and board members 12 District Advisory board members 29 Community representatives who participated at the district)
	Increased budget for management activities	2020-	Funds available for management	Financial details	N/A for this period
Creation/Renewal of management frameworks	Creation/Renewal of WMA resource management plan	2017 2022 2027	Existence of WMA resource management plan	WMA resource management plan	Plan created and approved.
	Creation/Renewal of WMA business plan	2018 2023 2028	Existence of WMA business plan	WMA business plan	WMA business plan created and document available
Increased/ Maintained natural resource management infrastructure	Addition of solar electricity, radio communications and internet access to WMA infrastructure	2018	Implemented or not	Proof of implementation	Implemented fully, photo evidence
Increased control of resources	Allocate and maintain community grazing area (*HCV*)	2017 2022 2027	Resource management plan	Resource management plan	Plan created and approved.
	Non-timber (including carbon, water)rights (*HCV*)	2017 2022 2027	Resource management plan	Resource management plan	Plan created and approved.
Improved community livelihoods	Employment of village game scouts	2018-	# people registered as village game scouts # people employed as village game scouts	Registry/payment sheets	28 registered game scouts 27 game scouts employed

	Increased village budgets for development	2020-	Funds available for villages	Financial details	N/A for this period
Formal women's empowerment	Formation of regularly meeting women's forums in WMA member villages	2017-	# of forums # of forum members	Meeting records	1 forum per village for 5 total forums Each village forum has 24 members for 120 members overall
Female representation in WMA leadership	Women in leadership positions in WMA	2017-	# of women in leadership positions	WMA leadership records	15 of the 50 leaders of the WMA are women
Formal relations structure	Appeals and complaints committee	2017	# of appeals and complaints logged	Appeals and complaints log	No Appeals or Complaints Logged Appeals and complaints log available
Informal relations structure	Bi-annual feedback meetings with WMA	2018	# of meetings held # of attendees	Meeting Records	Meeting Agenda and Attendance Sheets available

4.1.8. Monitoring Plan Dissemination (CM4.3)

Carbon Tanzania has shared the full translated community monitoring plan with the communities through the WMA. These documents are available on the internet for the communities, other stakeholders, and all those concerned, the WMA office will have hard copy and has internet access as well. Carbon Tanzania also prepares project report that are based on compiled data and are available to the communities. In addition, Carbon Tanzania holds bi-annual meetings to share project information and data with community members. These meeting minutes are then available to the community with originals kept at the WMA office and copies available upon request from Carbon Tanzania.

Optional Criterion: Exceptional Community Benefits

The project is predominantly implemented by the Authorised Association of the Makame WMA (with assistance from Carbon Tanzania and project partners). The communities have ownership and management rights of the project area, which are being reinforced through the project, primarily through the resource management plan which was renewed during this period. Their activities (through the implementation of the resource management plan) will generate the CCB benefits. Additionally, according to the Human Development Index²⁵, the project is occurring in a low human development country. During this verification period the project achieved exceptional community benefits in the long term and short term, creating positive net impacts on the community and specifically women. Likewise, the project benefit sharing mechanism remains intact and functioning. Many of the specific quantified benefits can be found in the results column of the

²⁵ UNDP. (2016). Human Development Report 2016: Human Development for Everyone. Retrieved from: <http://report.hdr.undp.org/>

Community Monitoring Plan Table 4.1.7. More detail on community benefits is provided in the following sections 4.1.9.-4.1.13

4.1.9. Short-term and Long-term Community Benefits (GL2.2)

The project theory of change available as annex 1 explains the projects path to generating short-term and long-term net positive well-being benefits for smallholders/community members and includes the activities the project will undertake and the associated expected outputs, outcomes and impacts, both human and natural resource related. The Community Monitoring plan is directly related to the project theory of change, and through community monitoring, the project validates the assumptions of the theory of change and adjusts when necessary.

During this verification period the project has hit all its desired targets as shown in section 4.1.7 Community Impact Monitoring. In this period short term benefits to community members included; increased understanding of natural resource management, improved management capacity by the WMA and local leaders through training, approval of the RMP, solar electricity and radio facilities added to WMA office, gaining of rights of non-timber forest products, employment of VGS and continued functioning of the Women's Forums.

Long term benefits generated during this period include that increased community understanding of natural resource management couples with improved governance at the local and WMA level improve the sustainability of the natural resource base which the community depends on in the long term. Likewise, the approval of the RMP has granted the community with rights to the crucial grazing area as well as non-timber products. Furthermore, women's leadership at the WMA level serves as a long-term example to women in the community of the ability to achieve leadership status in the WMA and the project. Lastly, project activities undertaken during this period set the stage for future carbon revenue, which will increase the availability of development and education funds in the long term.

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

Community Group	Non-cattle owning Masai (people living in poverty)
Net positive impacts	This group as socio-economically vulnerable often depend directly on forest products like honey and wild medicine to support them since they are without cattle, the normal currency in Masai society. Rights ensures this period through the approved RMP to the forest products and the continued health of the forest are a crucial benefit to these people. The group has benefited this period as the general community gained increased ability and understanding with regard to natural resource management. Non-cattle owning Masai depend directly on forest products and thus benefited directly as natural resource management understanding increased in the general community.
Benefit access	Non-cattle owning Masai may leave the village areas for long periods of time so benefits conferred by village development may not reach them, however when out of the village they are spending most of the time in the forest and often living off it, therefore the forest health and access benefits are available always. The approval of the RMP during this period guaranteed Non-cattle owning Masai members of the

	community access to forest products like honey and wild medicine that support them since they are without cattle.
Negative impacts	Non-cattle owning Masai have not seen any negative impacts from the project this period nor are they expected to in the future.

4.1.10. Net Impacts on Women (GL2.5)

In addition to the positive impacts derived by the whole community through the implementation of this project, there are several benefits focused on women. These include incorporating women into positions of leadership within appointed roles in the WMA leadership, hence creating opportunities to influence decision making. Furthermore, the implementation of women's forums serves to benefit women and advance their interests in the community. These forums are provided with technical training on land policy, law and administration. The forums mobilize women and the wider community to collectively address existing threats to their lands, demand accountable governance and participatory decision making by local elected leaders, and ensure all community members' views are considered in land management decisions. Forums also address gender inequality through women's economic empowerment. Forums are given both materials help and training in how to develop themselves economically. The additional impacts of the project on women, concurrent to those affecting the entire community, are outlined in section 4.1.1.

During this verification period women benefited from community wide project activities including the natural resource management education program, and the governance management trainings. The approval of the RMP during this period and all the benefits in confers were a direct benefit to the women in the community. Please see 4.1.7 for quantification of the results of community-based project activities during this period. During this period the desired objectives of formal women's empowerment and increased women's leadership were both monitored and considered adequate, specifically 120 women met in regular forums during this period, and 15 members of the WMA leadership were women, who were thus including in high level decision making. In this period there were no negative impacts on women associated with the project, therefore balanced with the multitude of benefits, the project had net positive impacts on women during this verification period.

