



**Verified Carbon
Standard**

BOOMITRA GRASSLAND RESTORATION IN EAST AFRICA THROUGH SOIL ENRICHMENT



Document Prepared by Boomitra Inc

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1 PROJECT DETAILS

1.1 Summary Description of the Project

In this project, we help pastoralists of Kenya in deploying practices that contribute to the sustainable development of the Savanna grasslands of East Africa. The project area, characterized by arid and semi-arid regions^{1,2}, is prone to frequent drought conditions. The zones categorized as semi-arid are under threat of turning into arid zones, while the arid zones are prone to dryness to the extent that pastoral activities will cease to be feasible in these zones in the foreseeable future.

The grazing of grasslands by both livestock and wildlife is widely prevalent, and degradation of land due to overgrazing is a prominent issue which has an adverse impact on soil carbon. Since grazing is the primary land use activity in the savannas, the soil carbon has been prominently altered and often degraded (See Baseline section for more details). Hence, there is a need for equipping the community with modern advancements and technological interventions for better and sustainable grassland management practices. In this context, the opportunity to introduce improved grassland management practices, including sustainable grazing practices, will significantly help the grasslands of the region and restore carbon to their soils, creating carbon removals while improving overall soil health. The proposed sustainable grassland management activities include rotational grazing and certain grassland management activities such as livestock and water management activities. All these project activities help in improving carbon sequestration, regenerating vegetation and accelerating restoration of soil fertility in degraded grasslands, and thereby improving SOC. This project will improve the livelihoods of the communities directly through the carbon credit payments. In this project, pastoralists will be mobilized to take up a variety of improved grassland management practices. These practices are proven ways to increase soil organic carbon, prevent further degradation of the grasslands, and enable pastoralists to improve their productivity.

In addition to increasing Soil Organic Carbon (SOC) in grasslands, this project is expected to generate several community and biodiversity benefits. The project contributes to the following UN Sustainable Developmental Goals (SDG): 2, 6, 8, 13 and 15 (see section 1.18).

¹ "World Bank Climate Change Knowledge Portal." Worldbank.org, 2020, climateknowledgeportal.worldbank.org/country/kenya. Accessed 5 Aug. 2024.

² Mirzabaev, A., J. Wu, J. Evans, F. García-Oliva, I.A.G. Hussein, M.H. Iqbal, J. Kimutai, T. Knowles, F. Meza, D. Nedjraoui, F. Tena, M. Türkeş, R.J. Vázquez, M. Weltz, 2019: Desertification. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. <https://doi.org/10.1017/9781009157988.005> Page:225

This project quantifies only GHG removals from new project activities, through the use of the VM0042 methodology. We estimate an average yearly GHG removal of 4,669 tons of CO_{2e} from instance 01 which is Kenya grasslands for this project and the number of grasslands participating in the project is also estimated to grow over the course of the crediting period through additional instances. The current crediting period estimated is 20-year crediting period. The total emissions reductions from this project instance 01 is 93,371 tons of CO_{2e} after deducting buffer credits.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	28-11-2023	VCS	Earthood Services Private Limited	NA

1.3 Sectoral Scope and Project Type

Sectoral scope	14. Agriculture, Forestry and Other Land Use (AFOLU)
AFOLU project category ³	Agricultural Land Management (ALM)
Project activity type	This is a grouped project which includes practices (activities) that demonstrably reduce net GHG emissions of grassland ecosystems by increasing soil organic carbon stocks by adopting sustainable and improved grazing practices.

1.4 Project Eligibility

1.4.1 General eligibility

The proposed project meets all the requirements set forth in the VCS Standard, VCS program and VCS methodology VM0042 “Methodology for Improved Agricultural Land Management”, Version 1.0, dated 19th October 2020⁴.

This is a voluntary project with the objective of promoting improved grassland management in the project area and meets all the six principles set out in section 2.2 of the VCS standard V4.5. Furthermore, to describe and justify how the project is eligible under the scope of the VCS Program, we use the criteria listed in section 2.1.1 of the VCS standard, V4.5, outlined in detail in the table below:

³ See Appendix 1 of the VCS Standard

⁴ VCS Verra Standard, VM0042 v1.

Criterion	Fulfilled (Yes/No)	Justification
The seven Kyoto Protocol greenhouse gases.	Yes	The project results in GHG removals through soil carbon sequestration, removing CO ₂ from the atmosphere and storing it as soil carbon. Transitioning to rotational grazing is a proven way to achieve soil carbon sequestration in grasslands.
Project activities supported by a methodology approved under the VCS Program through the methodology approval process.	Yes	The project activity is supported by the VCS methodology VM0042: Methodology for Improved Agricultural Land Management (version 1.0).
Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval.	Yes	The proposed project activity does not belong to any project categories that are excluded by VCS from being part of the VCS program.
Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements.	Not Applicable	This is not a Jurisdictional REDD+ program, hence this eligibility criterion is not applicable.
Ozone-depleting substances.	Not Applicable	The proposed project activity does not involve any Ozone depleting substances

As per Annex 1 of VCS standard V4.5, this project qualifies under Agricultural Land Management (ALM) activities that increase carbon stocks in soils by adopting sustainable grazing practices. This project is categorized under Improved Grassland Management (IGM) category which includes practices that demonstrably reduce net GHG emissions of grassland ecosystems by increasing soil carbon stocks.

Apart from the above, the project does not degrade any hydrological functions in the area and does not negatively affect any native ecosystems. Detailed LULC analysis of the project area has been done to check whether the project area is not cleared of native ecosystems within the 10-year period prior to the project start date. Overall, this project contributes to the development of native ecosystems and conservation of water resources.

This project is listed as per the VCS listing requirements and proceeded with validation. This project uses VCS approved methodology VM0042 which is eligible as per VCS requirements. The methodology does

not impose any scale and/or capacity limits. This project is not a fragmented part of a larger project or activity.

1.4.2 AFOLU project eligibility

As per Annex 1 and section 3.2 of VCS standard V4.5, this project qualifies under Agricultural Land Management (ALM) activities category that increase carbon stocks in soils by adopting sustainable grassland management practices. This project is categorized under Improved Grassland Management (IGM) category which includes practices that demonstrably reduce net GHG emissions of grassland ecosystems by increasing soil carbon stocks.

This project is not part or located in a jurisdiction covered by a jurisdictional REDD+ program.

1.4.3 Transfer project eligibility

This section is not applicable since this project is neither been submitted to any other GHG Programs and nor been rejected or registered by any other GHG programs.

1.5 Project Design

This is a grouped AFOLU project will have multiple project instances within the defined project boundary i.e., Kenya. As per VCS standard requirements Section 3.6.15, certain eligibility criteria have been defined for instances to be part of this project. At the time of validation, this grouped project has one project instance. In future monitoring reports, new project instances will be added. All the new instances will be verified as per the eligibility criteria outlined below and applicable guidelines and standards.

The initial PAIs have been defined in line with the requirements of VCS Standard v4.5 (Sections 3.6.10 to 3.6.16). Each future instance added to the project must be located within the project boundary i.e., Kenya, and must meet the eligibility criteria, baseline scenario, and additionality rationale defined for the initial PAIs.

1.5.1 Grouped project design

Inclusion Criteria for new project activity instances

The following paragraphs describes the minimum general eligibility criteria to be satisfied by new instances and evidence for how every criterion is fulfilled as per paragraph 3.6.16 of VCS Standard V4.5.

1. Meet the applicability conditions set out in the methodology applied to the project.

As per VM0042 version 1, each new project activity instance shall demonstrate compliance with the applicability conditions set out in the methodology. See section 3.2 of the PDD how this project meets the applicability conditions.

2. Use the technologies or measures specified in the project description.

All the new project activities shall implement one of the activities mentioned in the project activity description in Section 1.12 of the PDD.

3. Apply the technologies or measures in the same manner as specified in the project description.
Each project activity instance shall adhere to the technology specifications (mentioned in methodology / standard) employed by project activity. See section 1.11 for more details on eligible project technologies.
4. Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.
Each instance should clearly define the baseline scenarios comprising of unsustainable agriculture practices and related information in the PDD.
5. Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances, or face the same investment, technological and/or other barriers as the initial instances.
Each new Project Activity Instance shall demonstrate additionality as per methodology and VCS standard requirements.
6. Where grouped projects include multiple baseline scenarios or demonstrations of additionality, such projects will require at least one set of eligibility criteria for each combination of baseline scenario and demonstration of additionality specified in the project description.
Each new Project Activity Instance must demonstrate which of the baseline scenarios listed in the methodology will be applicable.

Including above, the following eligibility criteria for the inclusion of new project activity instances, as per clause 3.6.17 of the VCS Standard, V4.5 must be satisfied.

1. Geographical boundaries: all new project activity instances must be located within the boundaries of Kenya.
Each project activity instance is included shall be within the boundaries mentioned in section 1.13 of the PD. (Details of the grasslands with geocoordinates and KML files will be part of the evidence). All the grasslands included under this project instance are in Kenya. (Please see section 1.13 of the PDD for more details).
2. Comply with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial compliance with multiple sets of eligibility criteria is insufficient.
New Project Activity Instances shall comply with the full set of eligibility criteria for the inclusion of new project activity instances in this section. The selected lands are grasslands prior to project initiation and will remain as grasslands during the project lifecycle. A detailed Land Use/Land Cover (LULC) analysis has been carried out and is available in Section 3.4 of the PDD.
3. Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation / verification body (VVB).

Each new Project Activity Instance shall have monitoring plans that define technical, financial, geographic, and other relevant information. A detailed monitoring plan and other relevant information has been provided in Section 5 of this PDD.

4. Be validated at the time of verification against the applicable set of eligibility criteria.

Each new project activity Instance shall be validated at the time of verification against the applicable set of eligibility criteria as listed in this section.

5. Have evidence of project ownership, for each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).

New project activity instances shall demonstrate ownership by the project participant, from the start date of the project activity instance. See ownership section (1.8) of PDD more information.

6. Have a start date that is the same as or later than the grouped project start date as mentioned in section 1.9 of the PD.

All the new project instances shall provide evidence that the activities started after the group project start date. See start date section (1.9) for more information.

7. Be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).

All the new Project Activity Instances shall be eligible for crediting from the start date of the instance through to the end of the project crediting period (only). See ownership section (1.8) of PDD more information on carbon credit.

8. Where inclusion of a new project activity instance necessitates the addition of a new project proponent to the project, such instances shall be included in the grouped project within two years of the project activity instance start date.

The addition of a new project proponent to Project Activity Instances shall be included in the grouped project within two years of the project activity instance start date. Boomitra will be the project proponent of this project. However, this project may have multiple implementation partners.

9. The new project activity instances shall have soil textures covered by the calibration datasets used for the remote sensing technology for soil organic carbon stock measurement.

The remote sensing soil organic carbon stock measurement is an input to the biogeochemical model. In order for the remote sensing of soil organic carbon stock to be considered appropriate and representative of the conditions of the new project activity instance, the new instance shall have USDA soil textures within those present in the calibration datasets of the remote sensing algorithm. New calibration data may be added during verifications of the project for the representation of new soil textures that are not covered currently in the initial calibration datasets available at the time of validation. Thus, new project instances that have soil textures not represented in the initial calibration datasets available at validation may still be added to the

project in subsequent verifications if suitable calibration data for those soil textures is shown and similarly substantiated for representativeness.

Baseline scenario and additionality criteria of new project activity instances

The baseline determination and additionality demonstration for all project activity instances in a project, including any new project activity instances included in the grouped project, shall be combined and have the same standards applied. The following points describe the minimum general eligibility criteria to be satisfied by new instances and evidence for how every criterion is fulfilled as per paragraphs 3.6.10 – 15 of VCS Standard v4.5.

1. The project will clearly define one or more geographic areas within each project activity instance, including new instances as they are added. These geographic areas will be specified using geodetic polygons as described in Section 1.13. Geographic areas where project activities are planned or ongoing shall be clearly defined using geodetic polygons, as outlined in VCS Standard v4.5, Section 3.6.10. Geographic areas with no initial project activity instances are not included in the project. For future project instances, the project will ensure that the baseline conditions and additionality criteria remain consistent with those of the initial project activity instance. It will be demonstrated that the designated geographic areas for new instances share the same characteristics as the initial project activity instance, ensuring consistency across all project instances.
2. The measurement methods and procedures for determining the project eligible area comply with Sections 3.11.1 and 3.11.2 of the VCS Standard v4.5. To include new project activity instances, geospatial field boundary mapping techniques are used to demarcate the project area with multiple points, creating polygons in KML files. These KML files, which precisely delineate the project area where reductions and removals are quantified, exclude non-eligible areas such as roads, water bodies, waterways, forests, rock formations, settlements, and other areas not part of the project activity as defined by the VCS standard and VM0042 methodology. By using these advanced geospatial techniques, we accurately calculate the eligible area of the ranches under this project, ensuring compliance with VCS standards. These KML files are available for validation, encompassing all project instances and delineating the smallest administrative land divisions involved.

The determination of baseline scenario and demonstration of additionality are based upon and consistent with the initial project activity instances. The list of project activities will be reflected in all listed project activities in the 1st instances and in future instances to allow assessment of future instances against eligibility criteria per Section 3.6.16(2) and (3), VCS Standard, v4.5.

3. During the determination of the baseline scenario and the additionality, for the analysis of factors like common practices, relevant regulations, historical grassland desertification trends, and other relevant factors, the analysis area encompassed the project's entire geographic area, hence, this analysis holds good for the initial project activity instance and well as the future project instances.

The instance 01 of this grouped project meets all the eligibility criteria set out above.

1.6 Project Proponent

Organization name	Boomitra Inc.
Contact person	Chethan T. R.
Title	Director – Carbon Projects
Address	400 Concar Dr San Mateo CA 94402 USA
Telephone	+1 6502825671
Email	info@boomitra.com

1.7 Other Entities Involved in the Project

Organization name	EarthAcre Incorporated
Role in the project	Origination Partner
Contact person	Patita Nkamunu
Title	Head of Projects
Address	3057 N Clifton Ave, #10 Chicago, IL 60657 USA
Telephone	+254 740 857 023
Email	info@earthacre.com

Organization name	Athi Kapiti Wildlife Conservancies Association (AKWCA)
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Role in the project	Intervention Coordinator
Contact person	David Kasanga
Title	Chairman
Address	P. O. Box 619-00209
Telephone	+254 720 716709
Email	davidkasanga@gmail.com

Roles and Responsibilities of Origination Partner (EarthAcre)

1. The Origination Partner must assist with recruiting Landowners and Intervention Coordinators (defined below) and promoting the adoption of Improved sustainable land management and grazing practices through initiation of the Project.
2. To recruit Intervention Coordinators/ Landowners for the Project
3. To obtain consent of the Intervention Coordinators/ Landowners to execute the participation landowner agreement with Boomitra ("IC/ Landowner Agreement") and ensure adherence thereto including the Sustainable land management and grazing Practices
4. To provide accurate and validated land coordinates and ensure that the Landowner's land boundaries, legal identification and bank account information of the Landowners/Landowners are accurate to the best of their ability
5. To engage closely with all local stakeholders, and routinely conduct Local Stakeholder Consultations ("LSCs") following the requirements of the VCS program
6. To provide the Intervention Coordinators with technical and business knowledge and equip them with processes to recruit, monitor and incentivize Landowners/landowners
7. To ensure the collection of accurate landowner identification and land ownership details
8. To ensure that the list of Landowners/Landowners and their ownership of VCU is updated, accurate and credible to the best of their ability
9. To measure and monitor Project-related parameters that must be collected on the ground from the Landowners
10. To ensure consistent following of Sustainable land management and grazing Practices and other practices that lead to reduction or removal of GHGs.
11. To conduct landowner/stakeholder/environmental surveys when required for the validation and verification process of the Project.
12. To assist VVB or its representatives when they visit the Project Area for validation and/or verification

13. To ensure that the Intervention Coordinators/Landowners do not participate in any other GHG reduction projects offered by other organizations simultaneously with the Project during the Project Duration

Roles and Responsibilities of Intervention Coordinator:

1. Intervention Coordinators are legal entities that represent landowners and coordinate the adoption of Sustainable land management, biodiversity conservation activities and grazing Practices.
2. The intervention coordinator is to implement and coordinate the intervention activities (i.e., project activities - rotational grazing) within a specific local area (i.e. Athi Kapiti area).
3. Intervention Coordinators serve as the local institution which are very familiar with their area and are able to implement regenerative practices, but do not have the capacity to handle all the other complexities required for a rigorous carbon project.

1.8 Ownership

Boomitra collaborates with different implementation partners to promote improved and sustainable grassland practices through trainings and technical support to ranchers and bringing behavioral change in grassland management practices. Participation of ranchers in this project is totally voluntary. Before the ranchers joined this project, thorough and in-depth discussions were held with the help of local partners in the region. All ranchers are informed about this project through project field staff.

As discussed in section 1.7, EarthAcre is the origination partner for the project. Boomitra is the project proponent and EarthAcre is the origination partner. As discussed in Section 1.7, the roles of the origination partner is to identify the ranchers/pastoralists and enter into an agreement to train on sustainable grazing practices and make sure these ranchers/pastoralists are adopting them through sensitization with the indigenous communities according to the FPIC process and follow standardized monitoring template for grazing management on regular basis. These partners help ranchers/pastoralists in preparing the grazing plan, ranch management plan, etc in consultation with ranchers, local experts and implement them on ground.

As discussed in section 1.7, AKWCA is the intervention coordinator who is location specific for the project at the time of validation. Multiple intervention coordinators will be added over the project crediting period. The role of intervention coordinator is to implement and coordinate the intervention (rotational grazing) within a specific location (i.e. Athi Kapiti area in case of AKWCA).

Land Ownership

This grouped project includes both communities owned and privately owned grasslands of Kenya.

Kenya grasslands under this project are under both private ownership and community ownership. Private grassland owners have clear property title deeds issued by the competence authority in the country. In Kenya, land ownership falls under three categories: private land, community land, and government land. The constitution of Kenya specifically states that none of the land ownership models are superior, thus the law is applied uniformly on community land as it is on private and government land. As per Article 63 of Kenya constitution, customary land rights have the same legal standing as any other type of land

ownership⁵. All the lands included in this project are free from any litigation on land ownership and tenure issues. “Carbon Credit Sale Agreement,” involving AKWCA, pastoralists, and Boomitra, are legally bound under Kenyan law, ensure that the participating members affirm their ownership or rights to the land designated as project areas.

The project encompasses both communally managed and privately managed lands, each with distinct ownership and management structures that influence grazing practices and land use. These lands are primarily used for livestock grazing, with varying degrees of community coordination and private management.

Community managed and owned lands:

These lands are owned by the community ranchers/pastoralists having the required documents to represent the land ownership which has been registered under the Community Land Act No. 27 of 2016⁶. The land is set aside primarily for grazing and all the associated carbon benefits of improved grazing practices. Grazing on community-owned lands involves moving herds to different areas based on water and forage availability within the community owned land. Grazing areas are often designated by democratically elected following consultations with community members, ensuring equitable access.

- The Community Land Title Deed & Community Land Register to recognize and protect community land under the Community Land Act (2016).
- Each community has a list of its community members who jointly own the community lands

Privately owned and Communally managed land:

These lands are privately owned by the ranchers/pastoralists and land management is done jointly as a community. This type of land ownership is acknowledged under customary land tenure systems of the Community Land Act⁶ where community and individual rights coexist. To represent a system where land is part of a community but privately owned, the following documents will be required:

- Individuals or families within the community need a Certificate of Title or Lease for their privately owned parcels, and survey plans for accurate land demarcation.
- If land is registered as a conservancy, the landowners will jointly register a community-based organization or entity through which they operate. The landowners will also democratically elect board representatives and committees to represent their interest. Any land transactions involving this model of landownership and management, will need consent to be sought and approved by the elected committee.

However, land use and management vary from conservancy to conservancy.

⁵ Constitution of Kenya: Community Land. Kenya Law Reform Commission (KLRC). Accessed on 31 July 2024. <https://www.klrc.go.ke/index.php/constitution-of-kenya/117-chapter-five-land-and-environment/part-1-land/230-63-community-land>

⁶ Boone, R. B., Lesorogol, C. K., & Galvin, K. A. (2024). Drought frequency, conservancies, and pastoral household well-being. *Ecology and Society*, 29(1).

In these lands, communities live and graze their livestock within the common use areas such as grazing land. Here communities agree to leave a certain percentage of their land open for communal grazing and wildlife, while they fence off the remainder to create paddocks for natural growth of grasses for a buffer forage during the dry season/drought for their livestock. Without communities, their entire land would be fenced off and/or sold. If the entire land is fenced, then there would be no movement of livestock or wildlife, resulting in overgrazing.

Privately owned and managed grasslands:

These lands are owned by the individual rancher/pastoralist who have the required land documents to represent the land ownership, and they mostly focus on livestock rearing on their lands.

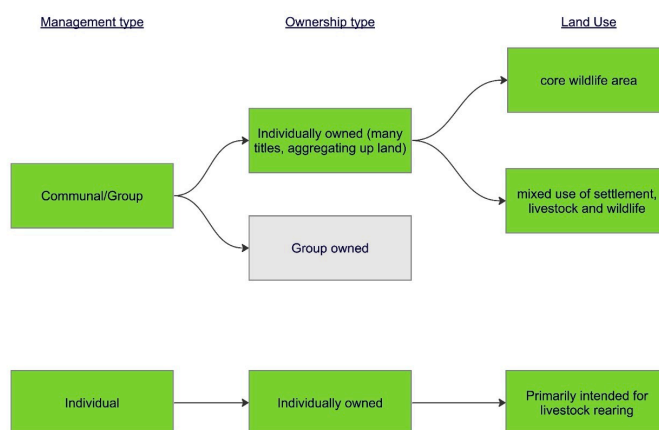


Figure 1: Polygon Ownership Scenarios

At the time of validation, only privately owned and managed grasslands have been onboarded. However, as outlined in Section 3.4 on the baseline scenario, assessments have demonstrated that regardless of land ownership type, grasslands in the baseline condition face inevitable degradation. This degradation is driven by continuous overgrazing, the absence of effective grazing management plans, competition between livestock and wildlife, and other contributing factors. As this is a grouped project, additional ranches will be onboarded in future instances, ensuring that all future project phases maintain a consistent baseline and demonstrate additionality in alignment with the initial project instances. This is in accordance with Section 3.6.11 of the VCS Standard v4.5 to ensure compliance and integrity across all project expansions.

Onboarded Lands in PAI 01:

Type of ownership	Name of the ranch	Landownership
Private	Lisa Ranch	Individual or Single Ownership
Private	Lukenya Ranch	Company/Family-owned ranch

Type of ownership	Name of the ranch	Landownership
Private	Machakos Ranch	Company/ Family

Table 1: Type of Ownership

In addition to the land ownership, the project also guarantees the permanence of each land tenure type mentioned. This is substantiated by Partner Level Agreements (PLAs), between Boomitra and the Origination Partner, for a total period of 30 years. These PLAs, subject to 10-year renewals, legally bind parties to maintain management practices safeguarding credited carbon stocks throughout the project's longevity. This process ensures permanence. For further details, refer to Project Longevity section of the Non-Permanence Risk Report.

Credit Ownership

A carbon agreement" is signed between the rancher/pastoralist and the intervention coordinator ie., AKWCA (at the time of validation) where the individuals or entities enrolling their lands irrevocably assign the right, title and interest to the every type of GHG reductions and removals, carbon credits, or verified carbon units (VCUs) thus generated on their lands during the project to the intervention coordinator which in-turn assign the complete right, title and interest to the GHG reductions and removals, carbon credits, or verified carbon units (VCUs) to Boomitra through legally binding agreements. This is covered by legal agreements with the individuals enrolling their lands.

These agreements, involving AKWCA, pastoralists, and Boomitra, are legally bound under Kenyan law. They ensure that:

- 1. Carbon Agreement between Rancher and Intervention Coordinator:** Pastoralists transfer their carbon rights to AKWCA, facilitating collective management and representation.
- 2. Carbon Agreement between Intervention Coordinator and Boomitra:** AKWCA, as a conservancy, enters into a binding agreement with Boomitra. This agreement grants ownership of carbon credits to Boomitra, as well as control over project activities and land use management within the land area covered by the carbon rights agreement with pastoralists.

The project activity will be implemented and maintained throughout the crediting period and the entire duration of the project, as stipulated in the legally binding agreement and discussed in detail in section 1.10.

Details about the carbon revenue sharing has been explained to each participating rancher. The agreement is available in both English and Swahili and is carefully explained point by point by the field team to ensure full informed consent of the ranchers. Since many carbon projects are operational in Kenya, the ranchers have been consulted, informed about double-counting of carbon credits, and checked whether the farm polygon has already been enrolled in another project.

At the time of validation, there are a total of 3 participating ranchers in this project which are privately owned. Details of their ownership has been outlined below.

Type of ownership	Name of the ranch	Total Area (hectares)
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Private	Lisa Ranch	2154.73
Private	Lukenya Ranch	1319.79
Private	Machakos Ranch	5558.27
Total		9,032.81

Table 2: Details of Ownership

Please refer the land document folder for more details. In the future instances, both type of landowners i.e., private and community landowners will be included to be part of the project. In case of communities, the community land management committee representative will be signing the carbon agreement on behalf of the ranchers of the community. In these lands, there is a single landowner who owns a large parcel of land areas.

In this project, ranchers/pastoralists have signed the agreement with Boomitra via the intervention coordinator and origination partner. Under the 1st Instance, Boomitra has planned 9033 ha of land to be part of the 1st Instance of the project and overall, we plan to onboard 11,291 ha for this project under multiple instances. A total of 3 land parcels or polygons, encompassing 9033⁷ ha area, is included in the project's 1st Instance. Some of the participating farmers may have enrolled multiple land parcels. As per VCS Standard V4.5, section 3.11.4, Boomitra's control on total area is around 80% of the total area planned in the 1st instance. However, the remaining 20% of land area is also from the same geographical region and has the same socio-economic conditions. Hence, the remaining 20% of the project area fulfills the additionality requirements and the same monitoring plan will be followed. During the first verification, the size of the 1st instance project area will be fixed.

1.9 Project Start Date

Project start date	January 10 th , 2019
Justification	The project start date is January 10th, 2019, the approximate time of adoption of the project activities by the first pastoralist/rancher participating in the program, under the educational guidance of ground staff. In the case of the first instance of the project the start date is the date on which the first rancher/pastoralist began an improved grazing management practice by the rancher in conjunction with an intervention coordinator and origination partner that lead to actual reduction and removal of GHG emissions. Start dates vary from ranch to ranch, and the

⁷ This area has been calculated using open-source software QGIS's EPSG:6933 as Coordinate Reference System (<https://epsg.io/6933>. Accessed on 5 Aug)

carbon removal is estimated uniquely for each ranch from their individual start dates.

As the project start date, the receipts of payment made in the form of petty cash voucher to labors employed in the ranch to implement improved grazing practices by digging in holes and fixing the poles for paddock demarcation, dated January 10th, 2019, is considered.

These receipts mark the commencement of fencing activities which is considered as an important tool in rotational grazing, including tasks such as digging holes and demarcating paddocks, to enable conservation. This action of creating paddock is to avoid the grazing in these paddocks and provide the rest period for forage to grow back. Initiating establishment of paddocks at this time allows for optimal rest period for grasses that are growing rapidly, providing better nutrition for the livestock and improving their overall health and productivity. The primary action that resulted in the actual generation of GHG ERR (emission reductions or removals) was the implementation of improved grazing through the creation of paddocks using fencing materials. As the reduction or removal of GHG emissions began on January 10th, 2019, this date is deemed the project's starting point.

It is to be noted that not all ranchers share same start date. Each ranch has different start dates and hence ERR generation will depend on start date of the project activity for that ranch. Revised ERR sheet has accommodated this ERs calculated based on the start dates of the individual ranch.

1.10 Project Crediting Period

Crediting period

- ☐ *Seven years, twice renewable*
- ☐ *Ten years, fixed*
- ☒ *Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)*

	The duration of the VCS project crediting period is initially 20 years with a possibility for renewal four times. The present project crediting period starts on 10 th January 2019 and ends on 9 th January 2039.
Start and end date of first or fixed crediting period	10-01-2019 to 09-01-2039

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	☒

☒ ≥ 300,000 tCO₂e/year (large project)

The estimated greenhouse gas emission reductions for the first Project Activity Instance (Instance 01) are summarized in the following table.

Calendar year of crediting period	Estimated GHG reductions or emission removals (tCO ₂ e)
10-Jan-2019 to 31-Dec-2019	0
1-Jan-2020 to 31-Dec-2020	5,245
1-Jan-2021 to 31-Dec-2021	5,210
1-Jan-2022 to 31-Dec-2022	4,297
1-Jan-2023 to 31-Dec-2023	4,907
1-Jan-2024 to 31-Dec-2024	4,907
1-Jan-2025 to 31-Dec-2025	4,907
1-Jan-2026 to 31-Dec-2026	4,907
1-Jan-2027 to 31-Dec-2027	4,907
1-Jan-2028 to 31-Dec-2028	4,907

1-Jan-2029 to 31-Dec-2029	4,907
1-Jan-2030 to 31-Dec-2030	4,907
1-Jan-2031 to 31-Dec-2031	4,907
1-Jan-2032 to 31-Dec-2032	4,907
1-Jan-2033 to 31-Dec-2033	4,907
1-Jan-2034 to 31-Dec-2034	4,907
1-Jan-2035 to 31-Dec-2035	4,907
1-Jan-2036 to 31-Dec-2036	4,907
1-Jan-2031 to 31-Dec-2037	4,907
1-Jan-2038 to 31-Dec-2038	4,907
1-Jan-2039 to 09-Jan-3039	107
Total estimated ERRs during the first or fixed crediting period	93,371
Total number of years	20
Average annual ERRs	4,669

1.12 Description of the Project Activity

This is a grouped project. All new project activity instances, including instance 01 of the grouped project, follow the below mentioned list of project activities and will satisfy the eligibility criteria as per Section 3.6.16(2) and (3) of the VCS Standard v4.5. The activities listed below are the non-exhaustive list of activities promoted across by the project within the project boundary. These practices shall be promoted in the future instances of the project also.

- Rotational grazing
- Livestock management
- Water management
- Promotion of capacity building programs
- Conservation of grassland biodiversity

Rotational Grazing

The principal project activity is the implementation of rotational grazing. We work with individual landowners or local pastoralist communities, educating and enabling their transition from conventional grazing (continuous grazing) to rotational grazing for their livestock (cattle, sheep, goats etc.). This is not just a discrete transition, as we continue to work with the pastoralists throughout the lifetime of the project to help them continually improve their practices.

Here are the general principles or activities of rotational grazing, as implemented in this project.

- 1) The grassland ownership unit is divided into organized grazing zones roughly similar in livestock carrying capacity⁸.
- 2) Livestock cycle between different grazing zones and will spend anywhere from a single day to several months in a single grazing zone⁹, to prevent overuse of any single grazing zone.
- 3) Livestock will not return to the same grazing zone more than once or twice a year.
- 4) Some grazing zones may be rested for more than one year to allow recovery.

1.12.1 Some of the major advantages of rotational grazing include:

- Increased soil fertility
- Decreased wastage of forage
- Increased quality of forage production
- Increase water infiltration and soil water holding capacity

Rotational grazing of livestock provides time for the vegetation to regrow following a grazing event and for the vegetation itself to reproduce and propagate further. Rotational grazing practices in this project will change the current grazing practices from continuous grazing to rotational grazing which includes removing livestock from continuous grazing in areas near settlements, thereby reducing grazing pressure on forage in these areas. To reduce negative environmental effects and provide quality pastures, rotational grazing is an alternative solution to continuous grazing. This will help ensure the availability of quality feed for animals while conserving the environment¹⁰. Herds undergoing rotational grazing led to a uniform impact of foraging across different plant species, reducing the chance of promoting potentially invasive plant species that increase in the presence of continuous grazing. Herds confined to a grazing zone also produce concentrated hoof impacts on the soils within the grazing zone, breaking up harmful surface crusts that promote sheet erosion and decrease rainfall infiltration¹¹. This enhances the soil

⁸ [Around 70% of the wildlife in Kenya is present on private and community lands. Livestock carrying capacity is calculated based on the area of the ranch. Since the communities share the land with wildlife, it is not easy to calculate the ranch's livestock-carrying capacity. However, experts in the region have been consulted, and a detailed plan is being prepared to calculate the ranch carrying capacity. A detailed plan will be submitted at the time of first verification.] "Conservancies in Kenya | KWCA." KWCA, 23 Aug. 2016, . Accessed 5 Aug. 2024.

⁹ Communities give different names to paddocks in the regions. Some call them blocks, zones, etc. All these names refer to Paddock Individual owner

¹⁰ Njoki Kahiu, J. Anchang, V. Alulu, Fava, F. P., Jensen, N., & Hanan, N. P. (2024). Leveraging browse and grazing forage estimates to optimize index-based livestock insurance. *Scientific Reports*, 14(1).

¹¹ *The erosional impacts of grazing animals*. Research Gate. (n.d.). [The erosional impacts of grazing animals](#)

structure and environment, making it more amenable to both plant growth and the storage of carbon. Altogether, the decomposition of the roots of the regenerated vegetation over time, combined with the return of carbon to the soil from livestock manure, lead to increases in soil carbon levels, effectively sequestering CO₂.

The project activities are centered around various forms of improved grassland management practices, with rotational grazing being the principal activity adopted by ranchers to increase Soil Organic Matter (SOM) and sequester CO₂. As the main focus of the project, rotational grazing is designed to optimize pasture utilization, improve soil health, and enhance biodiversity, contributing significantly to the sustainability of grassland ecosystems. By periodically rotating livestock across different grazing areas, ranchers can prevent overgrazing, allow for plant regrowth, and promote soil regeneration, thereby increasing the land's overall productivity and carbon sequestration capacity.

The project's activities, as outlined in this document, are intended to be non-exhaustive, encompassing the main activity i.e., rotational grazing and other subsidiary activities promoted across various project locations throughout the project's crediting period. Beyond rotational grazing, the project also includes a range of subsidiary activities, such as water management and conservation practices, and other efforts as indicated in the section 1.12. Since each rancher operates as an independent actor within the project, the exact combination of the subsidiary activities/ practices adopted can differ significantly from one rancher to another and is influenced by several factors, including individual land management behaviors, pre-existing soil conditions, hyperlocal weather patterns, and other region-specific variables.

Some of the subsidiary activities listed out below, that have not been adopted in the initial phase are planned to be implemented progressively throughout the project's crediting period. This phased approach allows for flexibility in scaling up project activities, ensuring that practices like water conservation, and biodiversity enhancement are introduced at a pace that aligns with the local context and the readiness of ranchers. By gradually integrating these additional practices, the project aims to facilitate a smoother transition towards comprehensive sustainable grassland management, accommodating the diverse environmental and socio-economic conditions across the project's locations. This strategy maximizes the potential for successful adoption and long-term impact.

Livestock management

It is extremely important to have proper livestock management plans for grasslands. To have sustainable grasslands, the livestock carrying capacity needs to first be assessed and livestock stocking rates adjusted accordingly. Environmental outcomes are largely dependent on better animal stocking rates in the grasslands^{12,13}. In this project, proper livestock management plans are developed with exhaustive consultations with local experts and local pastoralists.

¹² Kemp, David & Michalk, D.. (2007). Sustainable grassland and livestock management. Review. J Agric Sci. The Journal of Agricultural Science. (<https://researchoutput.csu.edu.au/en/publications/towards-sustainable-grassland-and-livestock-management>)

¹³ Maryline Boval, & Dixon, R. M. (2012, May). The importance of grasslands for animal production and other functions: A review on management and... ResearchGate; Elsevier BV. The importance of grasslands for animal production and other functions A review on management and methodological progress in the tropics

Water management

Water management activities include development and distribution of water resources in grassland ecosystems, which regulate soil erosion through flooding, protect water quality and quantity, reduce the impacts of drought, improve infiltration of water, etc. small ponds and water points are the few water management activities promoted in this project. All these activities lead to greater water accumulation, which aids in gradual infiltration of water into the soil¹⁴. The improved soil moisture allows grasses to grow better in these areas than in others. These features are usually made using tractors or with livestock. Water management practices are decided with exhaustive consultations with local experts, based on the grassland topography and water availability.



Figure 2: Water points inside the grasslands

Capacity building programs and trainings

Effective implementation of project activities is possible only when proper awareness has been created among the project participants. Without capacity building activities and trainings, the overall objective of the project cannot be achieved. Hence, with the help of local experts in the region, various trainings are arranged with the local pastoralist communities to sensitize them about the project activities and their advantages.

Multi-species Grazing (Wildlife and Livestock)

Recent ecological research has shown the importance of wildlife in the carbon cycle, highlighting how feedback loops among plants, animals, and diseases have a significant influence upon carbon sequestration and storage (Schmitz et al., 2018; Sitters et al., 2019)^{15,16}. These “zoogeochemical” effects of wildlife are responsible for 10 to 1100%, with a median change of 40%¹⁵ of ecosystem carbon fluxes and storage, depending on the type of ecosystem (Schmitz et al., 2018). This research demonstrates that ecosystem restoration projects not only present an opportunity to conserve biodiversity, but also, they can provide a viable and effective means to sequester carbon and to mitigate the impacts of climate change. It is important to manage grazing of both wildlife and livestock (in this

¹⁴ Sui, Y., Ou, Y., Yan, B., Xu, X., Rousseau, A. N., & Zhang, Y. (2016). Assessment of micro-basin tillage as a soil and water conservation practice in the black soil region of Northeast China. *PLoS One*.

¹⁵ Schmitz, O. J., Wilmers, C. C., Leroux, S. J., Doughty, C. E., Atwood, T. B., Galetti, M., ... & Goetz, S. J. (2018). Animals and the zoogeochemistry of the carbon cycle. *Science*, 362(6419), eaar3213.

¹⁶ Sitters, J., Kimuyu, D. M., Young, T. P., Claeys, P., & Olde Venterink, H. (2020). Negative effects of cattle on soil carbon and nutrient pools reversed by megaherbivores. *Nature Sustainability*, 3(5), 360-366.

Kenya grassland) together to improve grassland health especially in Kenya grasslands¹⁷. Boomitra, along with our implementation partners, works within the cultural frameworks of the local communities and practices of sustainable natural resource management and pastoralism to integrate both wildlife and livestock grazing systems within critical wildlife habitat regions of the project area.



Figure 3: Multi-Species Grazing

Conservation of flora and fauna biodiversity

Recent research has shown that having diversified livestock system results in further biodiversity, both in terms of the species of plants that thrive on the land and in the composition of the soil microbiome,

¹⁷ (Wachiye, S., Pellikka, P., Rinne, J., Heiskanen, J., Abwanda, S., & Merbold, L. (2022). Effects of livestock and wildlife grazing intensity on soil carbon dioxide flux in the savanna grassland of Kenya. *Agriculture, Ecosystems & Environment*, 325, 107713.)

because different livestock species exhibit distinctive feeding modes and preferences, placing a varied grazing pressure on the environment¹⁸. In the context of African savannas, recent ecological research has also shown the importance of wildlife in the carbon cycle, highlighting how feedback loops among plants, animals, and diseases have a significant influence upon carbon sequestration and storage. These “zoo geochemical” effects of wildlife are responsible for 10 to 1100%, with the median change of 40%¹⁵ of ecosystem carbon fluxes and storage, depending on the type of ecosystem¹⁵. The project intends to promote livestock and wildlife diversity in the region through conservation efforts, which will ultimately lead to a positive impact on SOC content in the area. Management plans will be prepared as a part of conservation activities and implemented through continuous stakeholder engagements. These plans recognize that degradation of a conservancy’s natural resources, through declining wildlife populations and lessening of livestock grazing quality, must be reversed through various ways including restocking, reintroduction, habitat management, land-use planning, enhanced security, and a scientific livestock grazing plan that leaves room for abundant wildlife.



¹⁸ The Proceedings of the National Academy of Sciences (PNAS). (2019). Diversifying livestock promotes multidiversity and multifunctionality in managed grasslands.



Figure 4: Community Awareness Creation Programs

The 1st Instance of this project includes ranches from counties of Kenya. The area for the 1st Instance of the project during the time of validation is 9033 hectares. In this project, the enrolled ranchers/pastoralists are following one or more combination of the list of project activities mentioned above and the ranchers/pastoralists of the future instances will also be following one or more combination of the project promotes activities and shall be as per the eligibility criteria per Section 3.6.16(2) and (3), VCS Standard, v4.5.

County	Ranch Name	Suite of Baseline Grazing Practices ¹⁹	Suite of Improved Grazing Practices
Machakos	Lisa Ranch	Continuous grazing (Overgrazing & Overstocking)	Rotational grazing, Livestock management, Promotion of capacity building programs
Machakos	Lukenya Ranch	Continuous grazing	Rotational grazing, Water management, Livestock management
Machakos	Machakos Ranch	Continuous grazing	Rotational grazing, Water management, Livestock management

Table 3: Suite of Improved Grazing Practices

In these lands, there is a single landowner who owns a large parcel of land areas. This land has commercial ranching on board, with good rotational grazing plans and biodiversity practices.

Project Implementation Process

Boomitra, alongside ground implementation partners, will implement the all the project activities listed above throughout the project's crediting period. The initial implementation activities began on 10 January 2019, with the project's first rancher beginning the improved grassland management practice in conjunction with an implementation partner, marking the commencement of fence erecting activities, including tasks such as digging and demarcating paddocks, to enable rotational grazing.

As a part of the project implementation schedule, field procedures will be developed and will be made available during verification. With the help of ground implementation staff, project managers and field staff will monitor all activities to make sure data (adoption of practices, trainings conducted, etc.) is captured correctly and maintained at the partner level either in digital database or physical documents.

The field procedures are developed through exhaustive consultations with pastoralists and are motivated by the latest research. Pastoralists are given training on how to use technical tools for data to be recorded. With the help of ground implementation staff, project managers monitor all the activities to make sure data is captured correctly. The number of livestock grazing in paddocks and the time for which the grazing has been done in given paddocks are recorded. Regular training and awareness creation programs are necessary to improve grazing practices and bring behavior change among the pastoralists. The project developer has developed a generic standard operation procedure to implement the project. As per SOP framework, each pastoralist will prepare a grassland management plan with the help of implementation partner after considering various local variables.

As a part of project MRV process, it has been planned, hereafter to maintain the data in digital formats for easy access. This is possible only with carbon revenues.

¹⁹ A detailed Baseline Practice information is available in Section 3.4.

The overall implementation of the project will be conducted in the following steps:

1. **Initiation and Onboarding:** Identifying the project stakeholders and conducting an exhaustive consultation with ranchers to understand their needs and gather inputs for field procedures. Gathering the latest research findings to incorporate into the project's field procedures. The Technical training materials and tools are developed for recording data to be used during rancher training sessions.
2. **Training & Data collection:** Provide comprehensive training to ranchers on utilizing technical tools for accurate data recording. Monitor field activities with ground implementation staff to ensure correct data capture, specifically focusing on the number of cattle grazing and the duration of grazing in specific paddocks. Data related to baseline practices is captured during this process. Recording and maintaining data on the number of cattle and grazing durations in each paddock is conducted at this step. Conduct regular training programs and awareness campaigns aimed at improving grazing practices and fostering behavior change among ranchers.
3. **Development of Ranch Management Plan and training and capacity building of the ranchers:** Develop a generic standard operating procedure (SOP) for project implementation to guide ranchers. Facilitate each rancher in creating a customized grassland management plan in collaboration with implementation partners, considering local variables. Collaborate with ranch owners to implement their unique rotational grazing schedules. Engage ground partners to advise landowners on best practices and develop tailored practice packages for each ranch.
4. **Monitoring and Control:** Regularly monitor and evaluate the implementation process and its impact on grassland management and cattle grazing practices. Analyze the effectiveness of implemented measures and revise strategies if needed for continuous improvement.

Capacity building programs and trainings

Effective implementation of project activities is possible only when proper awareness has been created among the project participants, i.e., ranchers. Without capacity building activities and training, the overall objective of the project cannot be achieved effectively. These activities help ranchers develop the skills and knowledge necessary to effectively manage their land and livestock. With the impact of climate change becoming increasingly evident, capacity building programs can help ranchers adapt to changing environmental conditions and build resilience to weather extremes and other challenges.

Hence, with the help of local experts in the region, various training sessions are arranged for the local ranching communities to sensitize about the project activities and their advantages

Objectives of the grazing plan

The grazing plans has following specific objectives:

- To enhance harmonious coexistence of human being, livestock and wildlife through intensive grass management and by using traditional pastoralist knowledge

- To establish grass banks for extreme drought conditions.
- To reduced environmental degradation within and beyond conservation areas
- Create access routes for livestock to water points throughout the conservancy. Livestock are watered in natural rivers, individual water ponds, some boreholes and seasonal rivers in the region
- To spread out grazing pressure from livestock and wildlife.
- Reduce human-wildlife conflicts.
- Get economic benefits from the lands through livelihood diversification.

Grazing model

Community landowners graze their livestock in line with the seasons. From the onset of the long rain season, the livestock graze in rotational manners within the open lands (wet season grazing zone), usually between March and August. From August to November, the livestock are grazed within the fenced paddocks (dry season grazing zones). Dry season paddocks are built to withstand predation by carnivores such as lions and hyenas. During the extreme dry season grazing, landowners may buy hay, wheat straws and supplements but no additional paddocks will be rented in or outside the project area during the dry season for the purpose of grazing by the participating ranchers. Before the onset of dry season, the ranchers/pastoralists create forage reserve banks where the paddock is permanently fenced to reserve the fodder for livestock during un-natural circumstances. With the return of the short rains, herders resume grazing their livestock in the unfenced open lands within the conservancy via rotational grazing patterns that are agreed upon communally. In unfenced lands, herding techniques may also be employed to manage the movement of livestock between paddocks. Engaging local herders and communities in the planning and execution of rotational grazing can enhance its effectiveness, as they often have valuable insights into the land's conditions and grazing patterns. Skilled herders also known as rangers are appointed who use their knowledge of animal behavior and landscape features to guide livestock from one grazing area to another. This often involves employing dogs, guiding livestock along natural paths like bunds or natural barriers or using visual markers to direct movement. Effective herding ensures that livestock adhere to the planned rotation schedule, preventing overgrazing in any one area and allowing each paddock sufficient recovery time. These individuals possess an intimate understanding of the land's conditions, such as forage availability, water sources, and seasonal variations. Their insights are taken into consideration in designing of grazing schedules and paddock arrangements that are tailored to local conditions. Additionally, involving the community fosters cooperation and adherence to the grazing plan, as local herders are more likely to be invested in practices that reflect their knowledge and address their needs. Hence, with the knowledge of rangers and natural paths, open lands and communal grazing lands will lead to implementation of improved grazing practices and not lead to overgrazing.



Figure 5: Dry season paddock created in the Naretunoi conservancy

Below table outlines how communities graze their cattle in line with the seasons

Jan - Feb	Mar- April	April - July	Aug - Oct	Nov - Dec
Rotational grazing throughout the open lands of the conservancy (wet season grazing zone)	1. Long rains replenish the grass. 2. Rotational grazing throughout the open lands of the conservancy (wet season grazing zone)	Rotational grazing throughout the open lands of the conservancy (wet season grazing zone)	Livestock grazing in the dry season paddocks.	1. Short rains replenish the grass. 2. Rotational grazing throughout the open lands of the conservancy (wet season grazing zone)

Following guiding principles are agreed by communities to implement above grazing plan.

- The conservancy management will implement best management practice towards creating sustainable and healthy rangelands
- The conservancy will allow conservancy members to graze the cattle in the conservancy in controlled grazing management
- The conservancy management will allow the landowners to fence part of their lands and use for grazing during drylands
- The fenced land should not exceed 50% of the land of the total parcel. 50% or must remain as open grazing land for communal livestock grazing and wildlife.

OBJECTIVES	ACTIVITY	OUTCOME	IMPACT
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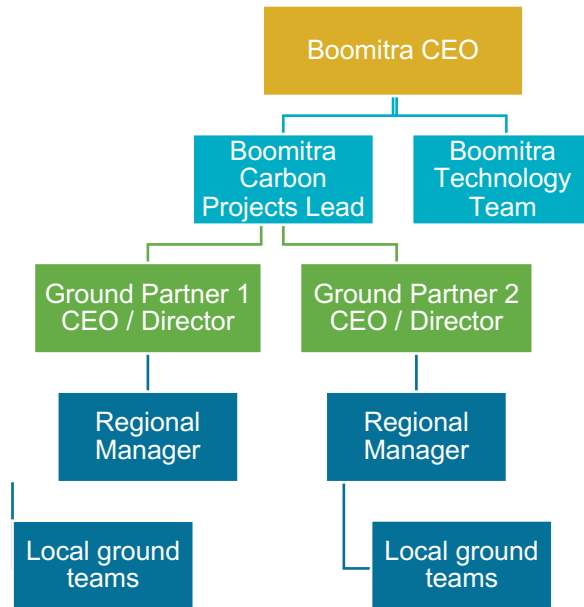
1. To ensure coexistences of human being, livestock and wildlife through intensive grass management	Rotational grazing	Grass cover maintained across the year and the carbon sink	Less degradation
	Community early sensitization forum	Coordinated rotational grazing	Knowledge share on pasture for the season
2. Establish grass bank for all grassers	Encourage removal of fence for open land and communal pasture	Increase movement for both wildlife and livestock	Movement from continuous grazing system to rotational grazing with wildlife
Reduced environmental degradation within conservation areas.	1. Environmental rehabilitation. 2. Through the creation of dry season paddocks.	Increase grass banks	Improved community economy, and reduced need to migrate out of pasture in the dry season
	Development of water management techniques	Increase water points and reduce run-off	Reduce erosion and trampling effects ²⁰

Table 4: Project Results Chain Underlying the Theory of Change Approach

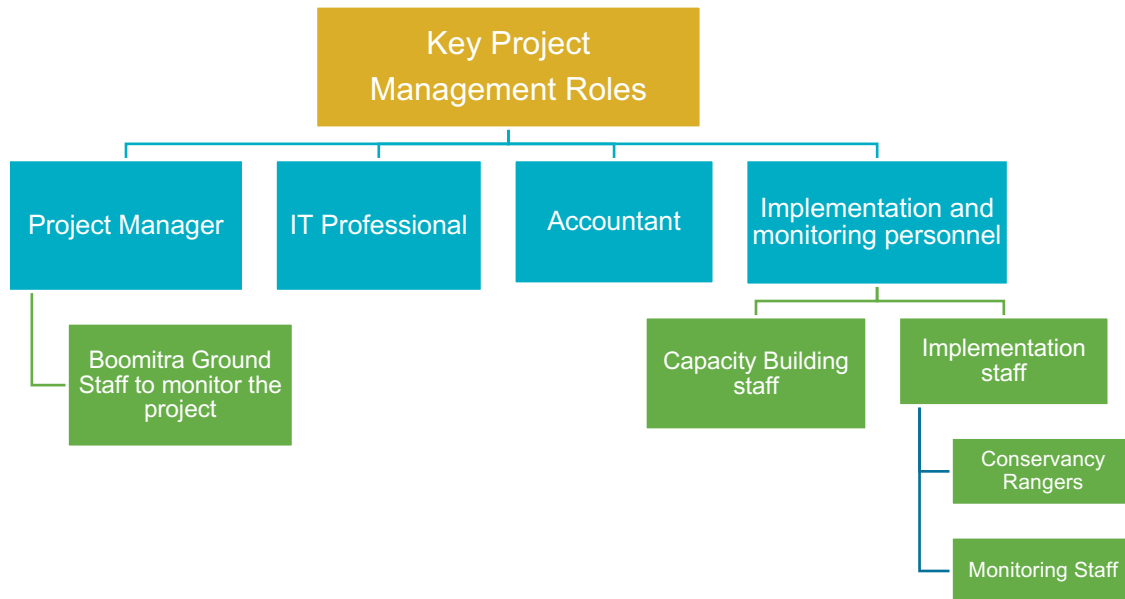
1.12.2 Project organizational setup

The project will operate under the guidance of the Boomitra carbon projects team and technology team, along with our local partners. All technical support will be provided by Boomitra, and ground-level project activities will be executed by our partners in conjunction with Boomitra. Agreements have been made between Boomitra and local partners, clearly explaining the roles and responsibilities of both parties. The following organizational setup has been planned for this project's implementation and monitoring.