4.1.11. Benefit Sharing Mechanisms (GL2.6)

The structure of a WMA is fundamentally set up to be fully participatory on every level and allow decision-making powers to ultimately be held by the community members. It a system designed to give equal voice and concern to all members of the community through a classic representative governing structure. More on the structure of governance in the WMA which ensures it as representative and held accountable by the community can be found in the Governance section. Makame WMA was set up as mechanism for the five member villages to gain rights over their natural resources and subsequently fairly and equitably share benefits from them. All financial benefits conferred from the project to the communities go directly to the WMA structure and thus we can be confident in the benefit sharing mechanism.

Per the WMA resource management plan, financial benefit sharing shall conform with laid down procedures from the Wildlife Division and Treasury for annual gross revenues as follows (WMA Regulation 2012):

- Capital Fund: Not less than 15% shall be capital, re-invested for WMA resource development.
- Trust Fund: Not less than 50% shall be directed to member village projects (to be split, 30% for community projects and 20% placed on fixed deposit to earn interest as a buffer for contingency, emergency, etc.).

- Operations Fund: Not less than 25% shall be used to strengthen the AA (i.e. operations, Secretariat support, MWMA meetings, training, etc.).

Carbon Tanzania has full confidence in the WMA benefit sharing structure and AA, and all benefits are conveyed through the WMA official bank accounts they operate. WMA finances are posted and available to the community for accountability. Carbon Tanzania at its bi-annual meetings does a financial disclosure of project activities for transparency. The WMA also employs a full time and qualified accountant to oversee financial activities. Carbon Tanzania monitors WMA benefit sharing through financial statements to ensure the mechanism is working and make recommendations and changes if anything is found to be inadequate.

During this monitoring period the detailed financial benefit sharing mechanism remained in place and functioning, however, was not used in practice as the project is still pre-revenue from the sales of emission reductions. This structure will be followed once the project is providing direct finance to the community and WMA. However, many of the benefits detailed in 4.1.7 were shared amongst the community. Primarily through the approval of the RMP, which guarantees all community members access to the grazing areas and non-timber forests products which are vital to their livelihoods. Furthermore, natural resource management education through the carbon champions program was available to all the community, at a grassroots level, and door to door. Women specific outputs including empowerment and leadership training ensured that women were also included in the project and its benefits. During this verification period no issues were flagged about benefit-sharing, either by the communities, the WMA, or partner organizations.

4.1.12. Governance and Implementation Structures (GL2.8)

The project is primarily governed and implemented by the Makame Wildlife Management Area administration in participation with Carbon Tanzania, that is overseeing the project design and assisting with its implementation. The governance of the WMA is distributed between the Village Council and the Authorised Association (AA), in collaboration with the District Government. It is these authorities that enforce the renewed WMA resource management plan which forms the foundation of the project, through which the enactment of traditional land management creates much of the CCB benefits. The responsibilities of these authorities and the regulations of the WMA can be found in the WMA Regulations 2012.

Per the WMA Regulations 2012, an AA is “a community-based organisation, whose primary objective is to conserve wildlife resources for the benefit of local community members ordinarily residing in that particular area”. In Makame it is a collection of representatives elected from all the involved villages, who make the decisions for the WMA and this project, on behalf of the greater community. It is their responsibility to prepare the resource management plan. It is composed of the Board and Executive Committee, both of which are elected and are required to contain approximately 30% women. These are supported by the Village Game Scouts, a Revenue Committee and a Security Committee, as well as additional representatives from each member village, to complete the AA. The AA works in conjunction with the Village Councillors, who are elected within each village. The Village Game Scouts are appointed to protect the natural resources within the WMA and help to enforce the resource management plan. They work closely with the Officer for Community and Patrolling. Within the villages there are also Women’s Forums. These contain 24 members each, elected from each of the sub-villages, that receive trainings regarding rights and leadership from UCRT, including on how to themselves rise to positions of leadership and how to demand and support better governance from existing leadership. Village governance is composed of the elected Chairman, the Village Executive Officer, Village Secretary and the Village Council; who undertake the requests of the entire Village Assembly (everyone above 18 years).

The District Government is responsible to support the WMA by establishing a District Natural Resources Advisory Body. This Body is comprised of the following members:

- District Commissioner
- District Executive Director
- District Legal Officer
- District Land Officer
- District Forestry Officer
- District Bee-Keeping Officer
- District Community Development Officer
- Three representatives of the AA

In addition, project governance and implementation are supported by UCRT and Carbon Tanzania. This support is aimed at improving governance structures within the WMA enabled through capacity building and training provision. Training topics include good governance, book-keeping, financial management, conflict resolution, and current government laws and policies. These organisations have experience working with a collection of specialised organisations, predominantly local NGOs, involved in the greater project area.

It is inherent in the functioning of a WMA that smallholders and community members are involved in decision making processes through their elected representatives. The concept of democracy is well understood throughout Tanzania and carefully applied in the implementation of this project by the project developers, Carbon Tanzania and UCRT.

4.1.13. Smallholders/Community Members Capacity Development (GL2.9)

Community member capacity development has already been undertaken in the project. The AA and the village leadership groups led the development of the Conservation Action Plan, conducted in August 2016. The village leadership groups have been involved in learning sessions with the project developer as well as with development partners in the landscape (The Nature Conservancy, Ujamaa Community Resource Team). Educational sessions in Maa and Kiswahili have been conducted by a skilled educator to explain all aspects of REDD developments to leaders, administrators and youth in the participating villages. These efforts have then been assessed to ensure knowledge and capacity was gained. Village Game Scouts have been trained in basic patrol protocols and monitoring for the project activities and have participated in the Carbon Baseline activity and wildlife counts. VGS have also been equipped with modern technology and a fully equipped based station. The Carbon Champions program has created 10 well informed and educated youth who have been provided employment opportunities to spread information and understanding of the project at all levels into the farthest reaches of the community. A financial training session has improved the capacity of the leadership to interact with the developer (and other future private interests) on financial matters and produced a financial guidelines document. From Carbon Tanzania's perspective these trainings have already led to a measured increase in the WMA's and AA's efficiency when interacting with the project developer. Throughout the project's lifespan one of Carbon Tanzania's focuses with our partners is developing and increasing the capacity of community members and of the WMA as an entity.

5. BIODIVERSITY

Net Positive Biodiversity Impacts

5.1.1. Biodiversity Changes (B2.1)

Table. Net positive biodiversity impacts on the 6 target threatened species present within the project area. This data was established through annual ground transects, camera trapping exercise giving an indication of relative abundance (calculated as the mean number of independent photographic 'events' per trap day x 100) and occupancy²⁶ (where relevant). Occupancy was further modelled using spoor counts in April 2019.