²⁰ Dunne, T., Western, D., & Dietrich, W. E. (2011). Effects of cattle trampling on vegetation, infiltration, and erosion in a tropical rangeland. *Journal of Arid Environments*.



Our local ground partners have been working with pastoralists for many years to promote improved land management practices. Boomitra has developed the key technology components required for the project, including the measurement of soil carbon to 50 cm depth and the tools and interfaces for pastoralist enrollment, implementation, and MRV activities.



1.12.3 Jurisdictional REDD+ Programs

This project activity and location are not covered by any jurisdictional REDD+ program.

1.13 Project Location

This is a grouped project encompassing the following countries.

Country: Kenya

This grouped project includes all types of grasslands in Kenya.

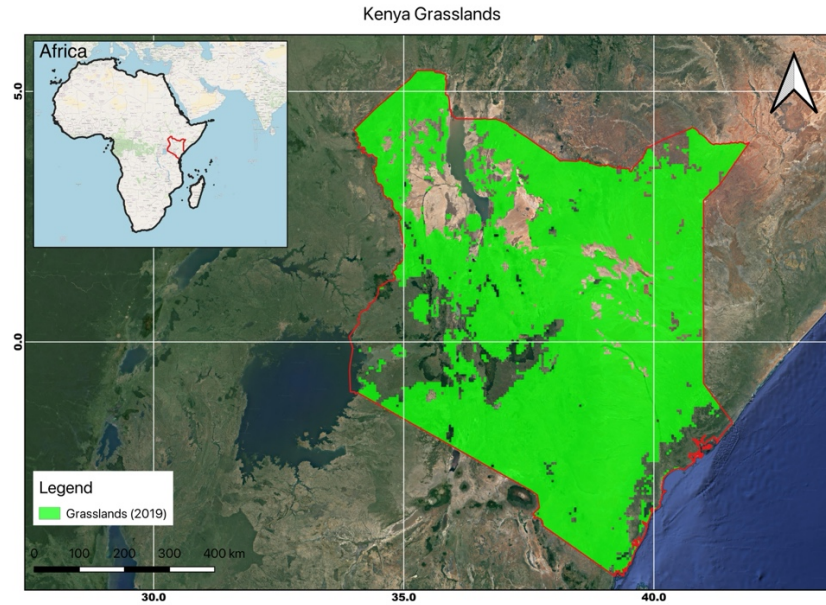


Figure 6: Grouped Project Boundary

The following table outlines the geo coordinates of the grouped project boundary.

Country	Longitude (Min_X)	Longitude (Max_X)	Latitude (Min_Y)	Latitude (Max_Y)
Kenya	33.9102887	41.9060215	-4.6768799	5.41412354

Instance 01 of this grouped project includes the grasslands of the Republic of Kenya.

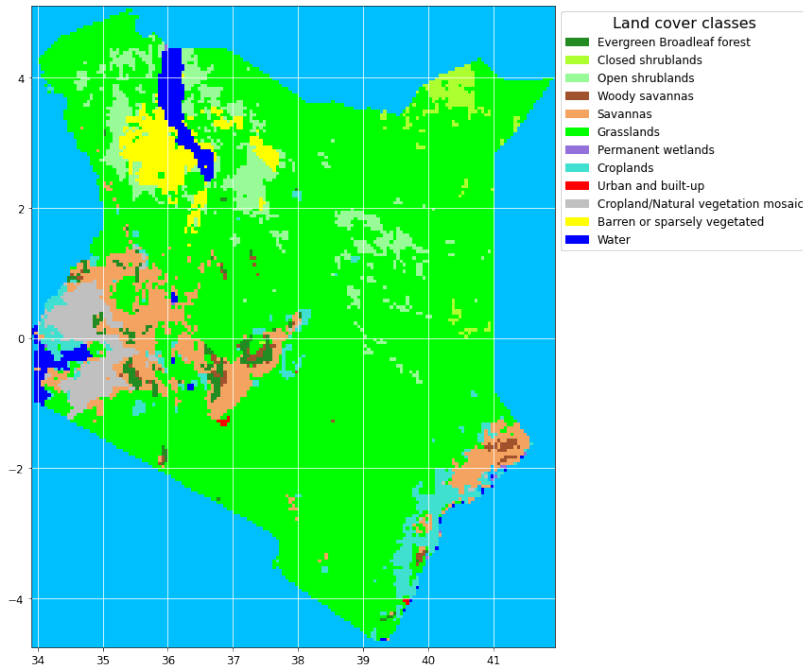
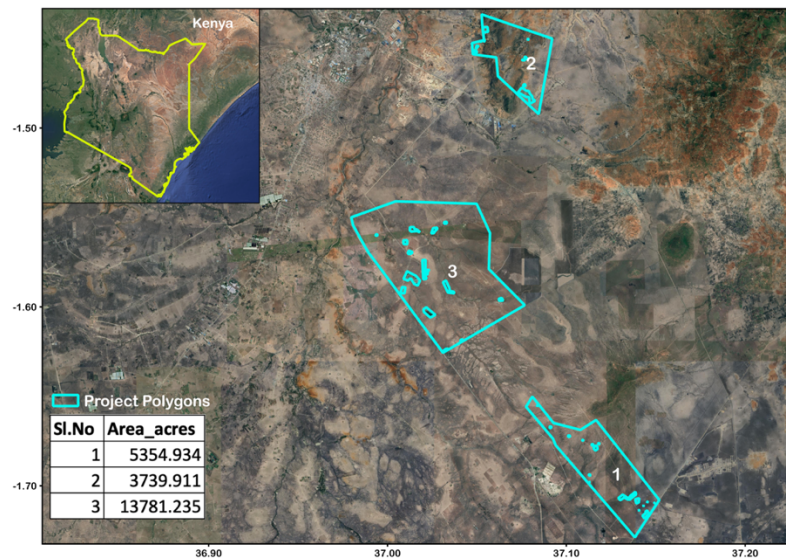


Figure 7: Kenya Grassland Map²¹

Instance 01 project polygon map (at the time of validation)



A GeoJSON with a more detailed set of coordinates is available separately for validation and verification.

²¹ [Nasa.gov,](https://nasa.gov/) 2024, [search.earthdata.nasa.gov/search/granules?p=C2484078896-LPCLOUD&pg\[0\]\[v\]=f&pg\[0\]\[gsk\]=-start_date&q=%20MCD12Q1%20&tl=1634797672!3!!&lat=-0.28125&zoom=0](https://search.earthdata.nasa.gov/search/granules?p=C2484078896-LPCLOUD&pg[0][v]=f&pg[0][gsk]=-start_date&q=%20MCD12Q1%20&tl=1634797672!3!!&lat=-0.28125&zoom=0). Accessed 5 Aug. 2024. product MCD12C1

Boomitra is in discussion with many ranchers/pastoralists who will be the part of this grouped project, spread across many counties (see figure below).

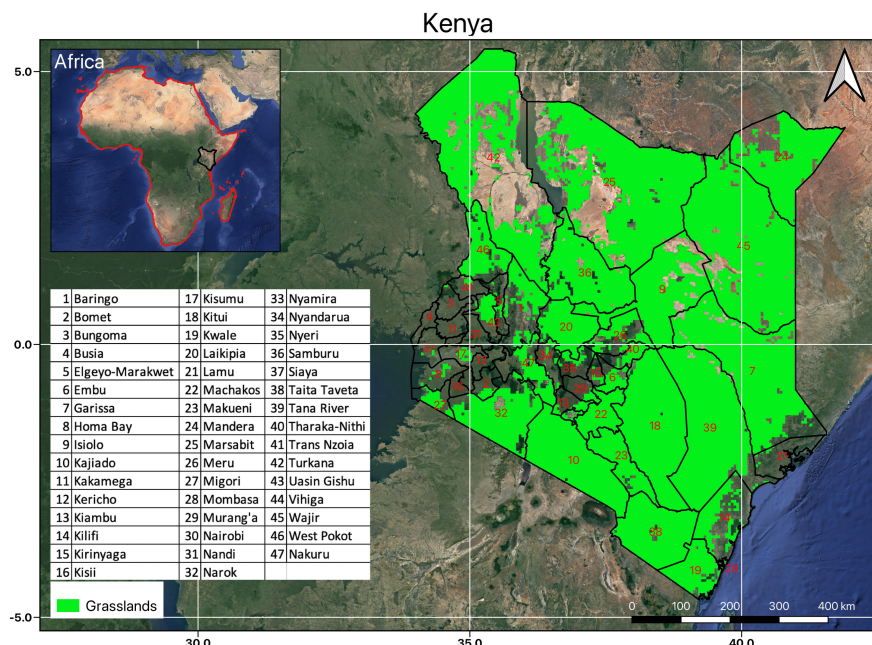


Figure 8: Grassland in Kenya

Note: During the listing of this project, the project boundary included Tanzania and Uganda along with Kenya. But the project boundary has been revised to include only instances from Kenya. This has been revised to adhere to the VCS Standard V4.5, Section 3.6.10 which mentions that geographic areas with no initial project activity instances shall not be included in the project unless it can be demonstrated that baseline scenario and additionality is applicable for such areas. At the time of validation, there is no initial project activity instances included in from Tanzania and Uganda and do not suffice the single baseline scenario and additionality. According to Section 3.6.13 of VCS Standard V4.5, Boomitra has redefined the geographic area such that a single baseline scenario can be determined for the revised geographic area or areas. Hence, the project boundary has been revised to Kenya only.

1.14 Conditions Prior to Project Initiation

The conditions prior to project initiation are the same as the baseline scenario. Please refer to Section 3.4 for detailed information. This project does not have negative impacts on environmental conditions, including climate, hydrology, topography, soils, vegetation, ecosystems etc., so the present and prior environmental conditions of this project are the same. The paragraphs below give a general description of the existing environmental conditions of the region where the project takes place, which cover both the region of first instance and the area of the grouped project locations as mentioned in the section 1.13.

Ecosystem type:

Eastern Africa (which includes Kenya) is characterized as a relatively dry area, with much of the region classified as semi-arid, arid, and hyper arid zones and some wet mountain regions. Kenya is a country with very rich diversified ecological zones and habitats. There are different types of ecosystems, including lowland and mountain forests, wooded and open grasslands, semi-arid scrubland, dry woodlands, inland aquatic, as well as coastal and marine ecosystems²². Nearly 25,000 species of animals and 7,000 species of plants have been identified and recorded in the region²³. This includes 393 mammal species, over 260 reptile and amphibian species, 1,105 bird species, many of which are rare or endangered and over 400 were under threat according to the 2020 IUCN list²⁴. Across East Africa, there are a variety of soil types including volcanic soils (nitisols), which are found on volcanic foot slopes such as near Mount Kenya have a greater capacity for moisture-storage, red soils (acrisols) which have more clay content resulting in poor porosity and lack of nutrient reserves, and black cotton soils (vertisols) that are clay-rich and contain an impermeable layer resulting in very slow drainage²⁵. Water availability and rainfall variability have a large impact on the savannah ecosystem, water security, potential for conflict between neighboring countries, and pastoralists' livelihood. East African countries typically experience a bimodal rainfall which consists of two rainy seasons over the course of the year that can vary wildly. Most often this includes a longer rain period from March – May, and a short rain period from October-December (see Figure: Seasonal Cycle of Rainfall below)²⁶. Over 85% of the land in Kenya is vulnerable to flooding and droughts²⁷. The 1st instance of the grouped project lies in the grasslands of Kenya, classified as Masai Xeric Grasslands and Shrublands.

²² [Convention on Biological Diversity. \(n.d.\). Biodiversity Facts - Kenya. Accessed on 5 Aug](#)

²³ [Kenya Wildlife Service. \(n.d.\). Priority Ecosystems and Species. Accessed on 5 Aug](#)

²⁴ [Ministry of Tourism, Wildlife & Heritage.](#)

²⁵ [Gachene, C. K., & Kimaru, G. \(2003\). Soil fertility and land productivity.](#)

²⁶ [Palmer, P. I., Wainwright, C. M., Dong, B., Maidment, R. I., Wheeler, K. G., Gedney, N., Hickman, J. E., Madani, N., Folwell, S. S., Abdo, G., Allan, R. P., Emily, Feng, L., Maslin Gudoshava, Haines, K., Huntingford, C., Kilavi, M., Lunt, M. F., Shaaban, A., & Turner, A. G. \(2023\). Drivers and impacts of Eastern African rainfall variability. Nature Reviews. Earth & Environment.](#)

²⁷ [Government of Kenya \(GoK\) \(2018\) Ministry of Devolution and ASALs. State Department for Development of the Arid and Semi-Arid Lands: Strategic Plan \(2018-2022\). Government Printer, Nairobi.](#)

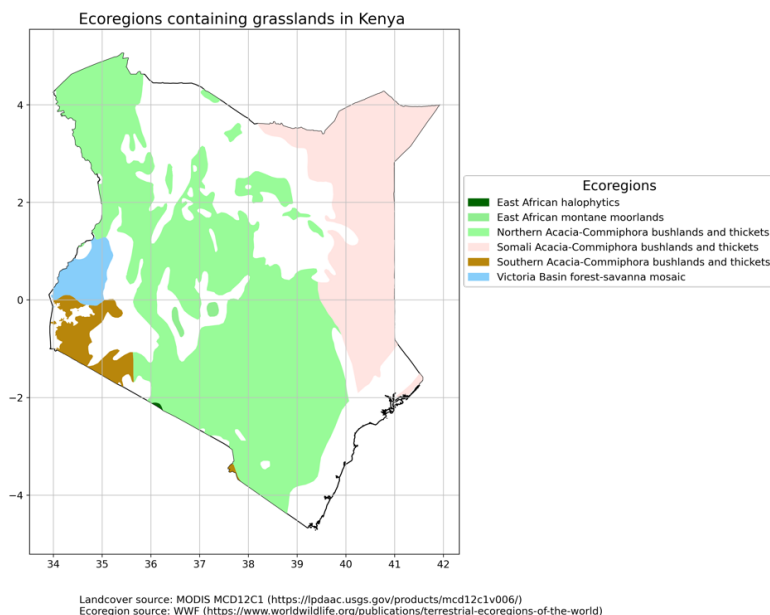


Figure 9: Ecoregions containing grasslands in Kenya

Climate and Rainfall:

The East African region consists of four main climatic zones - tropical/equatorial climate, savannah climate, desert/semi-arid climate, and montane climate. The climatic conditions are shaped by the region's varied topography and three significant climatic phenomena: the Inter-Tropical Convergence Zone (ITCZ), the Indian Monsoon, and the El Niño Southern Oscillation (ENSO). These processes have a direct impact on temperatures and notably influence the timing, duration, quantity, and quality of rainfall across the area. Over the past few years, changes in climatic conditions have been observed in the region, with temperatures experiencing an increase of approximately 1.3°C since 1960, averaging a rate of 0.28°C per decade²⁸. The region largely receives bimodal rainfall comprising of long rains (between March and May) and short rains (between October and December). It is observed that between the period of 1983-2021, the trends in short rains ranged from 1.44 to 2.36 mm season⁻¹ yr⁻¹, while long rain trends between 1985-2010 ranged from -0.65 to -2.95 mm season⁻¹ year⁻¹²⁹.

²⁸ "Africa | UNDP Climate Change Adaptation." Adaptation-Undp.org, 2024. Accessed 5 Aug. 2024.

²⁹ Palmer, P. I., Wainwright, C. M., Dong, B., Maidment, R. I., Wheeler, K. G., Gedney, N., Hickman, J. E., Madani, N., Folwell, S. S., Abdo, G., Allan, R. P., Emily, Feng, L., Maslin Gudoshava, Haines, K., Huntingford, C., Kilavi, M., Lunt, M. F., Shaaban, A., & Turner, A. G. (2023). Drivers and impacts of Eastern African rainfall variability. *Nature Reviews. Earth & Environment*.

From: [Drivers and impacts of Eastern African rainfall variability](#)

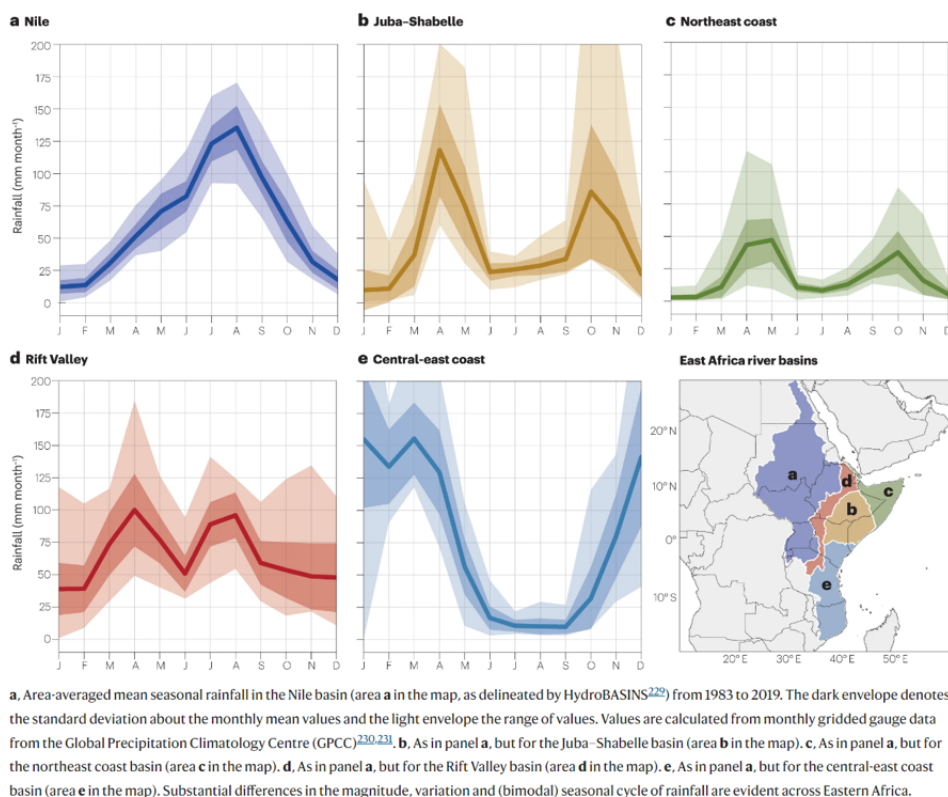


Figure 10: Seasonal Cycle of Rainfall³⁰

Kenya: Kenya has a diverse climate, ranging from arid and semi-arid regions to highland areas with significant rainfall. Due to its diverse topography and subsequent temperature variations, the highlands experience much cooler temperatures than coastal and lowland zones³¹. Seasonal variations in temperature include average temperatures ranging between 18°C at the higher elevations to 26°C along the coast. The mean annual rainfall is 668.6 mm, which varies considerably across the country, less than 250 millimeters (mm) falling in the arid zones of the north, to over 2,000 mm per year in the west annually. Most of the agriculture takes place in the highland areas, which receive approximately 1,000 mm of rainfall each year³².

³⁰ Paul I. Palmer, Caroline M. Wainwright Cardiff University, & Ross I. Maidment. (2023). Drivers and impacts of Eastern African rainfall variability.

³¹ Republic of Kenya (2013). National Climate Change Action Plan, 2013–2017: Vision 2030. Accessed on 5 Aug

³² National Environment Management Authority (2015). Kenya- Second National Communication to the United National Framework Convention on Climate Change.

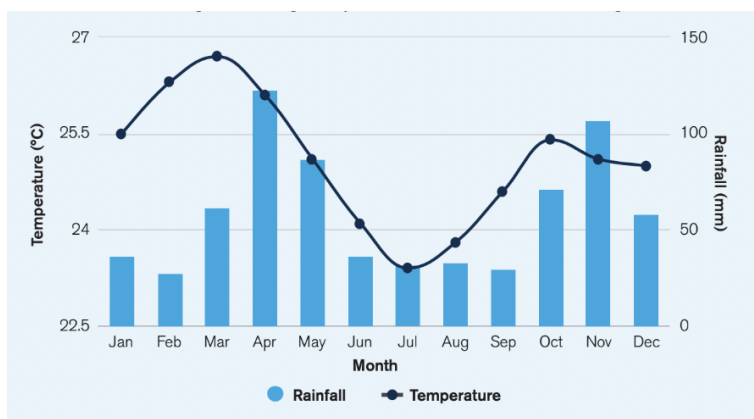


Figure 11: Average Monthly Temperature and Rainfall of Kenya for 1991-2020³³

Hydrology:

The hydrology of Kenya is influenced by the region's geography, climate, and the presence of various lakes and rivers. Here is an overview of the hydrological features and water resources in Kenya.

The hydrological system in Kenya is characterized by a diverse range of water bodies, including rivers, lakes, and aquifers. The hydrological system in Kenya is influenced by various factors, such as climate, topography, and land use patterns. Kenya has several major rivers that play a crucial role in its hydrological system. The most significant river is the Tana River (about 1,000 km)³⁴, which is the longest river in Kenya and provides water for various purposes, including irrigation, hydroelectric power generation, and domestic use. Other notable rivers include the Athi River, Ewaso Ng'iro River, Nzoia River, and Mara River³⁵. Kenya is home to several lakes, both freshwater and saline. Lake Victoria, the largest lake in Africa, forms a significant part of Kenya's western border. Lake Turkana, which is 300 Km long and 50 Km wide, located in the northern part of the country, is the world's largest permanent desert lake³⁶. Other notable lakes in Kenya include Lake Nakuru, Lake Naivasha, and Lake Baringo³⁷. Kenya faces several challenges related to its hydrology. These challenges include water scarcity in arid and semi-arid regions, water pollution from industrial and agricultural activities, inadequate water infrastructure, and the impacts of climate change on water availability and quality³⁸. The government and various stakeholders are working towards addressing these challenges through initiatives such as water conservation, watershed management, and the development of water storage and distribution systems.

Kenya has significant water resources, including lakes, rivers, and groundwater, which play crucial roles in supporting agriculture, hydropower generation, and freshwater supply for human consumption and

³³ [WBG Climate Change Knowledge Portal \(CCKP, 2020\). Kenya](#)

³⁴ [Wikimedia Foundation. \(2023c, July 14\). Tana River \(Kenya\). Wikipedia..Accessed on 5 Aug](#)

³⁵ [Wikimedia Foundation. \(2023a, May 2\). List of rivers of Kenya. Wikipedia. Accessed on 5 Aug](#)

³⁶ [Lake Turkana - The Jade Sea. Siyabona Africa.](#)

³⁷ [World, UNESCO. "Kenya Lake System in the Great Rift Valley." Unesco.org, 2018. Accessed 5 Aug. 2024.](#)

³⁸ [Chemiril Chepyegon, & Kamiya, D. \(2018\). Challenges Faced by the Kenya Water Sector Management in Improving Water Supply Coverage. Journal of Water Resource and Protection.](#)

wildlife. However, challenges such as water pollution, deforestation, and climate change impact the hydrological systems and water availability in the region.

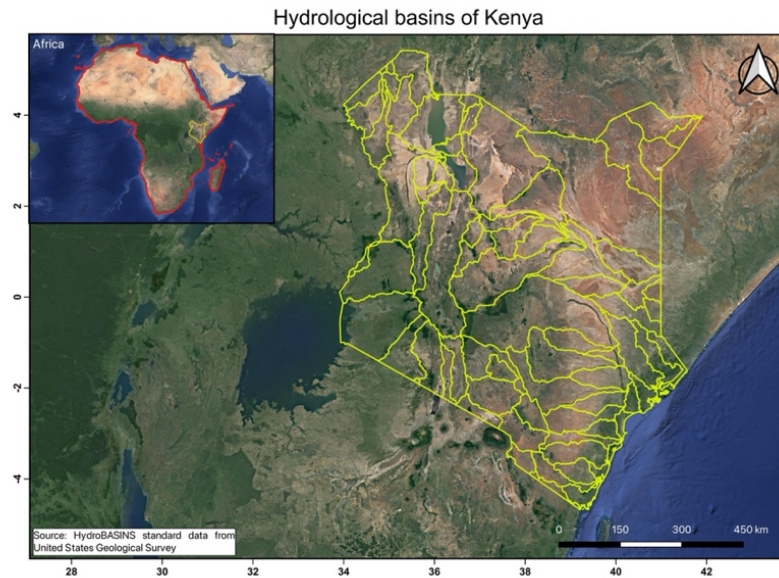


Figure 12: Hydrological Basins Map of Kenya

Topography:

Kenya known for its diverse topography has been divided into four main topographic regions. The Great Rift Valley is a prominent feature that runs from north to south, characterized by volcanic mountains, lakes, and deep valleys. The Central Highlands, located in the central part of the country, consist of rolling hills and plateaus, with Mount Kenya, the highest peak, situated in this region. The Eastern Plateau, found in eastern Kenya, is a relatively flat and arid area, including parts of Tsavo East and Tsavo West National Parks. Along the Indian Ocean, Kenya has a narrow coastal strip with beautiful sandy beaches, mangrove forests, and coral reefs³⁹.

³⁹ Wikipedia Contributors. "Geography of Kenya." Wikipedia, Wikimedia Foundation, 12 June 2024, en.wikipedia.org/wiki/Geography_of_Kenya. Accessed 5 Aug. 2024.