Species information	
<i>Biodiversity element</i>	Giraffe
<i>Estimated change</i>	Population increases
<i>Justification for change</i>	1. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 2. Prevention of meat poaching due to increased activity of the village game scouts within Makame WMA 3. Camera trapping exercise within the project area reported a relative abundance index of 218ind within the project area and an occupancy of 0.821.²⁷ 4. Annual transects recorded Giraffe in all years 2016 – 2019
<i>Biodiversity element</i>	African Elephant
<i>Estimated change</i>	Population remains stable or increases
<i>Justification for change</i>	1. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 2. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 3. Camera trapping exercise within the project area reported a relative abundance index of 233ind within the project area and an occupancy of 0.404. 4. Annual transects recorded elephant spoor in all years 2016-2019

²⁶ Data were divided into five 10-day time intervals, with each interval treated as a replication. If a species was recorded at a camera trap during a specific time interval it was marked as '1', if it was not recorded it was marked as '0'. All occupancy modelling was conducted in PRESENCE 12.10

²⁷ An Assessment of Mammal Diversity and Abundance in Makame Wildlife Management Area (WMA) by Camera Trap Survey April 2018 Charles Foley¹, Mustafa Hassanali¹, Paul Baran¹, Lara Foley¹, Alex Lobora², and Sarah Durant³ ¹ Wildlife Conservation Society, Tanzania Program ² Tanzania Wildlife Research Institute (TAWIRI) ³ Zoological Society of London

	5. Occupancy modelling showed significantly higher Elephant numbers inside compared to outside the project area (Occupancy: n=0.773)
<i>Biodiversity element</i>	African Wild Dog
<i>Estimated change</i>	Population remains stable or increases
<i>Justification for change</i>	1. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 2. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 3. Camera trapping exercise within the project area reported a relative abundance index of 100ind within the project area and an occupancy of 0.015. 4. Occupancy modelling indicates a population of 2 ind. Per 100km square.
<i>Biodiversity element</i>	Beisa Oryx
<i>Estimated change</i>	Population remains stable or increases
<i>Justification for change</i>	1. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 2. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 3. Camera trapping exercise within the project area reported a relative abundance index of 217 ind. within the project area and an occupancy of 0.275. 4. Annual transects recorded Oryx in all years 2016-2019.
<i>Biodiversity element</i>	African Lion
<i>Estimated change</i>	Stable population
<i>Justification for change</i>	1. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 2. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 3. Camera trapping exercise within the project area reported a relative abundance index of ~100ind within the project area. 4. Occupancy modelling showed density of 3.83 per 100km².
<i>Biodiversity element</i>	African Leopard
<i>Estimated change</i>	Stable population
<i>Justification for change</i>	1. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 2. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 3. Camera trapping exercise within the project area reported a relative abundance index of 208ind within the project area and an occupancy of 0.203. 4. Occupancy modelling showed density of 4.87 per 100km²

5.1.2. Mitigation Actions (B2.3)

The main threats to megafauna in this landscape stem from habitat fragmentation and loss of landscape connectivity, addressing these threats forms the fundamental design of this project. By successfully implementing the resource management plan, Makame WMA has enhanced habitat for resident and migratory megafauna. The design of this project and the wildlife laws of Tanzania has enabled the Authorised Association of Makame WMA to take the necessary actions, where needed, to maintain the protection of biodiversity within the project area. The WMA, its development and implementation under the wildlife act and land act of Tanzania ensure it is a community owned and participatory process that includes all community stakeholders ensuring representative decision making. The governance, management and implementation of the WMA is supported by Carbon Tanzania, District Government and other stakeholders as described in the contract between Carbon Tanzania and Makame WMA. Based on project design, implementation and structure of the WMA, the precautionary principle in environmental science²⁸ follows: to take preventive action in the face of uncertainty; shifting the burden of proof to the proponents of an activity; exploring a wide range of alternatives to possibly harmful actions; and increasing public participation in decision making.

5.1.3. Net Positive Biodiversity Impacts (B2.2, GL1.4)

The degradation of habitat that existed prior to project initiation in 2016 includes those conditions describe in section 2.1.5. of the Project Description (PD) and further the conditions are the same as the baseline scenario as described in section 3.1.4. of the PD. This REDD project was designed to implement the Makame WMA Resource Management Plan (RMP) which focuses on the protection and conservation of natural resources. The species outlined in section 5.2.1 of the PD all require large tracts of intact habitat and both resident and migratory populations exist in the project area, and adjacent habitats. In the case of resident predators (all of which are endangered) such as Leopard, Cheetah and Lion, the presence of prey species in sufficient densities is also essential for breeding success. The camera trapping exercise conducted in September to December 2017 as part of the biodiversity monitoring plan confirmed the presence of our targeted endangered species (section 1.1.1.) and further to that, occupancy modelling conducted in April 2019 confirmed the presence of Lion, Leopard, Cheetah and Wild Dog populations that are almost certainly ranging between Makame WMA and Tarangire National Park, along with megafauna such as elephant, oryx and giraffe, landscape connectivity is therefore critical for these herbivores.

As stated in the PD, the Tarangire–Manyara Ecosystem in northern Tanzania forms a patchwork of protected and unprotected areas and experience substantial human population growth²⁹. In the Tarangire – Manyara Ecosystem, pastoral Maasai areas such as areas around Makame WMA are gradually shifting away from exclusive pastoralism towards both subsistence and commercial agriculture and illegal hunting is rampant, particularly outside fully protected areas.³⁰ This

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²⁸ D Kriebel, J Tickner, P Epstein, J Lemons, R Levins, E L Loechler, M Quinn, R Rudel, T Schettler, M Stoto
Precautionary Principal in Environmental Science. Environ Health Perspect. 2001 Sep; 109(9): 871–876.

²⁹ Msoffe, F.U., Said, M.Y., Ogutu, J.O., Kifugo, S.C., de Leeuw, J., van Gardingen, P. & Reid, R.S. (2011) Spatial correlates of land-use changes in the Maasai-Steppe of Tanzania: implications for conservation and environmental planning. *Int. J. Biodivers. Conserv.* 3, 280–290.

³⁰ Kiffner et al. (2014) From savannah to farmland: effects of land-use on mammal communities in the Tarangire-Manyara ecosystem, Tanzania. *African Journal of Ecology*. Vol 53, issue 2.

development may directly and indirectly reduce wildlife species richness³¹ whilst reduced species richness often leads to a loss of functional species groups which in turn can lead to trophic cascades and may affect ecosystem services.³² Beyond such ecological consequences, a loss of species richness may directly compromise tourism, an important source for Makame WMA as well other areas within the Tarangire-Manyara ecosystem.³³

As part of this REDD projects, climate change and variability analysis using Climate Wizard³⁴ has been conducted to forecast future climate change scenarios in five community wildlife management areas in the northern Tanzania rangelands (Burunge, Enduimet, Lake Natron Basin, **Makame**, and Randilen) and four districts (Kiteto, Monduli / Longido, and Simanjiro) in Northern Tanzania. The analysis has projected climate scenario over the next 50 and 100 years. This analysis was produced using a set of 9 General Circulation Model (GCM) projections from the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project phase 3 (CMIP3). The Climate Wizard was developed to calculate 22 "derivative climate metrics" that are calculated from projections of both temperature and rainfall.³⁵ These climate change scenarios have clarified the impacts on availability of grazing for both pastoralist Masai and wildlife. This regional assessment is further supported by multiple national studies referenced in a synopsis by USAID³⁶ and articulated in the Tanzanian National Climate Change Strategy³⁷. In all cases there is recognition of supporting the planning and protection of indigenous habitat for livestock and wildlife.