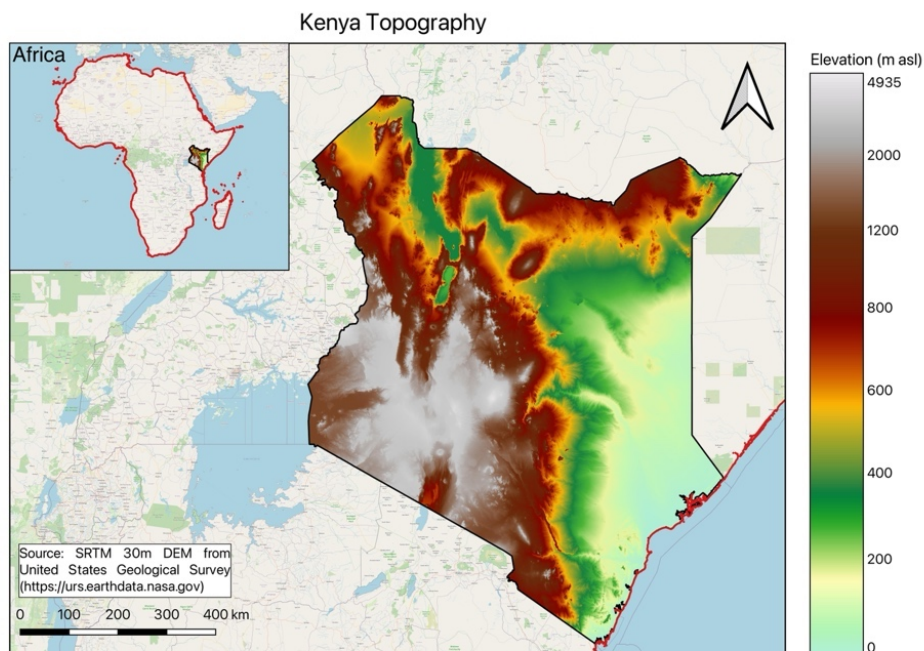


Figure 13: Topography Map of Kenya

Soils:

Kenya exhibits a range of soil types due to its diverse landscapes and geological variations. The most prevalent soil type is red soil (Ferrasols), characterized by its red color, fertility, and good drainage, predominantly found in the central and western highlands. Black cotton soil (Vertisols), rich in clay and moisture-retention capacity but challenging for agriculture when dry, occurs in parts of western Kenya, the Rift Valley, and Nyanza. Sandy soil (Arenosols), with low water-holding capacity, is common in arid and semi-arid regions like northern and eastern Kenya. Loam soil (Luvisols), a balanced mixture of sand, silt, and clay, offers good drainage and fertility and can be found in various parts of the country. Volcanic soil (Andosols), originating from volcanic ash and lava, is highly fertile and prevalent in areas of volcanic activity, such as the Rift Valley and western Kenya. Finally, peat soil (Histosols), with high water content and low oxygen levels, is present in swampy and wetland regions, including the Lake Victoria basin and the coastal areas⁴⁰.

⁴⁰Omuto, C. T. (2013, January 1). Chapter 11 - Major Soil and Data Types in Kenya (P. Paron, D. O. Olago, & C. T. Omuto, Eds.). ScienceDirect; Elsevier.

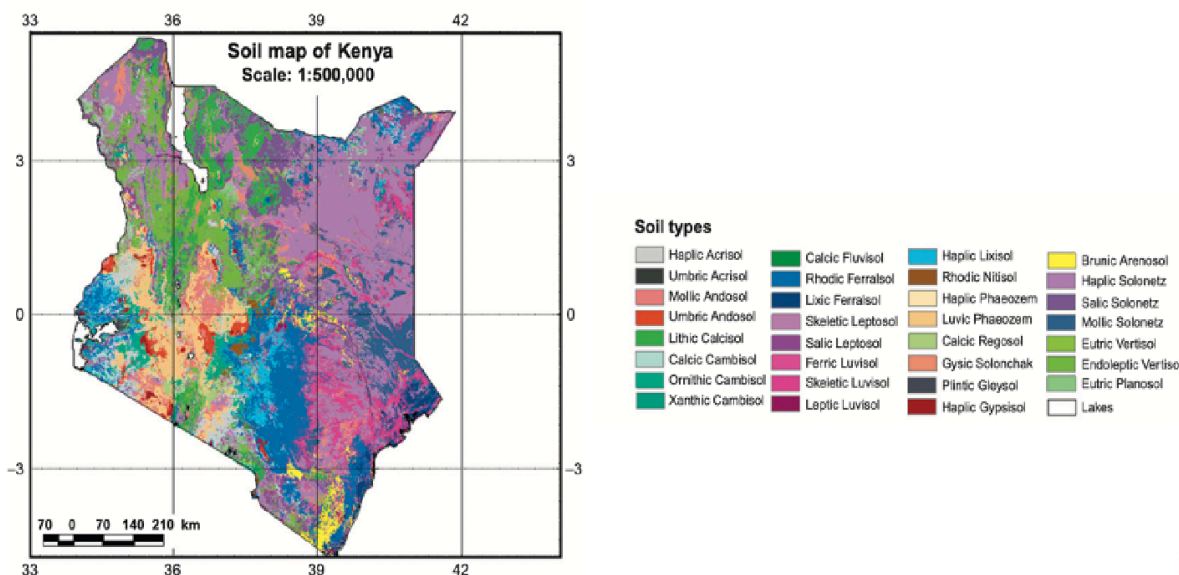


Figure 14: Dominant Soils of Kenya⁴⁰

Vegetation:

Kenya is a country with very rich diversified ecological zones and habitats. There are different types of ecosystems, including lowland and mountain forests, wooded and open grasslands, semi-arid scrubland, dry woodlands, inland aquatic, as well as coastal and marine ecosystems⁴¹. Nearly 25,000 species of animals and 7,000 species of plants have been identified and recorded in the region²³. Kenya is a country with diverse flora and fauna. Its landscapes range from the vast savannahs of the Maasai Mara and Amboseli National Parks to the dense forests of Mount Kenya and the coastal regions. The flora includes iconic acacia trees, baobabs, and various grasses that thrive in the different ecosystems. Kenya is renowned for its wildlife, with numerous species of mammals, such as elephants, lions, cheetahs, giraffes, zebras, and rhinos. The country is also home to over 1,000 bird species, making it a paradise for birdwatchers. In addition to the large mammals, Kenya's forests and wetlands support a rich diversity of smaller animals, including primates, reptiles, amphibians, and insects, making it a haven for biodiversity enthusiasts. The following image is the agroclimatic zone map of Kenya published by the Kenya Soil Survey, carried out by the Kenyan Ministry of Agriculture.

⁴¹ Convention on Biological Diversity. Biodiversity Facts - Kenya. Retrieved from "Main Details." Cbd.int, 2014. Accessed 5 Aug.

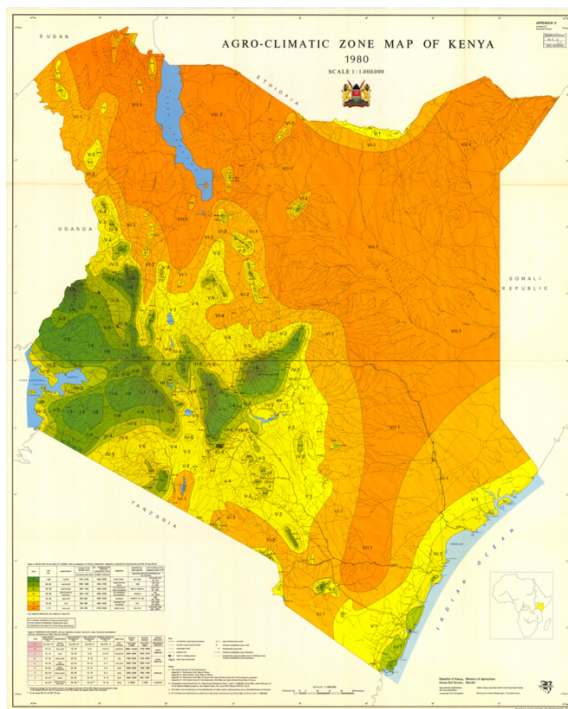


Figure 15: Agro-Climatic Zone Map of Kenya⁴²

The majority of grasslands in Kenya fall under the category of "savanna" ecosystems. Savannas are characterized by a combination of grasses and scattered trees or shrubs. Kenya has a wide variety of soils. Soils vary from sandy to clay, shallow to very deep and low to high fertility.

Current and historical land-use:

African grasslands, also known as African savannahs, are vast expanses of open grassy plains that cover a significant portion of the African continent. They are renowned for their iconic landscapes, rich biodiversity, and unique ecological characteristics. African grasslands are found across several countries in Africa but are predominantly in East Africa. In this project, we help pastoralists in deploying practices that contribute to the sustainable development of the Savanna grasslands of East Africa. The pastoralists of this region have largely resorted to implementing traditional grassland management methods on their lands.

The current land use scenario includes continuous exploitation of grasslands by overgrazing and higher livestock stocking rates acre-wise than the lands can handle in the region. Instance 01 of this grouped project is in Kenya and consists of native grasslands. These native grasslands were once fertile and home for various flora and fauna species but are now facing serious threats due to overgrazing by both wildlife and livestock, improper land management and high animal stocking rates. Overgrazing and trampling of savanna grasslands has become common, and this both reduces the ability of water to infiltrate the soil as well as exposes the soil to more direct sunlight – all of which negatively impact the metabolic activities

⁴² "Agro-Climatic Zone Map of Kenya. Appendix 2 to Report No. E1. - ESDAC - European Commission." Europa.eu, 2018. Accessed 5 Aug. 2024.

of microbes and plant roots and contribute toward baseline land degradation. Historically pastoralists by tradition, communities have become increasingly sedentary over the past few decades given changes in land policy/land tenure system and subdivision and a shift away from group management and ownership of land. Before the project implementation, there was no communal management of the land. Landowners operated as individuals, and typically did not allow for others to graze livestock on their land. This has resulted in continuous grazing patterns (overgrazing) across the pastures in the region, and consequently, the lands got degraded and wildlife conflicts started increasing. Increased grazing can eventually lead to loss of vegetation and grass cover, which in turn affects the carbon and nutrient allocation to soil organic matter. Land that is overgrazed becomes prone to colonization by undesirable and invasive plant species, which further reduces plant diversity and replaces perennial grasses⁴³.

Decades of unsustainable overgrazing by livestock in the region has resulted in excessive soil erosion, loss of Soil Organic Carbon (SOC), biodiversity and ecosystem services⁴⁴. In addition, high livestock stocking rates have also led to vegetation loss and resultant SOC loss^{45,46}.

Pastoralist communities in the region do not have enough capabilities to implement sustainable grazing practices on their own. As discussed in section 1.1, the grassland soils have degraded due to unsustainable grazing management practices in the region. Through this project, Boomitra along with the implementation partners on ground, is trying to contain further degradation and improve overall soil fertility of grasslands.

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

The proposed project is in full compliance of all applicable legal and regulatory requirements imposed by local, state, national and international policies. Further to this, there are no rules or regulations mandating the adoption or avoidance of any of the project activities in an enforceable manner.

The proposed project activity adheres to the following laws:

Kenya

⁴³ Kimiti, D. W., Hodge, A. M. C., Herrick, J. E., Beh, A. W., & Abbott, L. E. (2017). Rehabilitation of community-owned, mixed-use rangelands: Lessons from the Ewaso ecosystem in Kenya. *Plant ecology*, 218, 23-37.

⁴⁴ Bardgett, R. D., Bullock, J. M., Lavelle, S., Manning, P., Schaffner, U., Ostle, N., ... & Shi, H. (2021). Combatting global grassland degradation. *Nature Reviews Earth & Environment*, 2(10), 720-735.

⁴⁵ Mirzabaev, A., Wu, J., Evans, J., García-Oliva, F., Hussein, I. A., Iqbal, M. H., ... & Wertz, M. (2019). Desertification.

⁴⁶ (Wachiye, Sheila, et al. "Effects of Livestock and Wildlife Grazing Intensity on Soil Carbon Dioxide Flux in the Savanna Grassland of Kenya." *Agriculture, Ecosystems and Environment*, vol. 325, 2022.)

Relevant Law and its Description	Project Compliance
Article 42 of the Constitution of the Republic of Kenya stipulates the right of individuals to a clean and healthy environment. It further enforces the right to protection of environment for present and future generations ⁴⁷ .	The project does not jeopardize the health of the environment or its communities. Contrary through the implementation of proposed project activities, land degradation will be mitigated, promoting better development of the environment. The continued adoption of sustainable practices will prove beneficial for generations to come.
Under Article 69 of the Constitution of the Republic of Kenya, the following is stated ⁴⁷ : 1. Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits 2. encourage public participation in the management, protection and conservation of the environment 3. eliminate processes and activities that are likely to endanger the environment	The project activity ensures the sustainable development of land and environment. In mobilizing the pastoralists to adopt controlled grazing, the pastoral communities are actively involved in conservation efforts. This in turn leads to a decline in overgrazing, and thus an elimination of detrimental activities is made possible.
Kenya's Climate Change Act of 2016 promotes a framework of action in line with low carbon and developing an economy with reduced emissions of greenhouse gases. ⁴⁸	The project activity will facilitate sequestration of carbon in the soil, resulting in reduced emissions in the atmosphere.
Convention on Biological Diversity (CBD), 1992: The CBD's goals include the conservation of biodiversity, sustainable use of biological resources and equitable sharing of benefits arising from their sustainable use. Kenya ratified this convention in 1994. ⁴⁹	The project complies with this convention by promoting sustainable management of grasslands and their resources, thus improving the livelihood of dependent communities.
Kenya is a signatory state to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The convention regulates the international trade of endangered species of wildlife in the region. ⁵⁰	The project activity has no negative impact on any wild fauna and flora. The project will pave way for improved grasslands through carbon sequestration, which will also prove beneficial for the grazing of wildlife. It will thereby contribute to the overall biodiversity of the region.

⁴⁷ Kenya Law. (n.d.). Constitution of Kenya. Accessed 5 Aug. 2024.

⁴⁸ Kenya Gazette Supplement. (2016). The Climate Change Act. Accessed 5 Aug. 2024.

⁴⁹ Mita Manek. (2001). The Implementation of Biodiversity-Related Conventions. Accessed 5 Aug. 2024.

⁵⁰ "CITES IMPLEMENTATION DEPARTMENT | Kenya Wildlife Service." Kws.go.ke, 2022. Accessed 5 Aug. 2024.

Relevant Law and its Description	Project Compliance
The International Convention on the Elimination of All Forms of Racial Discrimination works for the protection and enforcement of the right against racial discrimination. ⁵¹ This was ratified by Kenya in 2001. ⁵²	The project activity does not violate the mandates of the convention.
The Stockholm Declaration of the United Nations Conference in Human Environment (1972), mandates creating development plans that incorporate science and technology to reduce environmental degradation ⁵³ . Kenya is one of the parties in the convention.	The project activity is in compliance with the convention. The reduction of carbon emissions into the atmosphere and subsequent sequestration in the soil will significantly decrease environmental degradation.

Table 5: Project's Compliance with Laws, Statutes and Other Regulatory Frameworks

Apart from the above, the project complies with all international laws regarding child labor, corruption and human rights. No activity in the project violates the above-mentioned laws.

Kenya has submitted its Nationally Determined Commitments (NDCs) to the UNFCCC, in which it has committed to reduce 30% of greenhouse gas emissions (GHG) by 2030 as compared to the baseline business-as-usual scenario (BAU). Additionally, it has committed a reduction of up to 32% of GHG emissions by 2030 compared to the BAU scenario. Economic activities included in the NDC include rain-fed agriculture, water, energy, tourism, wildlife, land use, land use change and forestry and health⁵⁴. To achieve committed goals, Kenya has planned to improve and adapt energy efficient solutions across the sectors. Encouraging sustainable farming, agroforestry, and various conservation methods constitute key measures anticipated by the government. Additionally, the government aims to enhance its policies and strategies through significant efforts in REDD+ projects.

The proposed project has a robust mechanism to identify each, and every parcel of land associated with the project to avoid any double counting of project carbon credits.

1.16 Double Counting and Participation under Other GHG Programs

1.16.1 No Double Issuance

⁵¹ [Audiovisual Library of International Law. \(n.d.\). International Convention on the Elimination of All Forms of Racial Discrimination.](#)

⁵² [Ohchr.org, 2024, tbinternet.ohchr.org/_layouts/15/TreatyBodyExternal/Treaty.aspx?CountryID=90&Lang=EN. Accessed 6 Aug. 2024.](#)

⁵³ [United Nations Environment Programme.\(n.d.\). Environmental Law Guidelines and Principles- Stockholm Declaration.](#)

⁵⁴ [NDC Kenya. UNFCCC. \(2020, December 24\).](#)

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.16.2 Registration in Other GHG Programs

Is the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

This is a grouped project. This grouped project is neither registered in any other GHG program nor going to register or participate in any other GHG Programs other than VCS. All new project instances to be added to this grouped project are required to demonstrate whether the project was part of any other GHG program.

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

The project has not been submitted to any other GHG Programs and has not been rejected by any other GHG programs.

1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

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

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

☐ Yes ☒ No

The project neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.17.2 No Double Claiming with Other Forms of Environmental Credit

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

☐ Yes

☒ No

This project neither has nor intends to seek or receive another form of GHG related environmental credit including renewable energy certificates or any other environmental credits.

1.17.3 Supply Chain (Scope 3) Emissions

The main occupation of the project pastoralist is livestock rearing and wildlife preservation. As per the early conversation (after the release of VCS standard V4.5) with the pastoralist, we have noticed that most of the project pastoralists sell to local buyers who visit the rancher lands directly. These buyers sell these livestock to multiple butcher units across the country, about which the pastoralists do not have any clear information.

In order to prevent any double counting of credits, Boomitra will keep an eye on the supply chain engaged in the entire process and will take the appropriate action by sending an email notifying about the project and the connected VCUs with it.

As per VCS requirements, Boomitra has posted a public comment⁵⁵ saying VCUs may be issued for the greenhouse gas emission reductions and removals associated with its projects on the website.

1.18 Sustainable Development Contributions

Kenya has adopted a national strategy to achieve all 17 SDG goals established by the United Nations in 2015 to address a wide range of social, economic, and environmental challenges facing the world. Each goal has specific targets and indicators to measure progress. These goals aim to achieve a more sustainable and equitable future for all by the year 2030. Since 2015, Kenya has taken various initiatives to achieve SDGs. Government and partners use targeted awareness creation and sensitization strategies through focus group discussions, sensitization forums, workshops, and discussion panels. Similarly, social media communication platforms are continuously used to disseminate SDGs to the public. The 2017 VNR identified low level of awareness on SDGs and a countrywide assessment was undertaken in 2019. This informs awareness campaign strategies, development and distribution of targeted IEC materials including translating SDGs into local languages⁵⁶.

This project contributes both directly and indirectly to the mentioned thematic areas.

The grouped project contributes to the following SDGs. The below table explains about the parameter selected from each of the goals and the project impact on that particular goal.

⁵⁵ "Grassland Restoration in East Africa through Soil Enrichment - Boomitra." Boomitra, 12 June 2024, boomitra.com/projects/boomitra-grassland-restoration-in-east-africa-through-soil-enrichment/. Accessed 6 Aug. 2024.

⁵⁶ "Kenya ... Sustainable Development Knowledge Platform." Un.org, 2022, sustainabledevelopment.un.org/memberstates/kenya. Accessed 6 Aug. 2024.

SDG Goal	Thematic area covered	Chosen Parameter	Project Impact
	1. Equality and inclusion, 2. Prosperity and innovation, 3. Green economy and climate change,	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.	The project activity improves soil quality by increasing Soil Organic Carbon (SOC). Higher SOC content leads to better productivity and improved soil fertility, making agricultural production more climate resilient.
	Green economy and climate change	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Increases in soil organic matter improve soil aggregates and structural stability, which help water infiltration into the soil by increasing soil aeration. This reduces excess runoff.
	1. Prosperity and innovation, 2. Green economy and climate change,	8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	The project provides employment to local communities during the implementation and monitoring process
	Green economy and climate change,	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	The project promotes sustainable grassland management practices in the project area, thereby removing CO ₂ from the atmosphere.
	Green economy and climate change,	15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and	Through rotational grazing practices, vegetation is allowed to grow and stay on the ground for more time, thereby allowing for

SDG Goal	Thematic area covered	Chosen Parameter	Project Impact
		floods, and strive to achieve a land degradation-neutral world	degraded grasslands to be gradually restored, and reversing desertification.

Table 6: Sustainable Developmental Goals identified for this project

1.19 Additional Information Relevant to the Project

1.19.1 Leakage Management

Grouped Project

Each new project instance will demonstrate that it has applied the leakage management conditions required by the methodology. If leakage is not relevant to the project activity instance, this shall be justified in the project description.

First Instance 01

There are no direct or indirect leakages expected from this project activity. The proposed activity is completely in-situ in nature, which does not contribute to indirect leakages or new emissions elsewhere. As clearly described in the project activity description section of the PDD, the activity proposed is purely to bring a behavioral change in the practices followed in the baseline. The project scenario does not involve any such activity that leads to new emissions elsewhere.

1.19.2 Commercially Sensitive Information

All information contained in this grouped project description document is not confidential and is available for stakeholders. However, information about commercials involved in project development, implementation and some of the procedures (financial audit reports, businesses forecasting model, etc.) may include commercially sensitive information because of the company's business activity.

Full information on internal procedures were shared with the VVB for auditing purposes, who can testify that all relevant information is present under this Project Description.

1.19.3 Further Information

There are no additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the grouped project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

Grouped Project

Local stakeholder consultations are undertaken at the level of the grouped project. As per the VCS Standard V4.5 requirement, local stakeholder consultations have been conducted across the project location. Boomitra has devised a robust grievance mechanism (explained in detail in the below sections), which allows stakeholders to raise concerns about potential negative impacts or stakeholder grievances during project implementation.

All stakeholder consultations will:

1. Provide a non-technical project summary either on pamphlet or on electronic format to the stakeholder. The summary document contains information on project activities, the geographical location of the project, contributions to sustainable development, and key benefits to local communities.
2. Describe the grievance mechanisms available
3. Describe risks, costs and benefits the project may bring to local stakeholders
4. Publicize the date, time and place of consultation (if consultations are planned as group consultations)
5. Solicit feedback from stakeholders either on a physical form or through electronic media
6. Receive stakeholders' consent and gauge their willingness to participate in this project
7. Inform stakeholders of the process of VCS Program validation and verification, and the validation/verification body's site visit.

Stakeholder consultations also include ex-ante and ex-post surveys. Sampling is not necessary for this project since we are planning to meet 100% of ranchers/pastoralists within the project area. As a part of an ongoing consultation process and communication with local stakeholders, Boomitra, with the existing project management structure, is developing various digital platforms to provide information to stakeholders, help with implementation and monitoring, and organize capacity-building activities. Boomitra, in collaboration with the region's implementation partners, has conducted baseline surveys and several one-on-one consultations with the project participating ranchers and other stakeholders. These are the primary tools for stakeholder engagement and consultation. Local stakeholder consultations have already been completed. Detailed FPIC procedures are followed before conducting large-scale meetings with the communities. Rancher/pastoralist communities expressed their

willingness to participate in this project. All the FPIC documentation is available for VVB during the validation.

As per the VCS standard, all the relevant stakeholders likely impacted by the project are consulted. Feedback forms were incorporated at the end of every consultation session. Initially, partners and the Boomitra team had one-on-one interactions with the ranchers to communicate the project details. These one-on-one consultations are ongoing throughout the project's lifespan.

Our implementation partners have devised the management plan for each ranch in consultation with experts. So, the consultations are ongoing activity which are conducted regularly along with awareness creation programs. To maintain ongoing communication with local stakeholders, Boomitra has devised a mechanism where all stakeholders can express their concerns through grievance mechanisms, which are discussed below in Section 2.1.4. In case of any grievance, concern, or input regarding the project, the participating ranchers can directly contact Boomitra or partner organization project personnel. Registers are placed at the partner organization to document stakeholder input, feedback, and concerns throughout the project's lifecycle. The implementation partners may conduct regular site visits, which provide an opportunity for stakeholders to ask questions, provide feedback, and witness the project's impact. Hence, the consultations with the project ranchers are continuous and ongoing throughout the project cycle.

The project will ensure conducting the local stakeholder consultation meeting for every new instance of pastoralists/ranchers added to this project to explain about the carbon project and get their consent for the project.

Instance 01

The stakeholder meetings are conducted as per VCS standard requirement. As per the VCS standard 4.5, section 3.18, all the relevant stakeholders likely impacted by the project are consulted. To facilitate ranchers/pastoralists and other stakeholders to join from different locations, the meeting was held virtually through zoom platform. The meeting was conducted through a virtual platform i.e., Zoom Platform accessible to facilitate the below identified stakeholders identified to attend the consultation from different locations.

The primary stakeholders of the project, i.e., the project ranchers/pastoralists, were invited in person and via telephone calls. Additionally, the implementation partners sent invitations via email. All other secondary stakeholders, such as the local communities excluding the specific ranchers directly involved, have been invited for meetings through local newspapers, email invitations, etc. A list of invitations, meeting evidence and the minutes of the meeting is provided in Appendix 02 of this PD. Most secondary and the tertiary stakeholders, including the Local authorities, including the Designated National Authority (DNA), were informed about this project with formal invitations via email communications. Local NGOs and academics were also invited via email invitations to provide their opinions about the project. All stakeholder groups identified in Section 2.1.1 have been invited and adequately represented in the meetings and consultations conducted by Boomitra to date, in compliance with Section 3.18 of the VCS Standard v4.5. Stakeholder meeting information is provided in detail in Appendix 2.

Baseline surveys, incorporating questionnaires, were conducted one-on-one with the ranchers and the partners. The analyzed results are also presented in the baseline scenario, Section 3.4 of this PD. All ranchers who are primary stakeholders and are directly impacted by this project have been individually contacted. 100% of the project-participating ranchers have taken part in all the surveys conducted to date, there are totally 3 participating ranches in the PAI 01 of this project.

2.1.1 Stakeholder Identification

Stakeholder Identification	All the relevant stakeholders are identified through a collaborative process involving Boomitra and implementation partners on the ground. The following table outlines the stakeholders identified for this project.		
	Primary Stakeholders	Secondary Stakeholders	Tertiary Stakeholders
	Pastoralists/ Ranchers	- Local authorities - DNA of the country - NGOs - Research Institutes - Local experts	- Policymakers - Government institutions - Media
	All relevant stakeholders were invited to the stakeholder meeting. Please see annexure 2 for more information.		
Legal or customary tenure/access rights	All the lands included in this project belong to individual pastoralist/rancher. There are no stakeholders, indigenous people (IPs), local communities (LCs) and areas outside the project area are impacted by this project.		
Stakeholder diversity and changes over time	As discussed in the ownership section, all lands included in this project are free from any conflicts as of now. There are no other substantial social, economic or cultural differences within the pastoralist/rancher communities. All the lands included in this project belong to individual pastoralist/rancher having similar social, economic, and cultural diversity in the region. No changes foreseen in this project.		
Expected changes in well-being	As discussed in Section 1.18, this project contributes to several SDGs. economic conditions are improved over time by carbon finance and rancher/pastoralists have access to sustainable grazing		

	practices through proper capacity building, thereby improving soil health and crop productivity.
Location of stakeholders	Not applicable as there are no location of stakeholders, IPs, LCs, and customary rights holders, and areas outside the project area that are predicted to be impacted by the project
Location of resources	All the lands included in this project are individually owned lands. There are no lands or territories and resources which stakeholders own or to which they have customary access in this project.

2.1.2 Stakeholder Consultation and Ongoing Communication

Date of stakeholder consultation	13 th July 2023
Stakeholder engagement process	The Stakeholder Consultation meetings were organized to create awareness about the Kenya Grassland project and its potential environmental benefits while seeking input from relevant stakeholders. The dates and agenda of the meetings were announced much prior to ensure full and effective participation by ranchers, partners, and other stakeholders. All meetings are conducted in the local language, and the materials presented are translated into the local language as well. All the meetings are performed in a culturally appropriate manner, including language and gender sensitivity, directly with local stakeholders or their legitimate representatives when appropriate. Although most participating ranchland owners are males, a concerted effort was made to include female members, especially during the presentation of the project activities, objectives, and benefits, hence ensuring gender sensitivity. During this meeting, the project details were presented in the local language, Swahili. Stakeholders were provided with information on the project's impacts, benefits, costs, and risks, as well as benefit-sharing mechanisms, monitoring processes, and grievance redressal mechanisms. Stakeholder engagement is facilitated through several methods. These include baseline surveys, feedback forms, and social media interactions on LinkedIn and Instagram. Additionally, bulk SMS messages containing consultation details are sent to stakeholders. At the time of validation, baseline survey was done for all the participating pastoralists/ranchers of the project to understand the without the project scenario. With the feedback provided by

	stakeholders, Boomitra identifies opportunities for improvement throughout the various stages of design and development of the project, which allows best practices to be implemented and stakeholder expectations to be met. This feedback is recorded internally for future reference in the excel sheets. See appendix 2 for more details.
Consultation outcome	See Appendix 2 for detailed explanation.
Ongoing communication	To maintain ongoing communication with local stakeholders, Boomitra has devised a mechanism where all stakeholders can express their concerns through grievance mechanisms. During the stakeholder meetings, these mechanisms are discussed, along with the risks, costs and benefits the project may bring to stakeholders. With the help of our local partners (Implementation Partners), the process of project which includes registration and issuance, documentation and VVB site visits are explained. As part of the monitoring plan, monitoring personnel visit each rancher/pastoralist at regular intervals to observe and record the project activity status. Rancher/pastoralists are provided with the contact details of project personnel to report any event or to seek any help to implement project activities. Regular trainings are provided to the farmers on project activities and are well documented. See below paragraph in this section, for more details on Boomitra's plan for sustained communication and consultation. Also, as discussed in Section 1.15 of this document, this project complies with all laws and regulations of Kenya, the host country.
Stakeholder input	See appendix 2 for detailed explanation.

Stakeholder Engagement Plan

Boomitra shall communicate and consult with local stakeholders in an ongoing process for the life of the project. Continuous stakeholder consultation involves ongoing efforts to gather input, feedback, and advice from stakeholders throughout the entire project duration. It requires consistent and proactive engagement with stakeholders to ensure their perspectives, concerns, and interests are considered in project decision-making and management. This is not a one-time occurrence but a continuous process that nurtures stakeholder relationships and allows project management to adapt to evolving needs, emerging issues, and updated information. The plan for sustained communication and consultation between Boomitra and communities regarding the project, includes:

1. Developing a communication plan that utilizes various channels such as regular physical and virtual meetings, phone calls, and electronic mails. Project milestone updates will be posted to

the communities and the stakeholders can contact Boomitra or the relevant personnel through the provided contact information.

2. Implementing a Feedback Mechanism: Logbooks and Registers placed at Implementation Partner Organization will document stakeholder input, feedback, and concerns throughout the project's lifecycle. Stakeholders can anonymously write comments or suggestions in these books. Boomitra will regularly check and collect all the comments. The Implementation Partners they may conduct regular site visits. These visits provide an opportunity for stakeholders to ask questions, provide feedback, and witness the project's impact.
3. Regularly reviewing the communication and consultation plan to ensure effectiveness and address the needs of all stakeholders. Revision and improvement will be undertaken as necessary. Adaptive management aims to enhance the efficiency of management strategies over time and increase the likelihood of achieving long-term objectives. Throughout project implementation, Boomitra will adjust the project design as needed, utilizing ongoing communication methods to address potential impacts and risks that may arise in the community over the project's lifetime. These modifications will be based on the project's evolving dynamics.

To maintain ongoing communication with local stakeholders, Boomitra has devised a mechanism where all stakeholders can express their concerns through grievance mechanisms, which are discussed in the below section 2.1.4. During stakeholder meetings, these mechanisms are discussed, along with the risks and benefits the project may bring to stakeholders. Through our local partners, the process of VCS registration and issuance and VVB site visits are explained. As part of the monitoring plan, monitoring personnel visit each ranch at regular intervals to observe and record the project activity status. Pastoralists/Ranchers are provided with the contact details of project personnel to report any event or to seek any help to implement project activities. Regular trainings are provided to the ranchers on project activities and are well documented.

2.1.3 Free Prior and Informed Consent

Obtaining consent

The project's approach aligns with the FPIC requirements as outlined in sections 3.18.7 and 3.18.8 of the VCS Standard v4.5. Boomitra respects stakeholders' rights to participate in and consent to consultations as part of project design and implementation. As outlined in Appendix 2, stakeholder feedback, input, and consent were considered and duly acknowledged by the project throughout all consultations. All participating ranchers have consented to the proposed activities and have been implementing them.

As discussed in ownership section, ranchers/pastoralists enrolling their lands irrevocably assign the right, title and interest to the Greenhouse Gas Reductions and Removals thus generated on their lands during the project to Boomitra. The individuals or entities enrolling their lands disclaim all right, title and interest to any Carbon Credits that may arise from the Land. This is covered by legal agreements with the individuals and/or entities enrolling their lands.

	At the time of validation, since the project operates on privately owned ranchlands in Kenya, and does not involve any indigenous or tribal community groups and their community lands – obtaining FPIC related to community land rights is not required in this case, as community lands are not involved. But in future instances while onboarding the community lands, FPIC process will be followed to obtain consent from the members of the community and the Community Land Management Committee as well adhering to the standard requirements. The Committee leader elected by the community will sign the FPIC consent form and the carbon agreement on behalf of the community. (Please refer the Section 1.8 for more details on the ownership rights.) The project does not infringe upon the property rights of participating ranchers. Legal agreements (enforceable and irrevocable) have been signed between the participating ranchers and Boomitra in accordance with section 3.7.1, point 6 of the VCS Standard v4.5. Prior to signing these agreements, major project details, including scope, activities, duration, outcomes, associated risks, benefits, and the auditing process, were explained comprehensively to the participating ranchers through our implementation partners. The agreement has been signed between the participating rancher and Boomitra. The agreement is available in both English and Swahili and is carefully explained point by point by the field team to ensure full informed consent of the ranchers. Since many carbon projects may be operational in Kenya, the ranchers have been consulted, informed about double-counting of carbon credits, and checked whether the ranch polygons have already been enrolled in another project.
Outcome of FPIC	Ranchers are made aware about the project’s benefits and the process how the project will be carried out under the VCS standard. The agreements were made available to ranchers in the local language so that they understand. The inference we received from this process is that lands included in this project are not encroached and none of the activities involves any relocation of people or communities in this project.

2.1.4 Grievance Redress Procedure

Development process	Boomitra has developed a multi-level grievance redressal model to handle grievances arising during the project cycle. This is one of the
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	key requirements to be met as per global standards. This grievance address mechanism is discussed in all stakeholder consultations and made available to all relevant stakeholders in the project area. All project participants that will be implementing the AFOLU activities need to operate in a synchronized manner in order to take better and effective decisions, and for carbon finance and Boomitra to incentivize actions that are in alignment with national policies and internationally agreed objectives. Achieving the desired results requires adequate support from human resources, including dedicated professional staff at different levels. A mutually accepted Safeguards and Safeguards Information System will be formulated to ensure that AFOLU activities do no harm to people or the environment, mitigate the risks of adverse environmental and social impacts of AFOLU activities, and promote benefits beyond carbon emission reductions.
Grievance redress procedure	This is addressed below.

Boomitra has developed a proper multi-level grievance addressal model to handle any grievances arising during the project cycle. This is one of the key requirements to be met as per global standards. These grievance addressal mechanisms are discussed in all stakeholder consultations and made available to all relevant stakeholders in the project area. All project participants that will be implementing AFOLU activities need to operate in a synchronized manner in order to take better and effective decisions, and for carbon finance and Boomitra to incentivize actions that are in alignment with national policies and internationally agreed objectives. Achieving the desired results requires adequate supporting human resources, including dedicated professional staff at different levels. A mutually accepted Safeguard and Safeguard information System will be formulated to ensure that AFOLU activities do no harm to people or the environment, mitigate the risks of adverse environmental and social impacts of AFOLU activities, and promote benefits beyond carbon emission reductions.

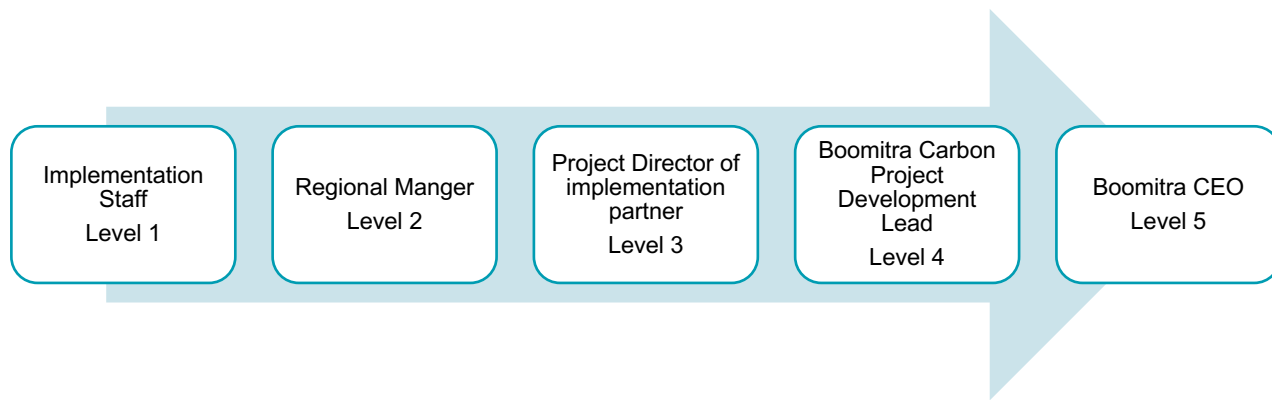


Figure 16: Level-wise grievance mechanism

Figure 16 depicts the level-wise grievance mechanism adopted under this project. Project participant communities will be provided with access to all channels (registers maintained at regional offices/head offices, phone numbers, and emails) available for them to register grievances.

The following table outlines the structure of the grievance mechanism channels available for stakeholders.

Mechanism	Method Chosen (include all known details e.g., location of book, phone, number, identity of mediator)	Justification of Choice (best practice)
Continuous Input / Grievance Expression Process Book	Physical register has been maintained at each implementation partner head office.	During our initial conversations with the ranchers and partners, they suggested that, for grievance redressal, it would also be helpful to maintain a physical register at our partners' office to record any grievances in person. Hence, in case if Ranchers/Pastoralists do not have access to internet or phone can come directly to the office and register their grievance.
Telephone access	EarthAcre Personnal +1 646 244 0686	Pastoralists can call this number to register their grievance.
Internet/email access	info@boomitra.com	Pastoralists who have an internet connection can contact through this method

Table 7: Structure of the grievance mechanism channels for stakeholders.

2.1.5 Public Comments

The project was open to public comments between 02 August 2022 to 01 September 2022. Two comments were received⁵⁷ and addressed during the validation period.

Comments received	Actions taken
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⁵⁷"Kenya ... Sustainable Development Knowledge Platform." Un.org, 2022. Accessed 6 Aug. 2024.

Organization: Laikipia Conservancies Association (LCA) Comment: This morning I was alerted to the listing of Project no 3340 (BOOMITRA GRASSLAND RESTORATION IN EAST AFRICA THROUGH SOIL ENRICHMENT) on the Verra registry. Looking at the submitted KML file, the intended project includes Laikipia Country, which therefore includes all LCA member landscapes. Although we have had a few introductory conversations with the proponent parties, EarthAcre and Boomitra, at no point has the LCA nor its constituent members consented to this project or entered into any agreements that would suggest otherwise.	
Organization: Maasai Mara Wildlife Conservancies Association (MMWCA) Comment: The Maasai Mara Wildlife Conservancies Association (MMWCA) is a membership organisation of the Mara conservancies, with a current membership of 22 Conservancies whose land is part of or integral to the Greater Maasai Mara ecosystem. Additionally, we are a member of the Kenya Wildlife Conservancies Association, contributing to the growth and development of conservancies nationally. Our Conservancies are based on a partnership between the Landowners and Tourism Partners, with MMWCA playing the coordination role. In this regard, we, among other things, work to create a common and unified front for landowners, communities, and tourist partners to strengthen conservancies and create a large-scale impact in the greater Mara Ecosystem. We note that Boomitra seeks to implement a	The discussions are going on regarding the consent of the organisations. Conversations with organizations are ongoing both verbally and via email. This process is ongoing, and updates will follow upon conclusion. Consent from ranchers/pastoralists will be obtained, and official agreements will be signed if they choose to participate in the project. Boomitra will provide the agreements as evidence to showcase the consent of pastoralists. Email evidence has been provided to VVB.

general, high-level grasslands restoration project in Southern Kenya, including Narok County. We wish to inform Verra that MMWCA, its member conservancies and relevant stakeholders in the Greater Mara Ecosystem are collaborating to implement sustainable grasslands management in the landscape. In this regard, we will seek carbon finance to support climate change mitigation goals under the “One Mara Carbon Project”. As we prepare to seek the VCS listing, we note that our identified project area falls within the boundaries of the Boomitra project. Therefore, given that we have secured conservancies stakeholders’ support in our area for our vision, we wonder if the Boomitra project may interfere with our ability to establish a successful, separate project for our land in the future.	
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2.2 Risks to Stakeholders and the Environment

Risks identified		Mitigation or preventative measure taken
Risks to stakeholder participation	No risk identified.	There is no risk identified in participation of stakeholders in the project. All the stakeholders are treated equally and are well informed about the project. The project does not create any negative impact to the livelihoods of community involved. Please refer the Table 8: Risk Assessment and Safeguarding Principles for more details.
Risks to stakeholder resources	No risk identified.	There is no anticipated risk from the project to stakeholder resources. All the property rights are recognized, respected, and supported by the project. The area proposed for this project are under private individual ownership. These lands have clear property title deeds issued by the competent authority in the country. All the lands included in this project are free

		from any litigation. As discussed in ownership section 1.8, ranchers enrolling their lands irrevocably assign the right, title and interest to the Greenhouse Gas Reductions and Removals thus generated on their lands during the project to Boomitra. The individuals or entities enrolling their lands disclaim all right, title and interest to any Carbon Credits that may arise from the Land. This is covered by legal agreements with the individuals and/or entities enrolling their lands. Legal agreements (enforceable and irrevocable agreement) have been signed between the participating ranchers and Boomitra in line with the section 3.7.1, point 6 of the VCS Standard v4.5. There is no observed loss of yield as discussed in section 3.2, project will not result in a sustained reduction of yield greater than 5% I productivity. The project is designed and implemented to avoid trade-off with food security, land loss, loss of yields, negative impacts on livelihoods, and climate change adaptation. This is ensured by carbon finance. The funds generated via carbon revenue can be directed towards developing various infrastructures related to sustainable ranching practice, water collection and storage infrastructure, ultimately enhancing the land productivity, food and water security, thus enhancing the adaptive capacities, resiliency and overall well-being of the ranchers.
Working conditions	No risk identified.	The project provides employment to local communities during the implementation and monitoring process with equal opportunities to all. The HR policy have been put in place to ensure a safe working condition for all the employees. On field staff and the representatives from the partners are also provided with safe and secured work culture.
Safety of women and girls	No risk identified.	Women and vulnerable communities will be encouraged to participate under this project and will be given equal opportunities. The HR policy have been put in place to ensure a safe working condition for all the women employees of the company. We have observed many representatives from the partners to be women of the locality and after consulting the

		representatives, no risk has been identified in the region and working scenario.
Safety of minority and marginalized groups, including children	No risk identified.	None of the activities in this project will impact the safety of minority and marginalized groups including children. Hence no risk is foreseen.
Pollutants (air, noise, discharges to water, generation of waste, release of hazardous materials)	No risk identified.	None of the activities in this project will release any pollutant which hazardous to environment. Hence no risk is foreseen. The project activity proposed under this project does not involve the construction of new buildings or setting up new industry. The core project activity is to promote sustainable grazing practices among the pastoralists. This activity does not generate any local co-pollutants or hazardous materials as a co-product. Sustainable management of grasslands improves soil properties. Increases in soil organic matter improve soil aggregates and structural stability, which help water infiltration into the soil by increasing soil aeration and reducing excess runoff. Due to rotational grazing practices, the plants are allowed to grow and stay on the ground for more time, thereby restoring grasslands and even reversing desertification. In addition, regenerated lands become much less likely to be converted to croplands, and the pastoralists can maintain or improve their livelihoods without resorting to land use change. This will protect and restore biodiversity, by maintaining and improving crucial habitats for flora and fauna of the region. There are no lands included in this project that are potentially culturally and/or ecologically sensitive. Agreements are signed between Boomitra and individual ranchers along with community heads (see section credit ownership section for more details) , which clearly explain the rules and guidelines of the project and its associated activities. With increasing depletion of natural resources, Environmental Impact Assessment (EIA) was mandated in Kenya under the Environment Management and Coordination Act of 1999 (EMCA, 1999). As per the statutory law, all projects likely to

		have a negative effect on the environment were categorized into three different groups based on their severity and required to undergo EIA ⁵⁸ , Boomitra's project does not require an EIA.
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2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

Discrimination and sexual harassment	Boomitra and its implementation partners do not involve in any form of discrimination or sexual harassment. Boomitra follows international standards and abides with all local laws when it comes to workforce and other sensitive aspects of project. We ensure an inclusive working environment free of discrimination at all stages of the employment life cycle, promote and create plans to allow different cultures to thrive by a providing conducive environment to flourish.
Management experience	Boomitra brings a diverse team to help cover several different aspects of the project execution, which is central to the overall management and governance of the project. Boomitra's carbon project development team comprise individuals with 10+ years of experience who have been successful in getting dozens of carbon projects 3rd party validated and verified, with a variety of international standards from CDM to Gold Standard. Boomitra's geospatial data science team includes individuals with more than 5 years of experience in extracting actionable information from satellite data sources throughout the electromagnetic spectrum. Boomitra's farmer engagement teams ensure that all the farmers' questions and concerns are answered and that farmers are efficiently recruited. This team is also supported by software innovations from the software development team that continually make it easier for farmers to participate in the program. For example, advising the farmers on best carbon practices may be done by the farmer engagement team through our implementation partners. More information about Boomitra is available at https://boomitra.com/. Boomitra does not foresee any gaps in expertise. Almost all project management is in-country, through the organizations of our partner consortium – who are almost always based directly within the project areas.

⁵⁸ENVIRONMENTAL IMPACT ASSESSMENT PROCESS in KENYA SIMPLIFIED HANDBOOK.

Gender equity in labor and work	The project does not negatively impact either directly or indirectly on gender equality and/or the situation of women or anybody on the project. Project does not take any account of gender roles and the abilities of men and women. All are treated equally and have equal opportunities.
Human trafficking, forced labor, and child labor	The project does not involve or force local communities as forced labor to work under this project. Forced labor is an illegal activity in the host country and the local labor compliance takes into account of the same.

2.3.2 Human Rights

Though the Country Kenya did not ratify the ILO⁵⁹ convention 169, Boomitra, in this project recognizes, respects, and promotes the protection of the rights of IPs, LCs, and customary rights holders in line with applicable international human rights law, and the United Nations Declaration on the Rights of Indigenous Peoples.

2.3.3 Indigenous Peoples and Cultural Heritage

This project does not include sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture and project do not require or cause the physical or economic relocation of peoples. All the project activities are happening on the lands which are owned by the communities in the region which they have proper land rights.

2.3.4 Property Rights

Rights to territories and resources	Not applicable. All the projects activities are happening on the lands which are owned by the private land owners and communities of the region representing proper land rights.
Respect for property rights	Not applicable. There is no anticipated risk from the project to stakeholder resources. All the property rights are recognized, respected, and supported by the project. The area proposed for 1 st instance of project are under private ownership. These lands have clear property title deeds issued by the competent authority in the country. All the lands included in this project are free from any litigation. As discussed in ownership section 1.8, ranchers/pastoralists enrolling their lands irrevocably assign the right, title and interest to the Greenhouse Gas Reductions and Removals thus generated on their lands during the project to Boomitra via Intervention Coordinators. The individuals or entities enrolling their lands disclaim all right, title and interest to any Carbon Credits that may arise from the

⁵⁹ "Up-To-Date Conventions Not Ratified by Kenya." [ilo.org](https://www.ilo.org/), 2014. Accessed 6 Aug. 2024.

	Land. This is covered by legal agreements with the individuals and/or entities enrolling their lands. Legal agreements (enforceable and irrevocable agreement) have been signed between the participating ranchers and Boomitra in line with the section 3.7.1, point 6 of the VCS Standard v4.5.
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2.3.5 Benefit Sharing

Process used to design the benefit sharing plan	Boomitra, in collaboration with its implementation partners, has contacted all participating ranchers, where we explained the project details and the carbon credit terms and conditions in the ranchers' native languages. Following these consultations, the ranchers have signed carbon credit agreements with Boomitra. Please see Ownership section of this document for complete details on benefit sharing. (Carbon rights agreements with farmers has been shared to VVB during the audit)
Summary of the benefit sharing plan	Before the rancher joins this project, thorough and in-depth discussions were held with the help of local implementation partners in the region, to discuss carbon revenue benefit sharing. This carbon sharing agreement has been devised in consultation with the ranchers. These carbon agreements also include revenue sharing processes and terms with the ranchers. The same agreement has been explained to the ranchers in their local language, and finally, ranchers willing to be part of the program are enrolled through the proper enrolling method.
Approval and dissemination of benefit sharing plan	Carbon agreements have complete details of the benefit sharing plan. Agreements have been shared to VVB during the process of audit.

2.4 Ecosystem Health

	Risks identified	Mitigation or preventative measure taken
Impacts on biodiversity and ecosystems	1. Introducing new (non-native) plant species can alter existing habitats, potentially displacing native flora and fauna.	Risk Category: Low No invasive species are introduced through project activities. The project promotes the regeneration of local existing native species.

	Risks identified	Mitigation or preventative measure taken
	2. Invasive species outcompeting local species.	This is an Improved Grassland Management project, the project primarily promotes rotational grazing activities in the project areas, which can be a helpful tool to mitigate the proliferation of invasive species. Rotational grazing can encourage a more diverse native plant community, which can be less hospitable to invasive species that thrive in disturbed environments. The project is helping with implementing strategies to enhance habitat connectivity and biodiversity, regularly monitoring, and by promoting diverse, native species (Please refer section 1.12 for the promoted project activities).
Soil degradation and soil erosion	Unsustainable grazing practices can lead to soil compaction and loss of soil structure	Risk category: Low The project promotes sustainable grazing and livestock management practices. All the activities in this project will help in improving soil health and increase SOC levels. See section 1.12 for more details.
Water consumption and stress	Non-availability of water due to erratic rainfall /climate change	Risk Category: Low One of the activities promoted in this project is water conservation and management which includes water management infrastructures like Keylines, Gabions, microbasins and ponds. The project provides training on monitoring and managing water use to ensure sustainable utilization of water. This activity will ensure water security in

Risks identified		Mitigation or preventative measure taken
		the region thereby reducing the stress on water availability in the project area.
Usage of fertilizers	- Excessive use of synthetic fertilizers can lead to nutrient runoff into waterways, causing eutrophication - Over-fertilization can disrupt soil microbial communities and reduce soil health. - Over-reliance on fertilizers can lead to long-term dependency, making the ecosystem less self-sustaining.	Risk Category: Low None of the project rancher/pastoralists use fertilizer in the ranchers. Educate ranchers on the benefits of natural regeneration of soil through practice of minimal soil disturbance to maintain soil structure and health. Project thrives to promote sustainable and regenerative grazing management practices. See section 1.12 for more details.

2.4.1 Rare, Threatened, and Endangered species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

☒ Yes

☐ No

If yes, list such species and habitats in the table below and provide evidence that the project will not adversely impact these areas.

Species and habitat	The list of species that fall in or adjacent to habitats for rare, threatened, or endangered species are as follows: - Lesser Kudu- Near Threatened - Gerenuk- Near Threatened - Oryx- Endangered - Plains Zebra- Near Threatened - Giraffe- Vulnerable - Colobus- Vulnerable - White-backed Vulture- Critically Endangered - Rupell's Vulture- Critically Endangered - African Wild Dog- Critically Endangered - Lion- Critically Endangered - Cheetah- Vulnerable - Leopard- Vulnerable
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13. Kori Bustard- Near Threatened

14. Secretary Bird- Endangered

15. Yellow-Crowned Crane (Grey-Crowned Crane)- Endangered

16. Tawny Eagle- Vulnerable

We do not foresee any net negative environmental outcomes in this project. All the project activities will ultimately lead to improvement of soil fertility. Increase in soil fertility means increase in forage yields and manage wildlife and livestock systematically without any conflicts between them. As discussed in the section 1.1 & 1.12 of this PD, integrated wildlife and livestock grazing systems has made lives of communities better in this area due to reduced wildlife conflict.