5.1.4. High Conservation Values Protected (B2.4)

There is no cases, documented or recorded where increased protection and implementation of the Makame RMP through this REDD project have created any negative impacts to biodiversity, grazing or water resources either within Makame WMA or in adjacent areas.

5.1.5. Invasive Species (B2.5)

No Invasive species currently present a threat in this landscape

5.1.6. Impacts of Non-native Species (B2.6)

This project is based on the WMA resource plan and will not use any non-native species

³¹ Ogutu, J.O., Bhola, N. & Reid, R. (2005) The effect of pastoralism and protection on the density and distribution of carnivores and their prey in the Mara ecosystem of Kenya. *J. Zool.* **265**, 281–293.

³² Flynn, D.F.B., Gogol-Prokurat, M., Nogeire, T., Molinari, N., Richers, B., Lin, B.B., Simpson, N., Mayfield, M.M. & Declerck, F. (2009) Loss of functional diversity under land-use intensification across multiple taxa. *Ecol. Lett.* **12**, 22–33.

³³ Nelson, F., Nshala, R. & Rodgers, W.A. (2010) The evolution and reform of Tanzanian wildlife management. *Conserv. Soc.* **5**, 232–261.

³⁴ Girvetz, E. H., Zganjar, C., Raber, G. T., Maurer, E. P., Kareiva, P., & Lawler, J. J. (2009). Applied climate change analysis: The climate Wizard tool. *PLoS ONE*, **4**(12)

³⁵ NTRI EENT Climate Change Report Final.

³⁶ www.climatelinks.org/sites/default/files/asset/document/tanzania_adaptation_fact_sheet_jan2012.pdf

³⁷ <http://tanzania.um.dk/en/~media/Tanzania/Documents/Environment/TANZANIA%20CLIMATE%20CHANGE%20STRATEGY/TANZANIA%20CLIMATE%20CHANGE%20STRATEGY.pdf>

5.1.7. GMO Exclusion (B2.7)

No genetically modified organisms currently occur or are planned to occur within the project area. GMO are currently illegal in Tanzania for non-academic uses.

5.1.8. Inputs Justification (B2.8)

No agricultural inputs are currently used.
Offsite Biodiversity Impacts

5.1.9. Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Actions (B3.2)

No negative offsite biodiversity impacts.

5.1.10. Net Offsite Biodiversity Benefits (B3.3)

This project provides considerable offsite biodiversity benefits as the project area in Makame WMA represents the southern limit of the Tarangire-Manyara ecosystem (see PD section 5.1.1.), an area of 35,000,000 Ha supporting the second largest mammal concentration within Tanzania. The ecosystem contains two national parks, Manyara and Tarangire that protect the core refuge for large mammals during the dry season (July – November). Once the rains begin in December, many of the large mammals disperse, migrating out of the national parks where they are protected, into a variety of areas where they have either no formal protection or into areas like Makame WMA where the communities have the rights to protect the wildlife. The Tarangire-Manyara ecosystem has a rich diversity of wildlife, with over 500 species of birds and over 100 species of mammals and thus Makame, which forms a large part of that represents a critical habitat for enigmatic megafauna and endemics species of birds.

Biodiversity Impact Monitoring

5.1.11. Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

Table 1.3.1. Outline of biodiversity monitoring plan, for more detail see PD section 5.4. and the Biodiversity Monitoring Plan for Makame Savannah REDD project

Objective	Activity	Anticipated impact	Indicator	Area monitored	Sampling method	Frequency of monitoring	Responsible to monitor
Protection of Acacia-commiphora woodland	Implementation of the Makame RMP	Maintenance of ecosystem diversity, habitat connectivity	Reduction of deforestation within the project area, see Section 2.1.	Carbon project area, 104,065 ha	Assessment of forest cover change via time series of classified satellite imagery	Every verification period	Carbon Tanzania
Annual monitoring of mammal populations in project area	Ground count surveys	Index of abundance for all mammal species	Species presence and absence	S14: 33.3KM S15: 24.2km S17:8.1km S18:24.2km Total 91.7km	Ground count survey methodology	Annual count first 2016, 2017, 2018	Carbon Tanzania
Monitoring of total mammal species in project area	Camera trapping	Presence and relative abundance of mammal species	Relative abundance index (RAI) of indicator species	Selected site within project area	Camera trap survey	September - December 2017	Wildlife Conservation Society
Monitoring of total mammal species in project area	Wet season occupancy survey	Presence and occupancy of HCV mammal species	Dung for Elephant and spoor for large carnivores and sightings for all mammal species	S14: 33.3KM S18:24.2km Total 57.5km	Occupancy modelling	April 2019 - 2046	Carbon Tanzania & School for field studies – centre for wildlife management studies. ³⁸

Ground survey methodology

Carbon Tanzania conducted annual ground counts over the five transect areas from 2016-2019. The methodology is outlined in the PD and Biodiversity Monitoring Plan. The results of the ground survey methodology so presence in all years of all target (trigger) species.

<i>Total records of target species from all transects</i>				
	2016	2017	2018	2019
<i>Giraffe</i>	1	2	1	3
<i>Elephant</i>	1	1	1	1
<i>Oryx</i>	1	1	1	1

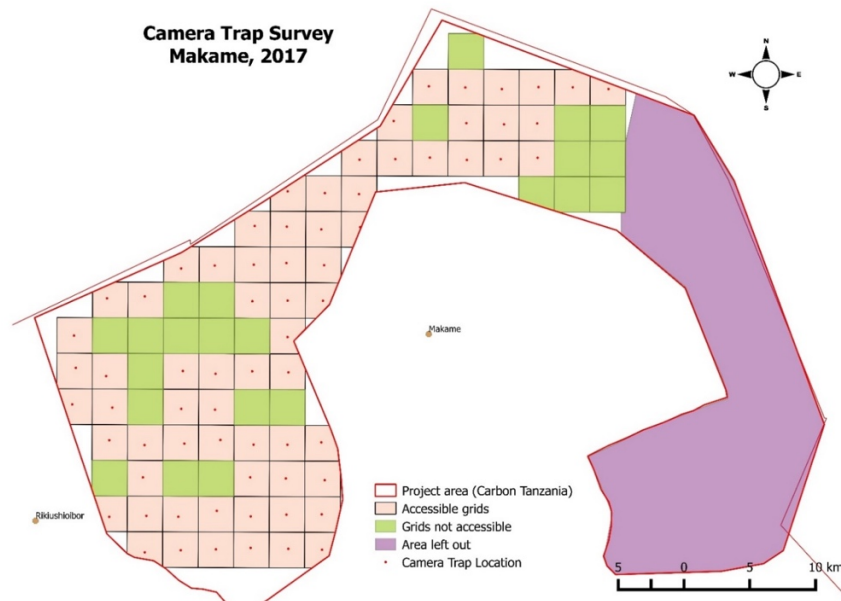
Camera trapping

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Camera trap analysis was conducted in the project area from September to December 2017 in partnership with the Wildlife Conservation Society (WCS) (see map below). The methodology is detailed in the PD and BMP. The results of this survey demonstrate the exceptional biodiversity within the project area, both in terms of the species presence and the relative abundance of these species. The results of this survey are included in section 4.1 of this report for trigger species. Further details of this study can be found in a report

³⁸ fieldstudies.org

on the exercise accessed online³⁹. A summary of this report including results are in the addition information section of this monitoring report.



Occupancy modelling

Occupancy modelling focused on assessing the presence and occupancy of the 6 target mammal species inside and outside the project area. Because accessibility of the project area in Makame WMA is very limited due to impenetrable vegetation cover in many parts of the project area (particularly during the wet season when many wildlife species move from adjacent Tarangire National Park to Makame WMA), we conducted road transects and analyze the data within an occupancy modelling framework.⁴⁰

The results can be accessed in detail and are summarised in the additional information part of this report. The table below outlines the results for the carnivore target species giving a estimate of density of individuals every 100km². This can be used year on year to consider not just presence but net positive impacts on these threatened species.

³⁹ An Assessment of Mammal Diversity and Abundance in Makame Wildlife Management Area (WMA) by Camera Trap Survey April 2018 Charles Foley¹, Mustafa Hassanali¹, Paul Baran¹, Lara Foley¹, Alex Lobora², and Sarah Durant³ ¹ Wildlife Conservation Society, Tanzania Program ² Tanzania Wildlife Research Institute (TAWIRI) ³ Zoological Society of London

Mackenzie DI, Royle JA. Designing occupancy studies: General advice and allocating survey effort. J Appl Ecol. 2005;42(6):1105–14.

MacKenzie DI, Nichols JD, Royle JA, Pollock KH, Bailey LL, Hines JE. Occupancy estimation and modelling - Inferring patterns and dynamics of species occurrence. Burlington: Academic Press; 2006. 324 p.

<i>Carnivores</i>	Density (ind/100 km ²)	lower CI	upper CI
<i>Lion</i>	3.83	3.26	4.41
<i>Leopard</i>	4.87	1.62	8.12
<i>African wild dog</i>	2.06	0.00	4.67

5.1.12. Biodiversity Monitoring Plan Dissemination (B4.3)

The biodiversity monitoring plan (BMP) has been translated and disseminated to the WMA, the same is the case for any results of monitoring undertaken in accordance with the monitoring plan. Data from biodiversity monitoring is also sent to the relevant authorities (TAWIRI)⁴¹ and added to databases for birds and mammals in the country, including the Tanzania Bird Atlas⁴². The camera trap report can be accessed online⁴³. Copies of all reports have been provided to the WMA. Optional Criterion: Exceptional Biodiversity Benefits

This project provides exceptional biodiversity benefits as the project area in Makame WMA represents the southern limit of the Tarangire-Manyara ecosystem (see PD map section 5.1.1.), an area of 35,000,000 Ha supporting the second largest mammal concentration within Tanzania. The ecosystem contains two national parks, Manyara and Tarangire that protect the core refuge for large mammals during the dry season (July – November). Once the rains begin in December, many of the large mammals disperse, migrating out of the national parks where they are protected, into a variety of areas where they have either no formal protection or into areas like Makame WMA where the communities have the rights to protect the wildlife.

The camera trapping exercise (see section 4.1) recorded all of the target species and their occupancy levels indicating not only a biological diverse environment but also that these species are in equivalent density as National Parks; 'This study has demonstrated that Makame WMA has a high diversity and density of large mammals, and should be considered a very important area for mammal conservation within the Tarangire ecosystem. When compared with the results of two other camera trap surveys, both in protected areas, that were carried out by TAWIRI staff using the same camera trap model and methodology, the figures for the Makame survey are surprisingly high. The camera trap rate (the total number of animals sighted / total trap nights) for Makame was 0.82 (2,500 sightings, 3,041 trap nights), with 42 species recorded. A study conducted in the dry season in Tarangire National Park in 2007 had a trap rate of 0.79 (2,965 sightings, 3,699 trap nights) and recorded 35 mammal species'. In addition to this the occupancy modelling finds the target carnivore species at high densities confirming the camera trap data.

⁴¹ Tanzania Wildlife Research Institute was included in Camera trapping exercise in partnership with WCS.

⁴² http://tanzaniabirdatlas.net/TBA_square_pdf/3604D_Makame_fn.pdf

⁴³ <https://www.facebook.com/wcstanzania/posts/surveying-mammals-in-makame-wmawcss-tarangire-elephant-project-in-collaboration-/1104258096403418/>

5.1.13. Trigger Species Population Trends (GL3.3)

Trigger species population trends and justification. All six are threatened species present within the project area. This data was established through annual ground transects, camera trapping exercise giving an indication of relative abundance (calculated as the mean number of independent photographic 'events' per trap day x 100) and occupancy⁴⁴ (where relevant). Occupancy was further modelled using spoor counts in April 2019.

Species information	
<i>Biodiversity element</i>	Giraffe
<i>Estimated change</i>	Population increases
<i>Justification for change</i>	5. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 6. Prevention of meat poaching due to increased activity of the village game scouts within Makame WMA 7. Camera trapping exercise within the project area reported a relative abundance index of 218ind within the project area and an occupancy of 0.821.⁴⁵ 8. Annual transects recorded Giraffe in all years 2016 – 2019
<i>Biodiversity element</i>	African Elephant
<i>Estimated change</i>	Population remains stable or increases
<i>Justification for change</i>	6. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 7. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 8. Camera trapping exercise within the project area reported a relative abundance index of 233ind within the project area and an occupancy of 0.404. 9. Annual transects recorded elephant spoor in all years 2016-2019 10. Occupancy modelling showed significantly higher Elephant numbers inside compared to outside the project area (Occupancy: n=0.773)
<i>Biodiversity element</i>	African Wild Dog

⁴⁴ Data were divided into five 10-day time intervals, with each interval treated as a replication. If a species was recorded at a camera trap during a specific time interval it was marked as '1', if it was not recorded it was marked as '0'. All occupancy modelling was conducted in PRESENCE 12.10

⁴⁵ An Assessment of Mammal Diversity and Abundance in Makame Wildlife Management Area (WMA) by Camera Trap Survey April 2018 Charles Foley¹, Mustafa Hassanali¹, Paul Baran¹, Lara Foley¹, Alex Lobora², and Sarah Durant³ ¹ Wildlife Conservation Society, Tanzania Program ² Tanzania Wildlife Research Institute (TAWIRI) ³ Zoological Society of London