Mitigation Plan

- The project promotes rotational and sustainable grazing practices. Establishment of protective measures to safeguard key habitats. This includes creating buffer zones called wildlife corridor around sensitive areas. To mitigate wildlife-human conflicts, the project includes a grazing plan that establishes wildlife corridors, allowing wild animals to move freely across the ranch and preventing continuous grazing within the ranch throughout the year.
- The Intervention Coordinator along with the Origination partner keep an account of the wildlife movement keeping a regular check on the count of wildlife movement ensuring conservation.
- Implementing construction and operational practices that minimize disturbance. This includes scheduling activities to avoid critical times for wildlife (e.g., breeding seasons).
- Using constructions like paddock fencing using polls, wire to secure the paddocks where the livestock can graze and not disturb the wildlife grazing and moving areas.
- Working with local communities to promote conservation awareness and reduce human-wildlife conflicts. Community-based conservation programs will be supported to ensure local involvement in protecting these species.

The project activities will be monitored and adaptive management plan will be implemented. Please refer Section 5.3 for a detailed monitoring plan and more information.

2.4.2 Introduction of species

Species introduced	Classification	Justification for use	Adverse effects and mitigation
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In this project, none of the project activities promote introduction of new/ invasive species in the project area.

Where invasive species exist in the project area, list such species in the table below and demonstrate that the project activity will not allow the species to thrive.

Existing invasive species	Mitigation measures to prevent spread or continued existence of invasive species
Not Applicable	The project promotes rotational grazing activities in the project areas, which can be a helpful tool to mitigate the proliferation of invasive species. Rotational grazing can encourage a more diverse native plant community, which can be less hospitable to invasive species that thrive in disturbed environments. The spread of invasive species is managed by the ranch owners as they receive training on the Grazing management Plan on the below aspects: • By dividing the ranch into organized paddocks – which ensures rest periods, the invasive species have less opportunity to establish themselves and outcompete native plants. Native plants have a chance to recover and strengthen their root systems, making them more resilient to competition. • Rotational grazing can encourage a more diverse native plant community, which can be less hospitable to invasive species that thrive in disturbed environments. • When livestock are concentrated in smaller areas (paddocks) during grazing periods, they leave behind manure which can enrich the soil. This

healthier soil can better support native plant growth, making it harder for invasive species to take hold.

2.4.3 Ecosystem conversion

Two sets of analysis have been done to check LULC variations among the participating farmers. One set of analysis is done using MODIS/Terra Land Cover Types (500 m resolution) data. Because of its coarse spatial resolution and lack of data for particular region for particular time point, we found some issues with classifying the farmer lands. Hence, we used GLAD Global Land Cover and Land Use Change dataset which has 30-m spatial resolution we could find that all the project participant ranches remained grasslands. Even with this dataset we had some issues like lack of satellite data for some of the time series. Therefore, we looked into the land records and history of the usage of the land. In this analysis we found that all the project polygons remained grasslands before and after the project implementation and these lands there was no clearing of native ecosystems took place at least 10 years prior to the project implementation.

Other Information AFLOU Specific Safeguards

Grouped Project

All new project instances need to conduct stakeholders' consultations. However, during the baseline data collection process, key information has been exchanged with stakeholders and feedback has been taken. Please see Appendix 2 for the complete process followed for this project.

Reporting Information and Implementation of Safeguards

Detailed analysis of all the risks associated with the project is assessed with respect to the project area and activity. The outcome of the assessment will help in designing the risk criteria and indicators through analyses of the data available based on country-specific legal frameworks.

The following table illustrates the criteria or risks assessed for this project.

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
Social	Application of free, informed and fair consent	The proposed activity involves ranchers who are either private landowners or pastoralists. Our project implementation partners have been working with these rancher communities for a long time. They have conducted awareness creation programs and capacity building trainings for the	Not applicable

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
		communities on the sustainable grazing practices and to address overgrazing in the area. Before the implementation of the project, the consent of the ranchers has been obtained. The project's approach aligns with the FPIC requirements as outlined in sections 3.18.7 and 3.18.8 of the VCS Standard v4.5. See section 2.1.3 for details, Stakeholder consultation programs are conducted to apprise about project objectives and necessary steps which needs to be followed as per the methodological requirement. As discussed in section 1.8, an agreement signed by the rancher to provide his consent to this participate in this project. Also, section 2.1.2 details on the project plans for continuous stakeholder consultation plans throughout the project's lifespan.	
	Vulnerable groups involved	There are no vulnerable groups present in the project. The activities in this project do not involve forest carbon, but many of the general principles promoted by this law are also pertinent to running a grassland project with positive communal and environmental benefits. Project does not involve any activity which will impact vulnerable groups. Most of the ranchers involved in this project are individual ranch owners. They	Not applicable

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
		have no technical assistance or capacities to adopt new sustainable grazing practices on their own.	
	Support tenure and resource rights	See ownership section. At the time of validation, only privately owned ranches have been involved in this project. However, community owned lands will be added in future instance of the grouped project and this project supports land tenure and resource rights. And detailed FPIC procedure will be followed with communities. (Please see ownership section 1.8)	Not Applicable
	Benefit Sharing	An agreement is signed with the ranchers/pastoralists that has information regarding the carbon revenue sharing mechanisms and other necessary legal clauses required to implement the project. An agreement is also signed with each ground implementation partner i.e., Intervention Coordinator & Origination Partner, outlining their responsibilities and revenue sharing.	Not Applicable
	Improve livelihoods, decent work and economic growth	The project provides employment to local communities during implementation and monitoring.	Not applicable
Environmental	Mitigate negative environmental impacts	This project does not have any project activity component which will result in a negative environmental impact. Instead, the project activity will allow communities to use and manage grasslands in a sustainable way. This project also does not allow for	Not applicable

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
		any change in land use, as per the requirements of the adopted methodology.	
	Enhancement of Biodiversity and ecosystems	Sustainable management of grasslands will improve soil properties. Increases in soil organic matter improve soil aggregates and structural stability, which help water infiltration into the soil by increasing soil aeration and reducing excess runoff. As a result of the rotational grazing practices, the vegetation is allowed to grow and stay on the ground for more time, thereby regenerating the lands gradually and reversing desertification. These measures also restore crucial habitats for the flora and fauna of the region.	Not applicable
	Address reversals and displacement of emissions	There are reversal and non-permanence risks associated with any AFOLU project due to both human induced activities and natural disasters. There is a possibility that ranchers might go back to traditional grazing practices, or even change their land use to farming due to either internal pressures from their own community or external pressure from fluctuating parameters such as the weather. Natural risks such as heavy rainfall, drought and earthquakes cannot be reasonably forecasted in the long term, which will affect the overall efficacy of the project.	Boomitra is employing the latest VM0042 methodology from VCS to estimate net carbon removals from the project. As per the methodology, a project-level buffer needs to be created and the number of buffer credits to be contributed to the AFOLU pooled buffer account shall be determined by applying the latest version of the VCS AFOLU Non-Permanence Risk Tool. This is an exhaustive tool that accounts for

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
		These risks are beyond human control. Our methodology of choice, VM0042, assumes no leakage/displacement of emissions, given that various aspects of the methodology are met, which are expatiated further in Section 4.3. Our project meets these requirements.	possibilities of direct and indirect (avoidable/unavoidable) reversals of the carbon removals. Beyond the buffer pool, the project also directly works to mitigate risks that can be controlled through human activities. For example, the possibility of ranchers returning to traditional grazing practices or changing their land use to farming is reduced through the educational work of our ground partners, who are chosen for their high level of trust in their local communities, which has been acquired over the course of decades. As a result, rural communities strongly trust the recommendations of our ground partners, making them less likely to cause reversals due to changes to their behavior. Hence, the project is capable of tackling the risks resulting from reversals – through both a buffer credit pool, and

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
			the efforts of locally-trusted ground partners.
Procedural	Legal compliance	As discussed in section 1.15, the project will adhere to all requirements of local and national laws.	Not applicable
	Transparency and Stakeholder engagement	All the project related documents are available at the VCS website. Simultaneously, local stakeholders' consultations will be held, and information related to the project activities will be discussed. Workshops for the ranchers are held regularly and local stakeholder consultations are held whenever communities are enrolled.	Not applicable
	Monitoring and reporting	A detailed monitoring plan will be developed to monitor the parameters (both quantitative and qualitative information) through monitoring surveys. As and when we go for verification, we conduct a detailed monitoring survey of the stakeholders with exhaustive questionnaires to get their feedback. Simultaneously, we undertake several capacity-building programs and awareness creations programs in the project area, and we collect feedback from the stakeholders. This will enable us to understand the project's impacts on sustainable development of the communities, as well as the grasslands.	Not applicable.
	Grievance mechanism	Boomitra has developed a proper multi-level grievance addressal	Not applicable

Criteria	Safeguarding Principle	Assessment	Mitigation Measure
		model to handle any grievances arising during the project cycle. This is one of the key requirements to be met as per global standards. The grievance address mechanisms are discussed in all stakeholder consultations. (See the below paragraphs for details)	

Table 8: Risk Assessment and Safeguarding Principles

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	VM0042	Improved Agricultural Land Management	V1.0, dated 19 th October 2020
Module	VMD0053	Model calibration, validation, and uncertainty guidance for the methodology for improved agricultural land management ⁶⁰	Dated 19 th October 2020, version 01
Tool	AFOLU Non- Permanence Risk tool	Non-Permanence Risk Tool	V4.0 dated, 19 th September 2019

3.2 Applicability of Methodology

⁶⁰ MODEL CALIBRATION, VALIDATION, and UNCERTAINTY GUIDANCE for the METHODOLOGY for IMPROVED AGRICULTURAL LAND MANAGEMENT Sectoral Scope 14 VMD0053, Version 1.0 Sectoral Scope 14 2 CONTENTS. 2020, verra.org/wp-content/uploads/imported/methodologies/VMD0053_Mo. Accessed on 6 Aug

Grouped Project

All new activities shall meet applicability conditions listed in Table 9 below and be demonstrated with justification in the project document.

The following table provides details of how each project Instance is eligible under Section 4 of the VM0042 methodology:

Methodology ID	Applicability condition	Justification of compliance
VM0042	Projects must introduce or implement one or more new changes to pre-existing agricultural management practices which includes, Improve grazing practices. A change constitutes the adoption of a new practice (e.g., adoption of one of the illustrative improved grassland management practices listed in Appendix 1), the cessation of a pre-existing practice (e.g., stop over grazing or continuous grazing), or an adjustment to a pre-existing practice that is expected to reduce GHG emissions and/or increase GHG removals. Any quantitative adjustment (e.g., decrease in fertilizer application rate) must exceed 5% of the pre-existing value.	The project activities are new activities implemented by the landowners relative to the baseline scenario. The current baseline scenario is continuous unsustainable grazing on community-owned and privately-owned grasslands. The proposed project activity introduces and expands new sustainable improved grassland management practices. In this project, none of the implemented improved grassland management activities involve the application of fertilizer in either the baseline or project scenarios. Therefore, the quantitative adjustment of agri-inputs is zero and does not exceed 5%. As such, it does not qualify as a practice in the project.
VM0042	Project activities must be implemented on land that is either cropland or grassland at the project start date and remains cropland or	The project is implemented on grasslands. The land has remained grasslands prior to the project and after the start of the project. This is the

	grassland throughout the project crediting period.	natural state of the land which is verified by satellite images over the past 10 years. As per the methodology, land use change is allowed under certain scenarios. However, this project does not promote or allow any land use change during the crediting period.
VM0042	The project area must not have been cleared of native ecosystems within the 10-year period prior to the project start date.	The grassland areas have not been cleared of native ecosystems – native ecosystems still exist, and this is verified by satellite images over the past 10 years. Analysis of these satellite images confirms that these lands have remained grasslands and are not converted or cleared of any native ecosystems.
VM0042	The project activity is not expected to result in a sustained reduction of greater than 5% in productivity, as demonstrated by peer-reviewed and/or published studies on the activity in the region or a comparable region.	The project will not result in a sustained reduction of greater than 5% in productivity. Livestock productivity has increased, as evidenced by the accelerated maturation of the animals. Previously, we noticed that livestock matured between 3.5 to 4 years. However, now we can observe them reaching maturity in the shorter time frame of 2.5 to 3 years. This will be demonstrated in section 4.3 of this PD

VM0042	The project activity cannot occur on a wetland. Note that this condition does not exclude crops subject to artificial flooding where it can be demonstrated that crop cultivation does not impact the hydrology of any nearby wetlands.	All activities will only be taken up on grasslands, which are neither wetlands nor croplands. This will be substantiated with maps and KML files.
VM0042	If the project activity involves the application of biochar, it must be produced using feedstock that would otherwise have been left to decay in aerobic or anaerobic conditions or been burned in an uncontrolled manner. Eligible feedstocks include one or more of the following categories of biomass: • Crop residues; • Material from pruning or thinning of woody vegetation (not including merchantable timber) in agricultural systems such as shade trees, orchards, windbreaks, stream buffers, silvopasture, or invasive removal on rangeland; • Off-cuts, sawdust, and other material produced as a by-product of forest management or harvesting operations; • Diseased trees or deadwood felled during plantation or woodland management; and/or	This is not applicable for this project since none of the project activities promotes biochar as a soil amendment.

	Residential, commercial, or industrial organic food or yard waste. <i>There may not be any other carbon incentive awarded for the production of biochar applied on the project area.</i>	
VM0042	Additional conditions where models are applied: The methodology does not mandate the use of any specific model. Rather, this methodology is applicable where empirical or process-based models used to estimate stock change/emissions <i>meet specific conditions.</i>	The project uses the process-based RothC model^{61 62}, which simulates carbon stock changes. Therefore, the applicability conditions of the stock change/emissions estimation model are not required. More details about use of RothC model in the project is in the section 5.3 of the PD.

Table 9: Applicability Conditions

Additional conditions where models are applied as per VM0042:

The project uses the process-based RothC model to estimate stock change/emissions in the baseline scenario and with-project scenario.

1. Is this model publicly available?

Yes, RothC is publicly available and fully documented at the Rothamsted Research website.⁶³

2. Shown in peer-reviewed scientific studies to successfully simulate changes in soil organic carbon and trace gas emissions resulting from changes in agricultural management included in the project description.

⁶¹ Rotich, H. K., Onwonga, R., Koech, O., & Mbau, J. (2020). Projected Changes in Soil Organic Carbon Stocks over a 50-Year Period under Different Grazing Management Systems in Semi-Arid Grasslands of Kenya. *Journal of Rangeland Science*, 10(4), 357-369.

⁶² Heikkinen, J., Kurganova, I., Lopes de Gerenyu, V., Palosuo, T., & Regina, K. (2014). Changes in soil carbon stock after cropland conversion to grassland in Russian temperate zone: measurements versus model simulation. *Nutrient cycling in agroecosystems*, 98, 97-106.

⁶³ "Rothamsted Carbon Model (RothC): Understanding Soil Carbon Dynamics." Rothamsted.ac.uk, 2022. Accessed 6 Aug. 2024.

RothC has been shown to be applicable in grasslands around the world, for various management conditions including continuous grazing^{64,65} and rotational grazing^{66,67}.

3. Able to support repetition of the project model simulations. This includes clear versioning of the model use in the project, stable software support of that version, as well as fully reported sources and values for all parameters used with the project version of the model. Where multiple sets of parameter values are used in the project, full reporting includes clearly identifying the sources of varying parameter sets as well as how they were applied to estimate stock change/emissions in the project. Acceptable sources include peer-reviewed literature and statements from appropriate expert groups (i.e., that can demonstrate evidence of expertise with the model via authorship on peer-reviewed model publications or authorship of reports for entities supporting climate smart agriculture, such as FAO or a comparable organization), and must describe the data sets and statistical processes used to set parameter values (i.e., the parameterization or calibration procedure).

RothC 26.3, the most widely available and used version, is used for all calculations. Specific calibration methods to determine parameters for each Practice effective/Crop Functional Group in each climate zone are determined using field trial data from peer-reviewed literature, and these details will be provided in the latest model validation report at the time of each verification.

4. Validated per datasets and procedures detailed in VMD0053 “Model Calibration and Validation Guidance for the Methodology for Improved Agricultural Land Management”, with model prediction error calculated using datasets as detailed in the same module, using the same parameters or sets of parameters applied to estimate stock change/emissions in the project

The model calibration, validation, and model prediction error will be calculated as defined in Section 5.2.5 of VMD0053. Any modified or alternative models shall be used only as per VMD0053. The Model Validation Report will provide the validation methods and prediction error quantification, as detailed in VMD0053 at the time of each verification.

5. The same model version and parameters/parameter sets must be used in both the baseline and project scenarios. Model input data must be derived following guidance in Table 6 (Section 8.2) and Table 7 (Section 8.3). Model uncertainty must be quantified following guidance in Section 8.5. Models may be recalibrated or revised based on new data, or a new model may be applied, provided the above requirements are met.

The same models, model versions, and parameters are used for both baseline and project scenarios. Model input data is derived following guidance in Table 6 (Section 8.2) and Table 7 (Section 8.3). Model uncertainty is quantified following guidance in Section 8.5. Models are

⁶⁴ Smith, S. W., Vandenbergh, C., Hastings, A., Johnson, D., Pakeman, R. J., Wal, R. van der, & Woodin, S. J. (2013, December 6). Optimizing carbon storage within a spatially heterogeneous upland grassland through sheep grazing management - ecosystems.

⁶⁵ Jebari, A., Alvaro-Fuentes, J., Pardo, G., Almagro, M., & Prado, A. del. (n.d.). Estimating soil organic carbon changes in managed temperate moist grasslands with Rothc. PLOS ONE.

⁶⁶ Liu, D. L., Chan, K. Y., Conyers, M. K., Li, G., & Poile, G. J. (2011). Simulation of soil organic carbon dynamics under different pasture managements using the RothC carbon model. Geoderma, 165(1), 69–77.

⁶⁷ Poeplau, C. (2016). Estimating root: shoot ratio and soil carbon inputs in temperate grasslands with the RothC model. Plant and Soil, 407(1-2), 293–305.

recalibrated or revised based on new data, or a new model may be applied, provided the above requirements are met.

General description of RothC model

The Roth-C model, also known as the Rothamsted Carbon (RothC) model, is a biogeochemical model widely used for simulating carbon dynamics in agricultural and natural ecosystems. Developed by scientists at the Rothamsted Research Institute in the United Kingdom, the model aims to understand and predict the processes involved in carbon cycling, specifically the decomposition and turnover of organic matter in soils over time.

The Roth-C model operates based on a pool-based approach, where organic carbon is categorized into different pools based on its decomposition rate and stability. The model considers several key processes and factors that influence carbon dynamics.

Carbon Inputs: The model takes into account the inputs of organic carbon, such as plant residues, root exudates, and other organic materials added to the soil.

Decomposition: Roth-C simulates the decomposition of organic carbon, considering factors like temperature, moisture, and microbial activity. It distinguishes between active, slow, and passive carbon pools based on their turnover rates.

Climate and Soil Factors: The model incorporates climatic variables like temperature and precipitation, as well as soil properties such as texture, organic matter content, and pH, to estimate decomposition rates and carbon turnover.

Management Practices: Roth-C considers the effects of agricultural and grassland management practices on carbon dynamics, such as tillage, crop rotation, and organic amendments. These practices can influence the input of organic carbon and its subsequent decomposition rates.

Soil Carbon Balance: By simulating the inputs and outputs of carbon in the soil, the Roth-C model provides estimates of the net carbon balance over time, including carbon sequestration or loss.

The model has been calibrated and validated using field measurements and long-term experiments, allowing it to be applied in various agricultural and grassland systems and land use scenarios. It has been used globally to assess the impacts of management practices, land use changes, and climate change on soil carbon stocks, greenhouse gas emissions, and overall soil health. The RothC model used in this project has been shown to be applicable in grasslands around the world, for various management

conditions including continuous grazing^{68,69} and rotational grazing^{70,71}. Several peer-reviewed field trial datasets exist for the proper validation of the model within the IPCC climate zones and soil textures found in this project^{72,73}. Hence, the RothC model is valid and applicable for this project.

3.3 Project Boundary

Grouped Project

The Grouped Project and each new project instance will define a project boundary as per the VM0042 V1.0 methodology.

The carbon pool included in Instance 01 is outlined in the table below:

Carbon Pool	Included?	Justification/ Explanation of Choice
Aboveground tree biomass	No	None of the project activities promoting any activities which increase woody biomass. Due to rotational grazing, biomass of grass does increase and noted here as 'herbage dry matter'. (See the reference: https://www.sciencedirect.com/science/article/pii/S0167880922002249). Hence, the above ground biomass is not included in the carbon pool in the project.
Aboveground non-tree biomass	No	As per VCS rules this has been excluded. (VM0042, table 2)
Belowground biomass	No	Project does not promote agroforestry as one of the project activities.
Dead wood	No	As per VCS rules this has been excluded. (VM0042, table 2)

⁶⁸ Smith, S. W., Vandenbergh, C., Hastings, A., Johnson, D., Pakeman, R. J., Van Der Wal, R., & Woodin, S. J. (2014). Optimizing carbon storage within a spatially heterogeneous upland grassland through sheep grazing management. *Ecosystems*, 17, 418-429.

⁶⁹ Asma Jebari, Álvaro-Fuentes, J., Pardo, G., María Almagro, & Agustin del Prado. (2021). Estimating soil organic carbon changes in managed temperate moist grasslands with RothC.

⁷⁰ Li Liu, D., Chan, K. Y., Conyers, M. K., Li, G., & Poile, G. J. (2011). Simulation of soil organic carbon dynamics under different pasture managements using the RothC carbon model. *Geoderma*, 165(1), 69-77.

⁷¹ Poeplau, C. (2016). Estimating root: shoot ratio and soil carbon inputs in temperate grasslands with the RothC model. *Plant and Soil*, 407(1-2), 293-305.

⁷² Byrnes, R. C., Eastburn, D. J., Tate, K. W., & Roche, L. M. (2018). A Global Meta-Analysis of Grazing Impacts on Soil Health Indicators. *Journal of Environmental Quality*, 47(4), 758-765.

⁷³ Elsevier. (2017, November 6). Critical review of the impacts of grazing intensity on soil organic carbon storage and other soil quality indicators in extensively managed grasslands. *Agriculture, Ecosystems & Environment*. Abdalla, M., Hastings, A., Chadwick, D. R., Jones, D. L., Evans, C. D., Jones, M. B., Rees, R. M., & Smith, P. (2018). Critical review of the impacts of grazing intensity on soil organic carbon storage and other soil quality indicators in extensively managed grasslands. *Agriculture, Ecosystems & Environment*, 253, 62-81.

Carbon Pool	Included?	Justification/ Explanation of Choice
Litter	No	As per VCS rules this has been excluded. (VM0042, table 2)
Soil Organic Carbon	Yes	Included as per VCS AFOLU Requirements as the landcover under the baseline scenario is comprised of grasslands. The proposed project activity increases this pool in the project scenario.
Wood Products	No	As per VCS rules this has been excluded. (VM0042, table 2)

Table 10: Carbon pool included in this project

The project boundary of Instance 01 is outlined in the following table.

	Source	Gas	Included?	Justification/Explanation
Baseline	Soil Organic Carbon	CO ₂	Yes	Primary stock changing due to improved grassland management activities
		CH ₄	No	As per the methodology (section 5), excluding these gases. Please refer the paragraph below the table for more explanation.
		N ₂ O	No	
		Other	No	
	Fossil Fuel	CO ₂	No	As per methodology (section 5), where the increase in greenhouse gas emissions from any project emissions or leakage source, and/or decreases in carbon stocks in carbon pools, is less than five percent of the total net anthropogenic GHG emission reductions and removals due to the project, such sources and pools may be deemed de minimis and may be ignored (i.e., their value may be accounted as zero).
	Soil Methanogenesis	CH ₄	No	
	Enteric Fermentation	CH ₄	No	
	Manure Deposition	CH ₄	No	
		N ₂ O	No	
	Use of Nitrogen Fertilizers	N ₂ O	No	
	Use of Nitrogen Fixing species	N ₂ O	No	
	Biomass burning	CO ₂	No	
	Biomass burning	CH ₄	No	
		N ₂ O	No	
	Woody biomass	N ₂ O	No	

	Source	Gas	Included?	Justification/Explanation
Project	Soil Organic Carbon	CO ₂	Yes	Primary stock changing due to improved grassland management activities
		CH ₄	No	As per the methodology (section 5), excluding these gases. Please refer the paragraph below the table for more explanation.
		N ₂ O	No	
		Other	No	
	Fossil Fuel	CO ₂	No	As per methodology (section 5), Where the increase in greenhouse gas emissions from any project emissions or leakage source, and/or decreases in carbon stocks in carbon pools, is less than five percent of the total net anthropogenic GHG emission reductions and removals due to the project, such sources and pools may be deemed de minimis and may be ignored (i.e., their value may be accounted as zero).
	Soil Methanogenesis	CH ₄	No	
	Enteric Fermentation	CH ₄	No	
	Manure Deposition	CH ₄	No	
	Use of Nitrogen Fertilizers	N ₂ O	No	
	Use of Nitrogen Fixing species	N ₂ O	No	
	Biomass burning	CO ₂	No	
	Biomass burning	CH ₄	No	
		N ₂ O	No	
	Woody biomass	CO ₂	No	

Table 11: Project Boundary

Project activities are taking place throughout the project area and primarily affect soil carbon. All other stock or pool changes are deemed de minimis relative to the total net anthropogenic GHG reductions and removals. Insignificant emission sources are excluded according to the VCS rules.