<i>Estimated change</i>	Population remains stable or increases
<i>Justification for change</i>	5. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 6. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 7. Camera trapping exercise within the project area reported a relative abundance index of 100ind within the project area and an occupancy of 0.015. 8. Occupancy modelling indicates a population of 2 ind. Per 100km square.
<i>Biodiversity element</i>	Beisa Oryx
<i>Estimated change</i>	Population remains stable or increases
<i>Justification for change</i>	5. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 6. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 7. Camera trapping exercise within the project area reported a relative abundance index of 217 ind. within the project area and an occupancy of 0.275. 8. Annual transects recorded Oryx in all years 2016-2019.
<i>Biodiversity element</i>	African Lion
<i>Estimated change</i>	Stable population
<i>Justification for change</i>	5. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 6. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 7. Camera trapping exercise within the project area reported a relative abundance index of ~100ind within the project area. 8. Occupancy modelling showed density of 3.83 per 100km2.
<i>Biodiversity element</i>	African Leopard
<i>Estimated change</i>	Stable population
<i>Justification for change</i>	5. Habitat protection through the updating and implementation of the WMA resource management plan protects habitat. 6. Prevention of poaching due to increased activity of the village game scouts within Makame WMA 7. Camera trapping exercise within the project area reported a relative abundance index of 208ind within the project area and an occupancy of 0.203. 8. Occupancy modelling showed density of 4.87 per 100km2

6. ADDITIONAL PROJECT IMPACT INFORMATION

Birds within Makame WMA

Until recently virtually nothing was known about the avifauna of this vast area, but work by the Tanzania Bird Atlas⁴⁶ over the last 15 years and further supported by data gathered by this project, has enabled us to develop a species list of Makame WMA and the surrounding area. Makame WMA falls within 5 quarter degree bird atlas squares and a total species list of 500 species of birds of which two are endemic to Tanzania, Ashy Starling and Yellow-collared Lovebird and 6 are listed by IUCN as threatened species. The project area is situated in the northern of these quarter degree squares (Square number 3604D). All data including maps and species lists are available online.

Makame WMA represents the southern-most limit for several species restricted to the Somali-Masai biome such as Vulturine Guinea-fowl, Hunter's Sunbird and Pringles Puffback. Makame WMA is thought to be an important area for Palearctic migrants wintering in east Africa⁴⁷ and its ephemeral wetlands are important breeding areas for many species of waterfowl that migrate into the area during the onset of the rains in December-January. The Makame landscape is also critical for wide-ranging threatened species such as White-backed and White-headed Vultures (see PD map 5.5.1.d/e), these species are now critically endangered and declines can be related to habitat fragmentation and loss of large herbivore-predator interactions that provide the carrion for these species.

Species of birds recorded by this project in Makame WMA between 2017-2018

Genus	Species	Common names (Eng)	Red List status (IUCN)	Population trend (IUCN)
<i>Bucorvus</i>	<i>leadbeateri</i>	Southern Ground-hornbill	VU	decreasing
<i>Gyps</i>	<i>africanus</i>	White-backed Vulture	CR	decreasing
<i>Gyps</i>	<i>rueppelli</i>	Rüppell's Vulture	CR	decreasing
<i>Trigonoceps</i>	<i>occipitalis</i>	White-headed Vulture	CR	decreasing
<i>Polemaetus</i>	<i>bellicosus</i>	Martial Eagle	VU	decreasing
<i>Sagittarius</i>	<i>serpentarius</i>	Secretarybird	VU	decreasing
<i>Lamprolornis</i>	<i>unicolor</i>	Ashy Starling	LC	Stable
<i>Agapornis</i>	<i>personatus</i>	Yellow-collared Lovebird	LC	Stable

Camera trapping exercise.

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Total species recorded during the camera trapping exercise September-December 2017.

Mammal species recorded in Makame WMA. Included for each species are (a) the number of camera trap events, (b) relative abundance index (RAI) with standard error, (c) the total number of animals recorded, (d) the modelled occupancy estimates, with 95% confidence interval range, and (f)

⁴⁶ www.tanzaniabirdatlas.net

⁴⁷ Baker N.E. and Baker E.M. (2002) Important Bird Areas in Tanzania: A first Inventory. Wildlife Conservation Society of Tanzania. Dar-es-Salaam, Tanzania.

naïve occupancy. Modelled occupancy was only undertaken for those species with captured at a minimum of six camera trap sites.

Species	Number camera trap events	Relative Abundance Index (RAI)	RAI Standard error	Total number animals recorded	Modelled occupancy	Modelled occupancy 95% CI range	Naïve occupancy
Kirk's Dikdik	674	1087	15.04	727	0.955	0.8639 - 0.9859	0.954
Lesser Kudu	305	565	9.84	335	0.858	0.7413 - 0.9277	0.831
Bush Duiker	264	539	8.85	266	0.745	0.5544 - 0.8722	0.754
Aardwolf	116	414	8.18	116	0.459	0.3358 - 0.5883	0.431
Bushpig	100	250	3.46	122	0.745	0.5544 - 0.8722	0.615
Giraffe	96	218	3.18	108	0.821	0.5915 - 0.9351	0.677
Impala	72	343	7.58	118	0.365	0.2449 - 0.5043	0.323
Spotted Hyaena	69	300	7.19	73	0.436	0.2895 - 0.5943	0.354
Common Warthog	68	213	3.71	74	0.694	0.4424 - 0.8658	0.492
Common Eland	64	256	2.62	68	0.479	0.3226 - 0.6390	0.385
White-tailed Mongoose	60	273	3.50	63	0.392	0.2639 - 0.5362	0.338
Aardvark	55	183	1.91	55	0.617	0.4121 - 0.7872	0.462
Crested Porcupine	46	209	2.37	48	0.397	0.2663 - 0.5447	0.338
African Elephant	28	233	3.12	38	0.245	0.056 - 0.404	0.185
Fringe-eared Oryx	26	217	4.08	29	0.275	0.1352 - 0.48	0.185

Species	Number camera trap events	Relative Abundance Index (RAI)	RAI Standard error	Total number animals recorded	Modelled occupancy	Modelled occupancy 95% CI range	Naïve occupancy
Leopard	25	208	2.25	26	0.231	0.1269 - 0.3827	0.185
Caracal	20	154	1.20	20	0.395	0.1494 - 0.7078	0.200
African Buffalo	17	170	1.92	28	0.162	0.0892 - 0.2773	0.154
Grant's Gazelle	16	533	8.18	32	NA	NA	0.046
Striped Hyaena	16	133	1.18	16	0.419	0.1255 - 0.7840	0.185
Common Genet	15	188	2.26	15	0.165	0.0753 - 0.3254	0.123
Honey Badger	15	125	0.82	16	0.567	0.0757 - 0.9544	0.185
Slender Mongoose	12	109	0.55	12	0.189	0.1058 - 0.3153	0.169
Scrub Hare	11	220	2.98	11	NA	NA	0.077
Bat-eared Fox	11	122	0.80	11	0.256	0.1324 - 0.4362	0.138
Greater Kudu	9	100	0.00	9	0.158	0.0820 - 0.2833	0.138
Vervet Monkey	8	200	1.48	9	NA	NA	0.062
Wild cat	8	133	1.48	8	0.173	0.0497 - 0.4560	0.092
Black-backed Jackal	6	100	0.00	7	0.106	0.0467 - 0.2211	0.092
Bushy-tailed Mongoose	5	250	1.28	5	NA	NA	0.031
Steenbok	5	125	0.91	5	NA	NA	0.062
Bushbuck	4	400	NA	4	NA	NA	0.015
Zorilla	4	133	1.05	4	NA	NA	0.046
Natal Red Duiker	3	300	NA	3	NA	NA	0.015
Large-spotted Genet	3	150	1.28	3	NA	NA	0.031
African Wild dog	3	100	0.00	7	NA	NA	0.046
African Civet	2	100	0.00	2	NA	NA	0.031
Lion	2	100	NA	2	NA	NA	0.031
Plains Zebra	2	100	NA	2	NA	NA	0.031
Banded Mongoose	1	100	NA	1	NA	NA	0.015
Coke's Hartebeest	1	100	NA	1	NA	NA	0.015
Dwarf Mongoose	1	100	NA	1	NA	NA	0.015
Cattle	118	562	13.72	565	NA	NA	0.323
Sheep and goats	2	200		20	NA	NA	0.015
Human	32	400	8.28	63	NA	NA	0.123

Occupancy modelling April 2019.

Herbivores

	Detection probability			Occupancy	
	Estimate	SE		Estimate	SE
Elephant dung	0.773	0.039		0.578	0.069
<i>Kirk's dik-dik</i>	0.102	0.066		0.660	0.395
<i>Lesser kudu</i>	0.010	0.009		0.988	0.626
<i>Zebra</i>	0.010	0.009		0.988	0.626
<i>Impala</i>	0.015	0.010		0.990	0.371
<i>Warthog</i>	0.010	0.009		0.988	0.626
<i>Sheep & goat</i>	0.297	0.111		0.178	0.073
<i>Donkey</i>	0.147	0.091		0.326	0.189
<i>Cattle</i>	0.288	0.066		0.518	0.112

Carnivores

	Density (ind/100 km ²)	lower CI	upper CI
Lion	3.83	3.26	4.41
Leopard	4.87	1.62	8.12
<i>Spotted hyena</i>	5.90	2.66	9.13
<i>Striped hyena</i>	0.44	0.15	0.73
<i>Cheetah</i>	0.59	0.00	1.26
African wild dog	2.06	0.00	4.67

Annex. Project theory of change.

ACTIVITIES	OUTPUTS	OUTCOMES	IMPACTS	HUMAN IMPACTS
TARGET 1				
Anti-poaching/illegal grazing	Increased law enforcement	Increased security of land	Protection and conservation of natural resources in WMA	Improved provision of ecosystem services (medicinal plants, reduced dust levels, reduced erosion, prevention of siltation of water holes and dams)
	Increased patrol hours and coverage	Decreased poaching and illegal grazing		Especially adequate pasture for livestock
Marking boundaries with signs	Community understanding of resource management plan and zone boundaries	Better pasture quality/quantity		Sustainable and conflict free pastoralism
	No deforestation in project area	Carbon stays in forest, community receives carbon revenue		Income from tourism
Conservation awareness campaign	As above	As above		Food security
Establish carbon payment scheme	Financial incentive for community to conserve the forest	No deforestation in the project area Better adherence to the resource management plan		Security and sustainability of livelihoods
TARGET 2				
Develop a business plan	Provides a tourism pathway for WMA	Better managed tourism industry	Promotion of tourism in Makame WMA and natural resource conservation	Increased community resilience
	Better decision making			
Increased hunting tourism	Increase number of hunting tourists	Increased tourism revenue for WMA		Increased employment opportunities, especially favouring youth
		Creation of employment opportunities within communities		Improved provision of ecosystem services (medicinal plants, reduced dust levels, reduced erosion, prevention of

				siltation of water holes and dams)
		Increased protection of wildlife, less poaching		Revenue source for community development
		Increased incentive to conserve natural resources		
		Diversified income/employment sources		
TARGET 3				
Income/expenditure postings	Create transparent expenditure	Increased confidence in the WMA	Improve livelihoods of Makame WMA communities	Improved quality of life
	Increased trust & confidence in leaders	Greater respect for the resource management plan		Enhanced well-being
	Empowerment of community members over finances			Greater community cohesion
Financial accountability to community	Equitable distribution of community income	Improved service provision		Increased community resilience
		More efficiency in community development projects		Greater stability
TARGET 4				
Review resource management plan	Create more relevant resource management plan	Resource ownership	Secure land rights for WMA and natural resource conservation	Eliminate poverty through resource ownership
Stakeholder agreement on resource management plan	Maintain community resource ownership			
Authenticate resource management plan with government	Ensure stakeholder understanding of the plan			
Share new resource management plan accordingly				
TARGET 5				

Support traditional grazing zones and by-laws	Decreased unlawful grazing and land use	Better availability of graze lands throughout the whole year	Protect and maintain the culture and tradition and natural resource conservation	Security and sustainability of livelihoods
		Improved rangeland health		Food security
		Healthy cows		Wealth
		Increased connectivity for cattle and wildlife across the landscape		Formalization of grazing rights
		Resilience and sustainability of pastoralism		
TARGET 6				
Governance training for WMA leadership	Improved capacity to manage natural resources	Better implementation of the resource management plan	Strengthen governance, improve livelihoods and natural resource conservation	More trust and confidence in leadership and the WMA structure
Governance training for village leaders & comm. members	Improved capacity to manage natural resources	Improved management of the WMA		Improved service provision
Governance training for women's leadership groups	Improved capacity to manage natural resources			Improved livelihoods
Ensure female representation in leadership	Better integration of women into decision making	Consideration of women in community decisions		Empowerment of women
		Empowerment of women		Increased gender equality

Accuracy assessment for remote sensing satellite imagery analysis for monitoring forest cover.

An accuracy assessment of the 2019 forest/non-forest map was performed using 100 ground truth points per class⁴⁸ for a total of 200 ground truthing points derived from high-resolution imagery in Google Earth (e.g. Digital Globe, Airbus, MAXAR). These companies provide imagery from satellites that collect multispectral imagery at very high resolution (2 - 4 meter resolutions), that meets the requirements of the methodology of $\leq 5\text{m}$ resolution for ground-truthing imagery. Distribution of validation points was limited to areas where high resolution imagery was available for corresponding dates to the classification imagery. Only one image was available for 2019, but two additional images were available from late 2018 (November). Within these high-resolution scenes accuracy assessment points were randomly distributed. As availability of high-resolution imagery corresponds to areas of active deforestation and development, it follows that these scenes are a mosaic landscape with patches of forest/nonforest. It is within this mosaic landscape where classification is most likely to be erroneous due to the scale at which deforestation is taking place and the resolution of Landsat which can create the challenge of mixed pixels. As such, the higher concentration of accuracy assessment points within these mosaicked landscapes is not only logical since deforestation is most prevalent here, but it is also where classification errors are more likely, thus increasing the difficulty of attaining the requisite classification accuracy. Distribution of all points is shown in the Figure below.