The demonstration that GHG sources other than SOC are excluded from the project boundary under both the baseline and project scenarios is justified using the 'CDM AR Methodological Tool for Testing the Significance of GHG Emissions in A/R CDM Project Activities v1.0'. In the calculation table, SOC (Soil Organic Carbon) emissions are shown as positive values. Specifically, SOC contributes 99.378% of CO₂ emissions within the project, indicating a significant positive impact on greenhouse gas emissions. Project activities aim to mitigate this CO₂ from the environment. This tool shows that SOC significantly dominates the scope of greenhouse gas (GHG) emissions compared to other sources within the project scope. In contrast, emissions from all other sources combined amount to less than 0.09%, reflecting their minimal impact. According to A/R CDM tool guidance, emissions below 5% of net anthropogenic removals by sinks are deemed insignificant and fall outside the project boundary. Therefore, GHG sources

that do not exceed 5% of total emissions are considered insignificant in terms of their impact on greenhouse gas emissions within the scope of the project and are excluded from further consideration.

A separate Excel workbook has been shared to VVB to provide a sufficient demonstration for why several GHG sources are excluded from the project boundary under both the baseline and project scenarios compared to SOC. This demonstration uses the CDM AR methodological tool for testing the significance of GHG emissions in A/R CDM project activities, which identifies the following GHG emission sources as de minimis.

To perform the calculation, the following GHG fluxes were considered: SOC sequestration, enteric methane, manure deposition, biomass burning, fuel consumption, and N fertilizer application. If there are significant emissions of these excluded GHG sources (more than 5% of net anthropogenic removals) during the course of the project, these parameters are also monitored during every verification as described in the section 5.2 and the monitoring plan as described in section 5.3.9.

- For the SOC flux, the average annual SOC sequestration value from the first monitoring period was used (see section 1.11).
- Enteric methane emissions were calculated using Equation 6 from the VM0042 v1.0 methodology.
- Manure deposition emissions were calculated using Equations 7 and 8 for CH₄, and Equations 21-26 for N₂O.
- Biomass burning emissions were determined using Equations 9 and 27.
- Fuel consumption emissions were assessed using Equations 3 and 4.
- N fertilization emissions were calculated using Equations 12, 13, and 20-24.

Activity data was obtained from surveys and attestations from ranchers. The following data was used as inputs for the equations:

- Livestock stocking rates: Obtained through surveys completed by the ranchers for both the baseline and project scenarios.
- Rate, frequency, and sources of N fertilization: Gathered through surveys completed by the ranchers for both the baseline and project scenarios.
- Fuel use: The area under machinery use for pasture preparation and fertilization in both the baseline and project scenarios was obtained from ranchers. Fuel usage was then derived from local bibliography, including theses and technical reports.
- Biomass burnt: Estimated based on the affected area (as attested by the ranchers) and biomass availability, which was derived from peer-reviewed studies and FAO publications.

Below are the excluded sources discussed in detail:

Livestock-related emissions:

This project in Kenya by implementing Improved Grasslands Project activities primarily focuses on large-scale soil organic carbon (SOC) sequestration, which significantly surpasses the greenhouse gas (GHG) emissions from manure deposition and enteric fermentation. Based on the baseline assessment survey, there is no significant level livestock rate and productivity change for livestock categories observed. As we have analysed, there is no statistically significant leakage because livestock numbers are not changing (decreasing or increasing) in a statistically significant manner, at least as seen for the initial crediting period – as measured through continuous farmer-attested livestock counts, which will be presented in the monitoring report. While these emissions are present in livestock production, their impact is observed minimal compared to the extensive land management and sustainable grazing practices promoted by the project⁷⁴. Furthermore, the methodology explicitly requires that decreases in livestock emissions due to a reduction in livestock numbers not be accounted for credit. Hence, livestock-associated enteric emission changes are not included, as they are also considered de minimis.

Emissions from enteric fermentation:

Unregulated mixed herds of livestock often graze insufficiently, which causes overgrazing and proper nutrient intake. This forces animals to eat poor-quality forage, leading to increased enteric fermentation and inefficient digestion. Ruminant livestock, particularly cattle, are the main source of methane (CH₄) emissions through enteric fermentation. In Kenya, enteric fermentation from livestock contributed 11.63 Tg of CH₄⁷⁵ in 2019, with cattle being the primary source⁷⁴. Under overgrazing conditions, digestibility is lower, leading to higher emissions. This project's sustainable grazing practices, such as controlled grazing and paddock rotation, improve forage quality and reduce manure pat accumulation. Better pasture management, with rest periods encouraging grasses to grow back taller and denser, ensures higher-quality food for the animals, enhancing digestion and reducing methane production. Enrolled ranchers receive training and guidance in mitigating enteric methane emissions through strategic feeding, improved pasture management, clean water, treatment, spraying, vaccination, deworming, salt licks, dairy meals, mineral licks, molasses, timely culling, and timely sale of steers.⁷⁶

Emissions from manure deposition:

Implementing improved grazing practices like rotational and controlled grazing significantly reduces emissions from manure deposition. Overgrazing results in animals concentrating in specific areas, creating patches of denuded land and concentrated manure deposits. Sustainable grazing encourages animals to spread out, leading to more even manure distribution across the pasture and reducing localized nitrous oxide (N₂O) emissions from manure decomposition.⁷⁷ Rotational grazing distributes

⁷⁴ “FAO Publishes Its First Global Assessment of Soil Carbon in Grasslands.” Newsroom, FAO, 14 Feb. 2023. Accessed 6 Aug. 2024.

⁷⁵ Savickienė, R., & Galnaitytė, A. (2024). Unveiling Determinants of Successful Dairy Farm Performance from Dairy Exporting EU Countries. Agriculture.

⁷⁶ Vargas, J., Ungerfeld, E., Muñoz, C., & DiLorenzo, N. (2022). Feeding strategies to mitigate enteric methane emission from ruminants in grassland systems. *Animals*, 12(9), 1132.

⁷⁷ Zhu, Y., Merbold, L., Leitner, S., Xia, L., Pelster, D. E., Diaz-Pines, E., ... & Butterbach-Bahl, K. (2020). Influence of soil properties on N₂O and CO₂ emissions from excreta deposited on tropical pastures in Kenya. *Soil Biology and Biochemistry*, 140, 107636.

manure more evenly and allows for rest periods⁷⁸, mitigating the uneven deposition and anaerobic conditions that promote N₂O emissions. A study in tropical dairy systems in Kenya found that continuous grazing led to higher N₂O⁷⁹ emissions from grasslands and bovine excreta compared to improved silvopastoral systems⁸⁰. Livestock spread more evenly across the pasture, leading to a wider distribution of manure, reducing localized impact, and slowing down decomposition, thereby decreasing CH₄ and N₂O⁸¹ emissions. Improved forage quality from better pastures results in more efficient digestion and reduced methane production. Rotational grazing helps maintain optimal moisture levels in the soil, promoting balanced decomposition and reducing N₂O emissions.

This VCS 3340 Project has the potential to sequester 93,371 tons of SOC across 9033 hectares of land, over the project's crediting period. This SOC sequestration potential is orders of magnitude larger than the emissions⁸² from manure deposition, enteric fermentation, and other GHG sources, which are insignificant and in much smaller quantities⁷⁴. Though livestock population rate present in the baseline and project scenario is the same, emissions from manure deposition and enteric fermentation account for only a small proportion of the overall GHG emissions from the project, likely around 1% of the total. In contrast, the project's SOC sequestration potential accounts for 99% of the total GHG benefits, highlighting the insignificance of these emission sources compared to the project's primary climate change mitigation impact. The project's focus on implementation or adoption of large-scale land management and sustainable grazing practices over the crediting period significantly impacts soil health and carbon sequestration in Kenya. The emissions from other GHG sources (ex: fossil fuel use, manure deposition, and enteric fermentation, etc.) are minor compared to the project's scope and scale processes.

Hence, according to the excel workbook "VCS 3340-Demonstration of significance of GHG sources excluded or included" provided, based on the provided data, SOC (Soil Organic Carbon) contributes 99.378% of total GHG emissions, making it the only significant source. Other sources, such as fossil fuels (0.000%), manure deposition (CH₄ at 0.520% and N₂O at 0.000%), use of nitrogen fertilizers (0.000%), use of nitrogen fixing species (0.000%) and biomass burning (CO₂ at 0.000%, CH₄ at 0.000%, and N₂O at 0.000%), collectively contribute less than 0.09% of total emissions. These minor sources fall well below the 5% threshold for significance. This indicates that SOC is the primary source of emissions and cannot be neglected. Therefore, estimated project GHG emissions other than SOC by these sources is considered

⁷⁸ Smith, R., Lacefield, G., Burris, R., Ditsch, D., Coleman, B., Lehmkuhler, J., & Henning, J. (2011). Rotational grazing. University of Kentucky College of Agriculture.

⁷⁹ Smith, R., Lacefield, G., Burris, R., Ditsch, D., Coleman, B., Lehmkuhler, J., & Henning, J. (n.d.). E X T E N S I O N Agriculture and Natural Resources • Family and Consumer Sciences • 4-H Youth Development • Community and Economic Development Rotational Grazing. Retrieved August 6, 202.,

⁸⁰ Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories CH₄ and N₂O Emissions from Livestock Manure 321 CH₄ AND N₂O EMISSIONS FROM LIVESTOCK MANURE ACKNOWLEDGEMENTS A B S T R A C T. (n.d.). https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_2_CH4_and_N2O_Livestock_Manure.pdf

⁸¹ Government of Kenya -Inventory of GHG Emissions from Dairy Cattle in Kenya 2020 -https://globalresearchalliance.org/wp-content/uploads/2021/11/Kenya-Dairy-Cattle-GHG-Inventory-Report_2020.pdf - Table 16: Emission factors (EF3) used in estimating direct N₂O emissions from manure management

⁸² <https://www.ilri.org/knowledge/publications/potential-soil-organic-carbon-sequestration-grasslands-east-african>

insignificant and can be neglected in the context of the project activity, as their sum is lower than 5% of net anthropogenic removals by sinks⁸³

Section 5.3.7, 5.3.8 and 5.3.9 includes a dedicated monitoring plan outlining how the project will track the livestock rate, productivity and the excluded GHG emission sources throughout the crediting period, ensuring that these sources are continuously monitored, and their emissions remain de minimis.

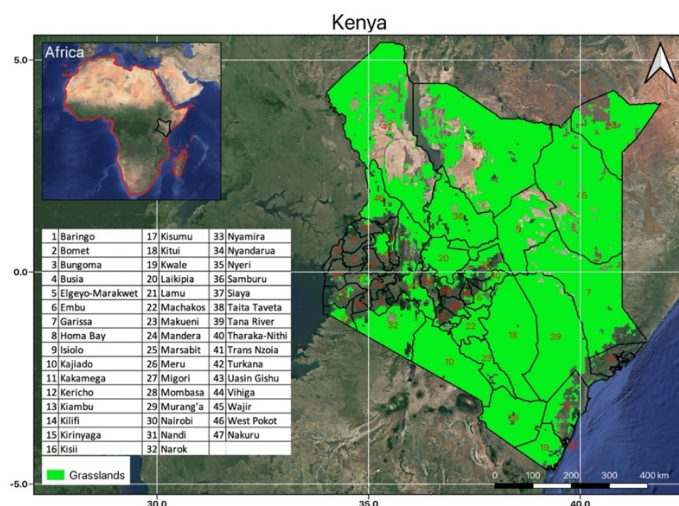


Figure 17: Project location (having grasslands) where project activities implemented in this grouped project.

Spatial Boundaries

The spatial boundaries of the project area consist of the grasslands located in the areas listed in section 1.13 of the PDD. The geo-fenced boundaries of individual project areas will be clearly demarked as per Section 5 of the methodology and will be available at any point when new areas are added. The digital files of individual grassland areas will be submitted in Keyhole Markup Language (KML) file format as required by the VCS Standard.

At the current time i.e., at the time of validation, a total of 9033 hectares are covered by this project's 1st instance, and approximately over 11,291 hectares are projected to expand over the crediting period to cover more pastoralists in the region.

Details of the complete project areas will be provided as a GeoJSON or KML file for validation and verification.

3.4 Baseline Scenario

⁸³ Literatures: Included in the estimation calculation sheet.

As per the methodology, “For each sample unit, a schedule of activities in the baseline scenario will be determined by assessment of practices implemented during the period prior to the project start date. The interval over which practices are assessed, x years, must be a minimum of 3 years and include at least one complete crop rotation, where applicable. Where a crop rotation is not implemented in the baseline, $x = 3$ years”. The most plausible baseline scenario is the continuation of traditional pre-project agricultural practices. The baseline scenario is determined by applying a historic look-back period as specified in Section 6 of VM0042. The schedule of activities, beginning with year $t = -3$, was applied in the baseline scenario from $t = 1$ onward. For each year, $t = -1$ to $t = -3$, information on agricultural management practices has been determined, per the minimum requirements specified in the Table 4 and explained below. For each year, $t = -1$ to $t = -3$, information on agricultural management practices has been determined, per the minimum requirements specified in the Table 4 and explained below.

According to VM0042, the baseline scenario is the continuation of the pre-project management activities.

The baseline scenario is identified as unsustainable grazing practices that have contributed to grassland degradation to a large extent. In the absence of the project activities, unsustainable grazing, increased human-wildlife conflict, land degradation and a decline in ecosystem health is prevalent, all of which further degrades the grasslands.

Baseline Scenario:

The fate of grasslands in the baseline scenario is one of inevitable degradation due to continuous overgrazing, driven by the absence of structured grazing management, land-use conflicts, and increasing pressure on limited pasture resources. Across different land tenure systems (including community lands, and private grasslands), unsustainable grazing patterns have led to severe ecological consequences, including vegetation depletion, soil erosion, and biodiversity loss.

Livestock are grazed without systematic planning, moving freely across pastures without designated rest periods for vegetation recovery. The lack of rotational grazing systems results in continuous land exhaustion, as livestock repeatedly deplete the same areas, leaving no time for fodder regeneration⁸⁴. This unregulated grazing pattern leads to heightened competition for resources, both among pastoralists and between livestock and wildlife. Wildlife such as wildebeest and herbivorous species share the same land as livestock, while predators like lions pose additional challenges. Both herbivorous and carnivorous animals inhabit these areas, leading to inevitable conflicts between livestock, humans, and wildlife when they graze in the same areas without any paddock creation. Pastoralists/ranchers share the pasture with herbivores, including wildebeest and carnivores like lions, increasing the risk of conflict. Without creating paddocks, there is no designated separation for livestock grazing, and wildlife freely graze on the same lands daily, exacerbating competition for resources. Pastoralists/ranchers share the pasture with herbivores, including wildebeest and carnivores like lions, increasing the risk of conflict. Without creating paddocks, there is no designated separation for livestock grazing, and wildlife freely graze on the same

⁸⁴ Kenya, in. “Karisia Walking Safaris.” Karisia Walking Safaris, 27 Jan. 2021, www.karisia.com/about-karisia/karisia-blog/2021/1/15/the-problem-with-community-conservation-in-kenya. Accessed 5 Aug. 2024.

lands daily, exacerbating competition for resources. The lack of rotational grazing systems means that both livestock and wildlife deplete the grassland resources, leading to significant ecological imbalances. Without paddock creation or designated grazing zones, human-wildlife conflicts intensify, further destabilizing the ecosystem. The absence of structured management means that no measures are taken to integrate wildlife corridors or buffer zones, restricting animal movement and further exacerbating habitat degradation. Training and capacity-building programs are nonexistent, leaving the pastoralists unaware of the benefits of sustainable practices and ill-equipped to manage their land effectively. Community involvement in monitoring and managing shared resources is absent, diminishing the sense of ownership and responsibility.

Over the past few decades, many pastoralists in the region have transitioned from their traditional nomadic lifestyle to a more sedentary one. This shift has been influenced by changes in land policy, the land tenure system, and the subdivision of land, moving away from group management and communal ownership. As a result, there has been a lack of communal land management. Individual landowners typically did not permit others to graze livestock on their land, leading to continuous and often overgrazing patterns. This has caused land degradation and increased wildlife conflicts. In response, conservancies have been established in the region. However, these conservancies lack proper grazing plans to manage rotational grazing alongside wildlife conservation. Consequently, overgrazing persists, as livestock continue to graze on individual lands, leaving insufficient time for fodder regeneration⁸⁵.

The current baseline practice of unsustainable grazing can be attributed to several factors. While both wildlife and livestock are responsible for the overgrazing of grasslands, policies enforced established during the colonial period, and schemes enacted by national and international bodies – have forced lifestyle changes in pastoral communities. From 2004-2018 the total population in Kenya increased from 30 to 50 million, while the pastoralist population is estimated to have declined from 6 to 4.5 million, with an associated loss of land equivalent to 2 million ha⁸⁶. These changes stem from loss of pastoralists' culture, identity, and intergenerational knowledge as well as increasing economic pressures that limit the livelihoods available to those who practice a pastoralist way of life. Without the project activities, pastoralists will continue to adopt increasingly unsustainable grazing practices, turn to agriculture (Croplands), or sell off their land completely, which ultimately all accelerate further degradation of the grasslands and ecosystem health.

In the baseline scenario, grazing remains the predominant land use activity, characterized by continuous grazing practices. These grasslands are primarily used for grazing, with no crop production occurring in the baseline scenario. The landholdings within the project area are primarily owned by individuals/companies, and grazing operations are conducted with varying levels of commercial intent. While the project seeks to enhance community livelihoods through improved grazing management, this does not imply that the baseline activities are conducted purely for localized self-sufficiency. Rather, they reflect a

⁸⁵ Mureithi, Stephen M., et al. "Community-Based Conservation: An Emerging Land Use at the Livestock-Wildlife Interface in Northern Kenya." ResearchGate, unknown, 13 Feb. 2019, www.researchgate.net/publication/331073417_Community-Based_Conservation_An_Emerging_Land_Use_at_the_Livestock-Wildlife_Interface_in_Northern_Kenya. Accessed 5 Aug. 2024.

⁸⁶ Zsuzsanna Bacsí, Mesfin Bekele Gebbisa, Lóránt Dénes Dávid, & Zsolt Hollósy. (2023). Pastoralism and Tourism in Eastern Africa—Quantitative Analysis from 2004 to 2018. *Sustainability*, 15(12), 9723–9723.

mix of traditional and structured grazing practices, shaped by both economic and environmental considerations. The project will introduce an additional, secondary revenue stream through carbon finance, which will indirectly contribute to livelihood enhancement by providing economic incentives for sustainable grazing management.

History of pastoral practices in Kenya

Pastoralism in Kenya can be traced back to the third millennium BC. Communities engaged in small-scale cattle herding, fishing and hunting settled in southern and central regions of Kenya, leading to the development of pastoral lifestyles. Pastoralism soon asserted dominance over the Savanna regions and rearing of cattle became a primary source of income. Due to the abundance of pasture in the rainy season, the grazing of livestock proved relatively easier than in the dry season. During the dry season, permanently watered areas such as swamps, streams etc. were heavily depended on for grazing activities. Thus, grazing practices alternated between wet and dry season grazing areas. This alternation was made possible due to communally held land, under the leadership of a council of elders who mandated resource allocation. Membership in these communities ensured that herders had access to grazing areas and resources requisite for their livestock. Access to pastures were regulated by the elders, allowing pastoralists, livestock and wildlife equitable usage of the landscape. Within the communities, a common language and social norms devised by the elders, comprising managed grazing practices, helped prevent land degradation and promote regeneration. The success of traditional pastoral activity can be attributed to this structure of governance, along with indigenous systems of knowledge that fostered land conservation practices.

Over the course of the Scramble for Africa and the resulting colonization of these territories, these structures and traditional knowledge systems and structures were considered inferior and western practices were implemented in their place. With the onset of the British colonial regime, ethnic communities, such as the Maasai, were restricted to relatively arid areas in the southern part of the country, while the fertile grasslands of the Rift Valley were occupied by British settler farmers. The British encouraged sedentarization, or the settling down of pastoralists, leading to different uses of land altogether. Government policies (and threats of appropriation) continually encouraged the further privatization and subdivisions of previously unfenced, communally owned land into individually-owned land plots, farms, and commercial grasslands⁸⁷.

With this division, there was greater competition and pressure for access to pastures, leading to overgrazing of available land and a subsequent reduction in livestock numbers. Following Kenya's independence in 1963, further degradation resulted from continuing to enforce subdivisions and ignore indigenous and pastoralist knowledge, as additional government strategies were initiated in line with prior British policies.

⁸⁷ Mwangi, E., & Ostrom, E. (2009). Top-down solutions: looking up from East Africa's rangelands. *Environment: Science and Policy for Sustainable Development*, 51(1), 34-45.

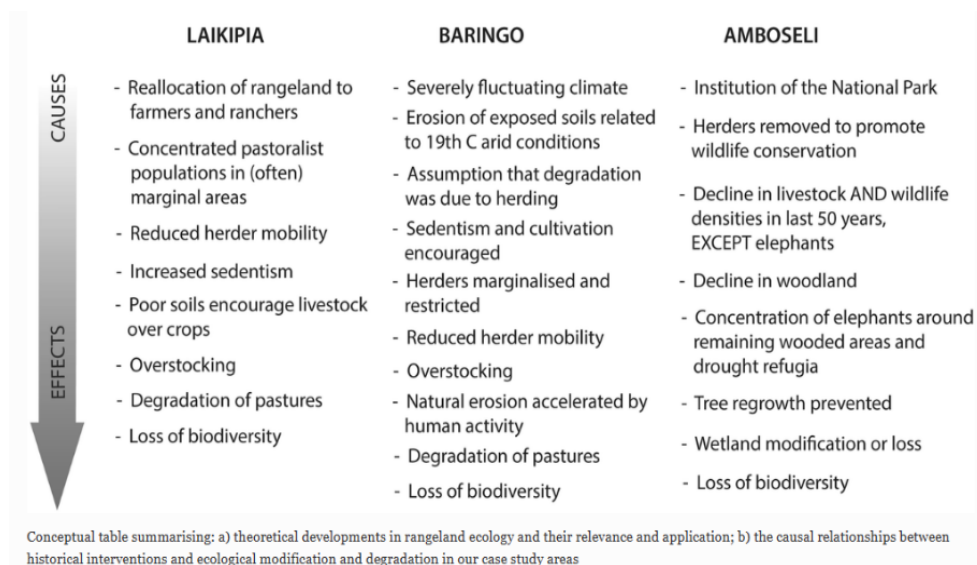


Figure 18: Baseline Description 2019⁸⁸

Kenyan grasslands are known as Savanna grasslands, which have a wide range of vegetation types with and without shrubs, and grasslands and rangelands together cover about 80% of the land area of Kenyan land mass⁸⁹. These grasslands that have supported pastoralism for several decades now face overwhelming resource demands in terms of water and vegetation due to increasing market forces that have enforced a shift toward agriculture and livestock product production (e.g., dairy products, etc.) to address an increase in food demand^{90,91}. The restricted local control over resources, limited mobility, rising human populations, and changing climate patterns are also major impediments to the diminishing pastoral communities of the region. This increase in food demand has resulted in expansion of agriculture lands into the grassland regions. This phenomenon is one of the main contributors to increasing a use for land degradation in the region. Additionally, there has been greater technical and economic assistance provided to crop cultivation and livestock production in recent decades, which many pastoralists took advantage of to diversify their income⁹². As discussed in section 1.1, overgrazing and high livestock stocking rates have degraded the soils in the project area. This has led to reduction in vegetation cover thereby reducing above- and belowground carbon concentrations in the region⁹³. At present, pastoralist communities in the region follow unsustainable grazing practices and face increasing pressures to sell their land or convert it to farmland. Climate change and anthropogenic activities play a

⁸⁸ Boles, O., Shoemaker, A., Colin Courtney Mustaphi, & Paul Jeremy Lane. (2019, June). Historical Ecologies of Pastoralist Overgrazing in Kenya: Long-Term Perspectives on Cause and Effect. ResearchGate; Springer Nature. https://www.researchgate.net/publication/333197244_Historical_Ecologies_of_Pastoralist_Overgrazing_in_Kenya_Long-Term_Perspectives_on_Cause_and_Effect

⁸⁹ Agricultural, Kenya. "Kenya Agricultural and Livestock Research Organization." Kalro.org, 2017. Accessed 6 Aug. 2024.

⁹⁰ Critical Transitions from Pastoralism to Ranching in Central Africa | Current Anthropology: Vol 62, No 1. (2017). Current Anthropology.

⁹¹ Kristjanson, P., Radeny, M., Nkedianye, D., & Sanford, R. (2002). Valuing alternative land-use options in the Kitengela wildlife dispersal area of Kenya. ResearchGate; unknown.

⁹² Galvin, K. (2009, September 11). Transitions: Pastoralists Living with Change. ResearchGate; Annual Reviews.

⁹³ (Wachiye, S., Pellikka, P., Rinne, J., Heiskanen, J., Abwanda, S., & Merbold, L. (2022). Effects of livestock and wildlife grazing intensity on soil carbon dioxide flux in the savanna grassland of Kenya. Agriculture, Ecosystems & Environment, 325, 107713.)

major role in grassland degradation, thereby reducing SOC concentrations in the region. At the same time, water infiltration has dropped by more than 25% in certain parts of the grassland region, alongside a 30% increase in bulk density and silt content⁹⁴. The following figure illustrates the areas that are vulnerable to degradation.

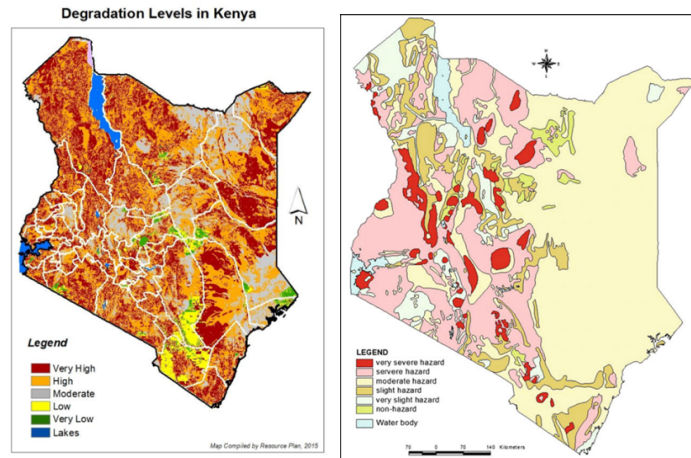


Figure 19: Severity of erosion risk in Kenya based on RS/GIS mapping^{95, 96}



⁹⁴ Omuto, C. T. (2008). Assessment of soil physical degradation in Eastern Kenya by use of a sequential soil testing protocol. *Agriculture, ecosystems & environment*, 128(4), 199-211.