Classification	Land-use class as determined from ground-truth points		Total	Accuracy (%)	Error of Commission (%)
				User's accuracy	
	Forest	Non-forest		(# correct/ row total)	
Forest	91	10	101	90.10%	9.90%
Non-forest	9	90	99	90.91%	9.09%
Total	100	100	200		
Accuracy (%) Producer's accuracy (# correct/ column total)	91.00%	90.00%		Overall Accuracy	

⁴⁸ Congalton (2005) suggests a sample sizes of 50 to 100 assesment points for each map category. Congalton, R. G. 2005. Thematic and Positional Accuracy Assessment of Digital Remotely Sensed Data. 2005 Proceedings of the Seventh Annual Forest Inventory and Analysis Symposium. 2005 October 3–6; Portland, ME.

Error of Omission (%)	9.00%	10.00%		90.50%
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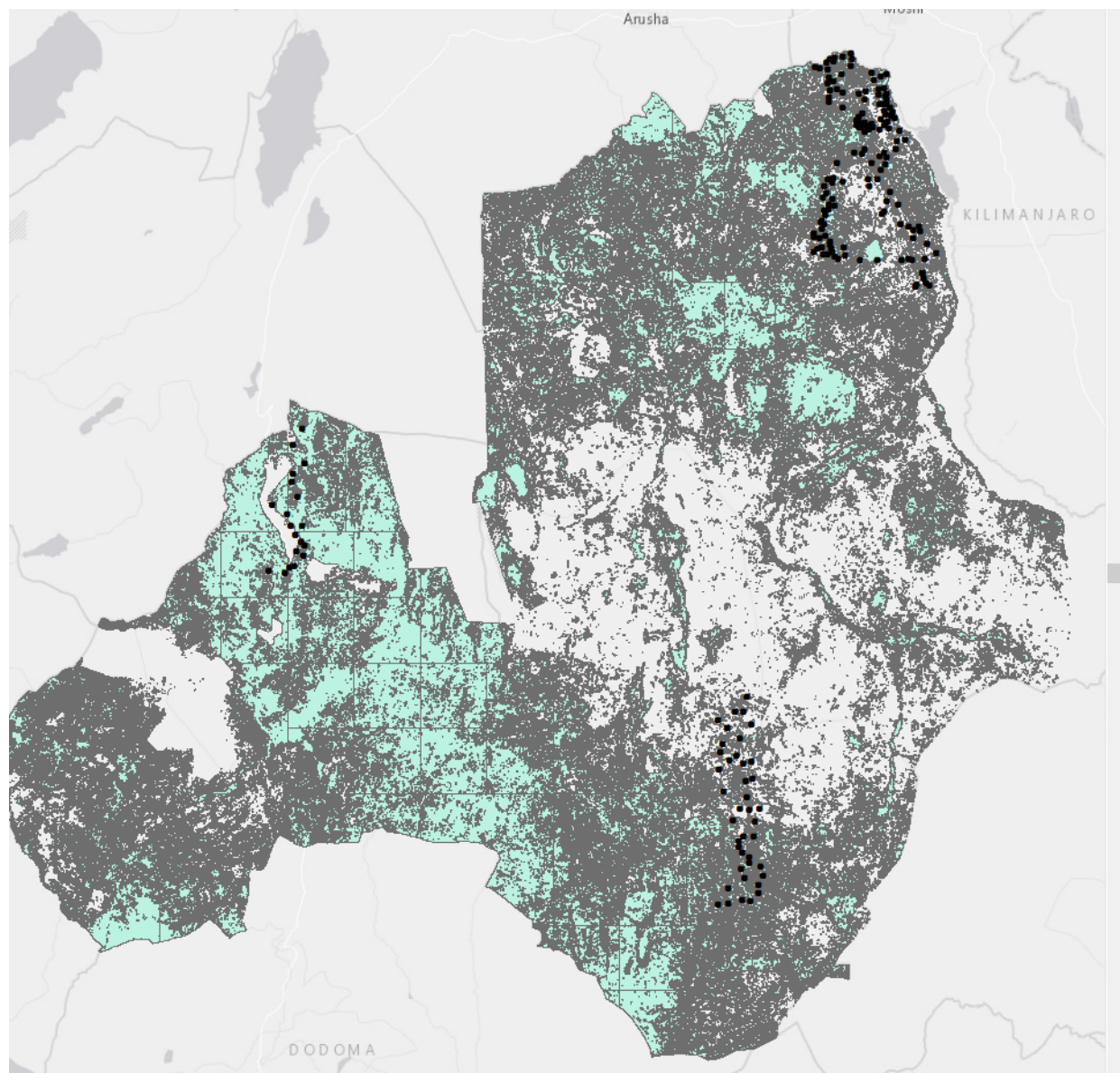


Figure 5.1. Distribution of accuracy assessment points across the reference region.

Confusion matrix of accuracy assessment points to analyze forest cover change in the monitoring period.

Google Earth Image		CORRECT = 1	INCORRECT	CORRECT = 1	INCORRECT
DATE	NUMBER	FOREST		NON-FOREST	
2/28/2019	1		1	1	
	2	1		1	
	3	1		1	
	4	1		1	
	5	1		1	
	6	1		1	
	7		1	1	
	8	1		1	
	9	1			1
	10	1		1	
	11		1	1	
	12	1		1	
	13	1		1	
	14	1		1	
	15	1		1	
	16		1	1	
	17	1			1
	18	1		1	
	19	1		1	
	20	1			1
	21	1		1	
	22	1		1	
	23	1		1	
	24	1		1	
	25		1	1	
	26	1		1	
	27	1		1	

	28	1		1	
	29	1		1	
	30	1		1	
	31	1		1	
	32	1		1	
	33	1		1	
	34	1		1	
	35	1		1	
	36	1		1	
	37	1		1	
	38	1		1	
	39	1		1	
	40	1		1	
	41	1		1	
	42	1		1	
	43	1		1	
	44	1		1	
	45	1		1	
	46	1		1	
	47		1	1	
	48	1			1
	49	1		1	
	50	1			1
	51	1		1	
	52	1		1	
	53	1		1	
	54	1			1
	55		1	1	
	56	1		1	
	57	1		1	
	58		1	1	

	59	1		1	
	60	1		1	
	61	1		1	
	62	1		1	
	63	1		1	
	64	1		1	
	65	1		1	
	66	1		1	
	67	1		1	
	68	1		1	
	69	1		1	
	70	1		1	
11/6/2018	71	1			1
	72	1			1
	73	1		1	
	74	1		1	
	75	1			1
	76	1		1	
	77	1		1	
	78	1		1	
	79	1		1	
	80	1		1	
	81	1		1	
	82	1		1	
	83	1		1	
	84	1			1
	85	1		1	
	86	1		1	
	87	1		1	
	88	1		1	
	89	1		1	

	90	1		1	
11/7/2018	91	1		1	
	92	1		1	
	93	1		1	
	94	1		1	
	95	1		1	
	96	1		1	
	97	1		1	
	98	1		1	
	99		1	1	
	100	1		1	
		91	9	90	10

TOTAL	FOREST		NON-FOREST	
	CORRECT = 1	INCORRECT	CORRECT = 1	INCORRECT
	91	9	90	10

Aerial photo of burn site in Makame Project Area from June 2019.