⁹⁵ Wanjogu, S., et al. Kenya Soil Survey SUSTAINABLE LAND MANAGEMENT in KIAMBINDU, KIARUKUNGU, KYEEKOLO and KISIOKI SMALLHOLDER IRRIGATION SCHEMES (Mbeere, Kirinyaga, Makueni and Kajiado Districts). 2006, Accessed on 6 Aug

⁹⁶ Mulinge, W., Gicheru, P., Murithi, F., Maingi, P., Kihui, E., Kirui, O. K., & Mirzabaev, A. (2016). Economics of land degradation and improvement in Kenya. *Economics of land degradation and improvement—A global assessment for sustainable development*, 471-498.



Figure 20: Degraded grasslands

According to a recent report, almost all the counties in Kenya suffer from some form of land degradation⁹⁵. In another report, the same type of assessment was carried out in the overall sub-Saharan Africa region, in which overgrazing and extensive agriculture practices have led to land degradation. The below table tabulates the reason, type and countries where land degradation is quite evident:

Type of land degradation	Affected land (% of total)	Affected population (% of total)	Countries affected	Main cause(s)
Water erosion	46	97	All countries in eastern Africa (Kenya, Tanzania, Ethiopia, Malawi, Zambia)	Deforestation, overgrazing, agric. practices
Wind erosion	38	18	Botswana, Chad, Djibouti, Eritrea, Mali, Niger, South Africa and Sudan	Overgrazing, deforestation
Salinization			Severe in Kenya (30%), Tanzania (27%)	Water mismanagement

Type of land degradation	Affected land (% of total)	Affected population (% of total)	Countries affected	Main cause(s)
Soil fertility and nutrient depletion	Approx. 100	Approx. 100	All countries	Agric. practices, overgrazing, deforestation
Loss of habitat (deforestation)	0.7% of annual change of forest and woodland area in east and southern Africa		Hotspots: Burundi (– 5.2%), Comoros (– 7%), Nigeria (– 3.3%), Togo (– 4.5%), Uganda (– 2.2%), Zimbabwe (– 1.7%)	Deforestation, overgrazing, agricultural practices

Table 12: Land degradation types and extent in sub-Saharan Africa⁹⁷

There is an urgent need to address and contain further land degradation in the region. This project helps to restore degraded lands with the help of good and sustainable grassland management practices.

As per baseline survey, the pastoralists in the region grazed continuously without having proper land management plan in place. They were not practicing any of the fire control mechanism. Pastoralists also expressed their concern that the grassland degradation and land use change (conversion to croplands) increased in the last 20 years in general and rainfall there been a change in rainfall and temperature patterns.



Figure 21: Livestock grazing in Kenyan grasslands

⁹⁷ Kirui, O. K., Alisher Mirzabaev, & Joachim von Braun. (2021). Assessment of land degradation “on the ground” and from “above.” *SN Applied Sciences*, 3(3).

As per the VM0042 methodology's, Table 4 on minimum specifications on management practices for baseline scenario, a baseline survey was conducted. This was conducted to evaluate the baseline scenario in the project area before the start of the project. The questionnaires used for the survey are attached in Appendix 3. Each of these ranchers/pastoralists were interviewed in-person and the responses were recorded in the excel sheet. A process telephonic conversation was followed up after the interview to re-assure the details from the ranchers. Details of livestock stocking rates and grassland management activities have been captured in the survey.

Based on the analysis of this survey the results were developed. The primary attributes from VM0042's table 4 that are relevant to this project are the "Animal Type" and "Animal Stocking Rate" under the Grazing Practice of Agricultural Management Practice. Since these are open rangelands, crops are not grown on these lands, and there is no irrigation, tillage or any kind of nitrogen application used (these practices are unheard of for rangelands in Kenya). Continuous grazing and overstocking in Kenya involve allowing livestock to roam freely over a pasture without rotational rest periods. This unsustainable practice leads to overgrazing, where livestock continuously feed on the same areas, depleting vegetation and compromising soil health. Without proper rest periods, plants don't have time to recover, leading to reduced forage quality, soil erosion, and diminished biodiversity, ultimately degrading the grassland ecosystem. Continuous livestock grazing is the primary land use and livelihood activity. No active grazing management is taking place, so livestock continuously graze the available grasslands in a deregulated approach. The primary types of livestock grazed are cattle, sheep, goats, and horses at varying stocking rates across the project areas. The baseline survey was conducted to collect information for a period of 3 years ($t=-3$) prior to the project start date i.e., from 2016 to 2019.

In accordance with VM0042 Methodology Box 1, Option 3 was followed⁹⁸ i.e., determination via consultation with, and substantiated with a signed attestation from the landowner of the sample field during that period was chosen to collect quantitative and qualitative data. Hence the data gathering was done via consultation & discussions with ranchers, verified and attested by the landowner of the ranches. However, this project solely considers SOC (Soil Organic Carbon) for calculating emission reductions; none of the survey parameters are utilized in these calculations. Furthermore, an expert opinion has been sought to analyze the status of all chosen project activities in the region during the project's commencement, as detailed in the additionality section.

All the private ranchers that are part of the 1st Instance of the project were interviewed for the survey; hence the sampling is 100%. The survey was followed by a telephonic conversation with the ranchers to

⁹⁸ As per Box 1 of the methodology, certain quantitative information inputs required by the model selected in qualification approach 1 needs to be collected using any one of the 4 options provided in Box 1. In this project, combination of option 1 and 3 have been used to collect some baseline information. Since this is a grassland project and there are no cropping practices involved in this project, many of the sub-options suggested in the methodology are not applicable. For example, receipts or invoices, farm equipment specifications, logs or files containing machine and/or sensor data, etc. is not applicable since there are no activities in the baseline scenario which are associated with the given options. Majority of the baseline data collected via consultation with and substantiated with a signed attestation from the farmers of the sample field during that period chosen to collect quantitative and qualitative data. Only the stocking rates and type of animals need to be reported for the parameter Pbsl and Daysbsl which have been collected after checking rancher cattle logbooks maintained at the ranch level. Rest of the baseline information has been collected using option 3 which is via consultation and substantiated with a signed attestation from the rancher of the sample field during that period.

understand the scenario better and get deeper understanding of the baseline scenario. The following observations have been summed up after careful observation of the baseline surveys (see baseline survey documents for complete data):

1. All the ranches are privately owned.
2. All the ranchers receive an average rainfall of 35 inches per annum.
3. All the ranches have remained grassland for the past 15 years.
4. There has been no drastic decrease in the number of livestock after the start date of the project. The major livestock type of includes cattle, sheep, goats, horses. In one of the ranches (Lisa Ranch), wildlife, predators, scavengers are also found grazing.
5. Ranchers confirmed that the ranch was not involved in any cropping or harvesting activities as the area was under grazing.
6. As per the survey conducted, the ranch was not under the usage of synthetic or nitrogen fertilizer. All the ranchers confirmed this through the attested baseline survey.
7. Regarding controlled burning taking place in ranches - As all ranches are under private ownership and well managed. No burning incidents are reported.
8. Animals were being grazed in free style or continuous grazing in baseline scenario.
9. The specifications related to crop planting and harvesting, nitrogen fertilizer application, tillage and/or residue management are not applicable. All the respondents have mentioned that no crop production, compost, and synthetic N fertilizers are used or practiced in the baseline scenario. Any area defined as cropland is considered non-eligible area and excluded from the eligible project areas.
10. Irrigation and water management practices like dams, natural valleys, water troughs, water pans etc., were not a part of the rancher's management practices in the baseline scenario.
11. Among surveyed ranchers/pastoralists, it was observed that all the ranchers practiced continuous/unplanned or free grazing methods in the ranchers before the commencement of the project activities i.e., in between 2016 to 2018. Following the project's initiation, all the 3 ranchers/pastoralists persisted with this practice and are in the process of transitioning to improved grazing practices.
12. Livestock count of various breeds of animals grazed at the ranch was also collected to understand the year-on-year change and general productivity of the ranch. The major types of livestock are cattle, horses, sheep, goats, and wildlife, scavenger, and predators. Among them, the cattle are predominant, including various types of bulls, cows, heifers, steers and breed is Friesian X boran and pure boran in the project area. The total count of cattle on a ranch before the initiation of the project (i.e., baseline) was on an average in 2016 to 2018 in the ranch was between 310 to 1700.
13. The major grass species in the project area are *Dinebra retroflexa* (Vahl) Panz., *Dinebra* sp., *Echinochloa colona* (L.) Link, *Eragrostis exasperata* Peter and many others and all of these species are perennial grasses.

14. The annual livestock count on the ranch was collected for the years 2016 to 2022. Data pertaining to livestock count from 2016 to 2018 was gathered, revealing a consistent upward trend in the total number of animals present on the ranch.
15. Wildlife grazing is observed in all the ranchers in the baseline scenario and the animals include Cheetahs, Wildebeest, giraffes, eland, Thompson gazelle, Zebra, Antelopes, Hyenas, Leopards, Wolves, Hedgehog, Porcupine, Vultures and Ostrich majorly. The wildlife sightings type and average per year ranges between 300 to 6000 animals per year which depends on the animal type. For example, in Machakos ranch Zebras are sighted grazing around 2833 animals per year. There has been incidence of wildlife and human & livestock conflict and predation in the project area which has resulted in livestock losses as Cheetahs, Leopard, Hyenas attack on the cows, goats and sheep while grazing. And even incidence of spread of zoonotic diseases by wildlife that killed a lot of cattle in the project area. This is leading to less forage availability for the livestock to graze.
16. Information gathered from ranchers regarding the number of herds and details about grazing areas or paddocks indicates a lack of proper herd division. Additionally, there was a failure to appropriately allocate resting days for the paddocks or grazing areas and record this data.
17. All the ranchers mention that there has been grassland degradation and land use change (conversion to croplands) increased in the last 20 years of the project initiation due to unsustainable grazing practices like lack of unmanaged grazing in the area, land sales for urbanization, subdivision of neighboring ranches to small holder plots, and population pressure.

The following observations have been summed up after careful observation of the baseline surveys.

County	Ranch Name	Suite of Baseline Grazing Practices
Machakos	Lisa Ranch	Overstocking, Continuous Grazing
Machakos	Lukenya Ranch	Overgrazing, Continuous Grazing
Machakos	Machakos Ranch	Overgrazing, Continuous

Table 13: Suite of Baseline Practices for the Project Ranchers/Pastoralists

A detailed assessment and analysis of the Baseline Scenario has been provided to VVB.

Each instance, when added, will demonstrate the baseline and additionality in line with the methodology. The project shall specify one or more clearly defined geographic areas within each project activity instances, including the new ones, as and when added. Such geographic areas shall be specified using the geodetic polygons as described in the section 1.13. The project will ensure that the baseline and the additionality of the new project instances remains consistent with the initial project activities. The determination of baseline scenario and demonstration of additionality are based upon and consistent with the initial project activity instances. Each new Project Activity Instance will demonstrate which of the baseline scenarios listed in the methodology will be applicable. During the determination of the baseline scenario and the additionality, for the analysis of factors like common practices, relevant regulations,

historical grassland desertification trends, and other relevant factors, the analysis area encompassed the project's entire geographic area, hence, this analysis holds good for the initial project activity instance and well as the future project instances. Hence, this describes the criteria to be satisfied by new instances (fulfilled as per paragraphs 3.6.10 – 15 of VCS Standard v4.5), and how the baseline scenario shall be assessed for this project, and that the baseline scenario of the initial activity instances is the same (or at least as conservative) as the future instances in the project's geographic areas.

The baseline shall be updated every 10 years in accordance with as per methodology. The procedure for updating the baseline shall be done with reference to Section 9.3 of the applied methodology. The baseline estimated for calculating carbon removals across the landscape will be re-evaluated at an interval of every 10 years from the project start date to reflect changing environmental and socio-economic scenarios. The baseline re-evaluation includes the procedures available at the time of re-evaluation.

3.5 Additionality

As per the latest VCS methodology requirements v4.1, section 3.5.3 and methodology (VM0042) requirements, the additionality of this project is demonstrated in the section below.

3.5.1 Regulatory Surplus

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

☐ Annex 1 country ☒ Non-Annex 1 country

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

☐ Yes ☒ No

If the project is located inside a Non-Annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?

☐ Yes ☐ No

The proposed project is not mandated by any law, statute or other regulatory framework, or for UNFCCC non-Annex I country, any systematically enforced law, statute or other regulatory framework. This project is a voluntary activity undertaken by Boomitra.

The project and implementation of the project activities is not mandated by any law, statute, or other regulatory framework in Kenya as applicable for grassland and rangelands⁹⁹. In Kenya¹⁰⁰, There is/are no legal, policy, or regulatory framework to enforce the improved grazing practices being prescribed under this project section 1.12. Thus, the regulatory surplus requirements of the VM0042 methodology are

⁹⁹ Mureithi, F. (2024, June 14). Government now bans livestock grazing in public forests. Nation; Nation.

¹⁰⁰ REPUBLIC OF KENYA MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES AND COOPERATIVES NATIONAL AGRICULTURAL SOIL MANAGEMENT POLICY. (2020).

met. These activities represent improved agricultural land management practices that exceed the legal responsibilities of landowners or land users. Participation in this project is a voluntary coordinated action by the Boomitra. There is no legal, policy, or regulatory framework to enforce the regenerative agricultural practices being prescribed under this project. Thus, the regulatory surplus requirements of the VM0042 methodology are met¹⁰¹.

Below are the relevant details discussing the lack of laws and policies mandating rotational grazing and sustainable livestock management in Kenya:

Kenya Rangeland Study - ELD Initiative: This report highlights the degradation of rangeland ecosystems in Kenya and the challenges faced in achieving sustainable development. It mentions the weak governance due to dysfunctional traditional laws and poorly functioning modern laws, leading to unsustainable management practices. The study emphasizes the need for effective rangeland governance to prevent degradation and improve livelihoods¹⁰².

Participatory Rangeland Management Toolkit for Kenya: This toolkit discusses the requirements for effective rotational grazing, emphasizing the need for organized communities to enforce by-laws. It addresses the challenges posed by the lack of formal policies and the reliance on customary systems, which may not be effective in promoting sustainable practices¹⁰³.

Integrated National Land Use Laws and Guidelines: The below listed laws and guidelines published and enacted by Government of Kenya, mentions the encouragement of adoption sustainable practices such as, rotational grazing, improved livestock management, but highlight the inadequacies in legal frameworks and the lack of mandate the practices on grassland, Tracking of adoption, Support of financial incentives, effective monitoring and evaluation, These cumulatively hinder sustainable land uses and natural resource management^{104,105}. While these acts establish some regulations for grazing permits, it reflects the broader issue of inconsistent policies across different regions in Kenya, which can lead to ineffective management of grazing lands.

List of Policies and Regulations

1. WILDLIFE (CONSERVATION AND MANAGEMENT) ACT¹⁰⁶
2. AGRICULTURE ACT¹⁰⁷
3. Forest Conservation and Management Act 2016 (34(1))¹⁰⁸

¹⁰¹ NRT GRAZING @ 2013-CREATING A HEALTHY AND DESIRABLE RANGLANDS IN NORTHERN KENYA. (n.d.). Retrieved July 23, 2024

¹⁰² Lutta I.A., Wasonga V.O., Karanja R., Saalu F., Njiru J. 2020. Costs and benefits of sustainable rangeland management practices in Northern Kenya. Report for the Economics of Land Degradation Initiative in the framework of the "Reversing Land Degradation"

¹⁰³ Participatory rangeland managment toolkit for Participatory rangeland managment toolkit for Kenya Second edition. (n.d.).

¹⁰⁴ LAW OF KENYA, AGRICULTURE ACT, CHAPTER 318-Revised Edition 2012 [1986] Published by the National Council for Law Reporting with the Authority of the Attorney-General www.kenyalaw.org

¹⁰⁵ National Environment Management Authority (NEMA) - Home. (For a sustained Societal Attributes – Infrastructure, Environmental Resources and Public Safety).

¹⁰⁶ https://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/WildlifeConservationandManagementActCap376_2_.pdf

¹⁰⁷ <http://www.kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/AgricultureActCap318.pdf>

¹⁰⁸ https://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/2016/No._34_of_2016.pdf

4. Sustainable Development and Equity in the Kenyan Context¹⁰⁹
5. Kericho County Environment Management Act¹¹⁰
6. Crop Production and Livestock Act¹¹¹
7. Independent Electoral and Boundaries Act¹¹²
8. The Tana River County Livestock Grazing Control Act, 2017¹¹³
9. “Legislation | Pastoralist Knowledge Hub | Food and Agriculture Organization of the United Nations.” Fao.org, 2019¹¹⁴

3.5.2 Additionality Methods

In addition to the demonstration of regulatory surplus, as per the VM0042 methodology, additionality is determined by a project method. We follow the 2-step process outlined in the methodology.

Step 1: Identify barriers that would prevent the implementation of a change in pre-existing agricultural management practices:

The project has identified various barriers for each individual improved Agricultural Land Management (ALM) activity discussed in this Project Document (PD) and implemented by the project. These barriers include cultural and social barriers, information and knowledge barriers, poverty and climate-dependent livelihoods, financial barriers, and socio-economic barriers. The detailed exploration of these barriers highlights the complexities and challenges faced in adopting practices such as rotational grazing, livestock management, water management, promotion of capacity building programs, conservation of grassland biodiversity, and multi-species grazing in Kenya's grasslands.

There are several barriers that prevent implementation of the change in practices¹¹⁵:

Information and Knowledge Barrier: The information and knowledge required to adopt the Rotational grazing, effective livestock and water management, the promotion of capacity-building programs, and the conservation of grassland biodiversity, including multi-species grazing of wildlife and livestock, collectively enhance sustainable agricultural practices and ecosystem health requires significant levels of capacity building through training and workshops. At the same time, the required information and knowledge are not easily accessible to every pastoralist. The nomadic nature of the pastoralist lifestyle obstructs continued access to formal education. The traditional system of schooling is inherently

¹⁰⁹ <https://kenyalaw.org/kl/index.php?id=1906>

¹¹⁰ <https://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/2021/KerichoCountyEnvironmentManagementAct2021.pdf>

¹¹¹ <http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/CropProductionandLivestockActCap321.pdf>

¹¹² <http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/IndependentElectoralandBoundariesCommissionNo9of2011.pdf>

¹¹³ <https://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/TanaRiverCountyLivestockGrazingControlAct2017.pdf>

¹¹⁴ https://www.fao.org/pastoralist-knowledge-hub/knowledge-repository/legislation/en/?pno=38&freetext=&year=&country_iso3=&ncl=&topics=

¹¹⁵ SPerils facing Kenyan pastoralists, livelihood innovations and wider impacts: learning from project experience. (2021). Development Studies Research.

incompatible with pastoralist practices and lifestyle. This can pose a barrier, preventing the implementation of sustainable knowledge systems in grazing and grazing-related activities. With added carbon credits revenue, pastoralists may be incentivized to adopt these sustainable practices at scale¹¹⁶. Knowledge barriers also play a critical role; many pastoralists lack awareness and understanding of rotational grazing's benefits and techniques. This gap in knowledge is exacerbated by insufficient technical support and training programs, which are essential for facilitating the transition to more sustainable practices ^{117,118, 119}.

Poverty and Climate-Dependent Livelihoods: Most pastoralist areas in Kenya are poverty-ridden, with a large proportion of the population falling under the national poverty line^{120,121}. Increasing instances of droughts and floods have grossly affected livelihoods that are largely dependent on climate-fed activities. With implementation of sustainable grassland practices (such as rotational grazing) and the added source of revenue derived from carbon credits, a two-fold advantage is accorded to the community¹²². Payment schemes for services outside traditional markets were typically absent. As a result, cost-benefit analyses are biased toward development over conservation, and planning efforts miss potential win-win areas and associated opportunities to finance conservation in innovative ways. Discussed studies in this section study emphasizes the lack of awareness and technical knowledge among pastoral communities as a barrier¹²³. Capacity-building programs are essential to educate communities on sustainable practices and the long-term benefits of rangeland restoration¹²⁴. Conservation of Grassland Biodiversity: Poverty and reliance on climate-dependent livelihoods make it challenging for communities to prioritize biodiversity conservation. Economic incentives and alternative income sources are crucial to support conservation efforts¹²⁵.

Financial Barrier: The proposed project activities require significant amounts of initial investment to adopt at scale. The pastoralists in the project area do not have such capabilities to invest upfront. For a long time, most of the developmental policies and funds allocated by the government of Kenya have been directed towards what are considered more productive agricultural avenues of the country. The arid areas

¹¹⁶ Florez, J. F., Karimi, P., John, Ángel, N. T., & Burkart, S. (2024). Developments, bottlenecks, and opportunities in seed markets for improved forages in East Africa: The case of Kenya. *Grassland Research*.

¹¹⁷ Khalil, M. I., Cordovil, C. M., Francaviglia, R., Henry, B., Klumpp, K., Koncz, P., ... & Rainer11, N. (2021). 35. Grazing exclusion and rotational grazing. *Recarbonizing global soils—A technical manual of recommended sustainable soil management: Volume 3*

¹¹⁸ Kenya Rangeland Study COSTS AND BENEFITS OF SUSTAINABLE RANGELAND MANAGEMENT PRACTICES IN NORTHERN KENYA. (n.d.). Retrieved August 5, 2024.

¹¹⁹ Wafula, W. M., Wasonga, O. V., Koech, O. K., & Kibet, S. (2022). Factors influencing migration and settlement of pastoralists in Nairobi City, Kenya. *Pastoralism*, 12, 1-14.

¹²⁰ Florez, J. F., Karimi, P., Paredes, J. J., Ángel, N. T., & Burkart, S. (2024). Developments, bottlenecks, and opportunities in seed markets for improved forages in East Africa: The case of Kenya. *Grassland Research*, 3(1), 79-96.

¹²¹ Income and Asset Poverty among Pastoralists in Northern Kenya: The Journal of Development Studies: Vol 53 , No 6 - Get Access. (2017). The Journal of Development Studies. <https://doi.org/10.1080/00220388.2016.1219346>

¹²² Mburu, S., Otterbach, S., Sousa-Poza, A., & Mude, A. (2017). Income and asset poverty among pastoralists in northern Kenya. *The Journal of Development Studies*, 53(6), 971-986.

¹²³ Mikula, R., Mburu, L., & Osuga, I. (2022). Rangeland Pasture Management Strategies during Drought among Pastoralists in Kajiado County, Kenya. *Current Science*, 2(6), 241-256.

¹²⁴ Lind, J., Sabates-Wheeler, R., Caravani, M., Kuol, L. B. D., & Nightingale, D. M. (2020). Newly evolving pastoral and post-pastoral rangelands of Eastern Africa. *Pastoralism*, 10, 1-14.

¹²⁵ Nyongesa, J. M., Donatti, C. I., & Kiptenai, T. K. (2023). Community-Based Rangeland Restoration for Climate Resilience and Pastoral Livelihoods in Chyulu, Kenya. *Maiko Nishi*, 35.

inhabited by the pastoralists did not fall within their scope.¹²⁶ Though a national policy to enable development in arid and semi-arid regions has since been adopted, additional revenues from the sale of carbon credits are essential to overcome investment barriers.¹²⁷ To adopt this practice, create necessary paddocks and fences needs investment, which being primary barrier in the ranchers¹²⁸ The study shows that poverty and vulnerability to climate change limit the adoption of rotational grazing, as immediate survival needs outweigh long-term ecological benefits¹²⁹.

Financial incentives and better market conditions are necessary to motivate pastoralists to adopt improved livestock management practices. The lack of adequate financial incentives and market conditions in Kenya serves as a significant barrier to the adoption of improved rotational grazing practices among pastoralists. Despite the government's efforts to provide various incentives, such as adoption incentives, infrastructure investment and capital allowances, many pastoralists remain hesitant to engage with formal financial institutions. This reluctance is often rooted in cultural barriers and a historical perception of financial services as risky, which discourages them from taking loans necessary for investing in better livestock management practices. For instance, the nomadic and pastoralist lifestyles prevalent in Northern Kenya complicate the ability of financial institutions to assess creditworthiness and extend services effectively, further entrenching these barriers¹³⁰.

While initiatives like the USAID Kuza program aim to enhance financial inclusion by offering impact incentives to financial institutions, the overall outreach remains limited. Many pastoralists continue to rely on informal financial mechanisms rather than engaging with formal systems that could provide the necessary capital for adopting sustainable practices^{131,132}. Considering the geographical challenges and poor infrastructure in pastoral areas make it difficult for financial institutions to reach these communities, exacerbating the issue¹³³ Consequently, without significant improvements in financial accessibility and a shift in cultural perceptions regarding loans, the adoption of rotational grazing and other sustainable livestock management practices will likely remain constrained.

Economically, the initial costs associated with implementing rotational grazing, such as building infrastructure for fencing and water supply, can be prohibitive for many pastoralists. Moreover, the reliance on traditional grazing methods, which have historically provided economic stability, creates a reluctance to adopt new practices that may seem risky without guaranteed market access for livestock

¹²⁶ Little, Peter D.; McPeak, John G.; Barrett, Christopher B.; and Kristjanson, Patti, "Challenging Orthodoxies: Understanding Poverty in Pastoral Areas of East Africa" (2011). Economics - Faculty Scholarship. 83. <https://surface.syr.edu/ecn/83>

¹²⁷ Maina, K. W., Cecilia Nyawira Ritho, Lukuyu, B., & Rao, J. (2022, June). Opportunity cost of adopting improved planted forage: Evidence from the adoption of Brachiaria grass among... ResearchGate. Opportunity cost of adopting improved planted forage Evidence from the adoption of Brachiaria grass among smallholder dairy farmers in Kenya

¹²⁸ Conelly, W. T., & Chaiken, M. S. (2000). Intensive farming, agro-diversity, and food security under conditions of extreme population pressure in western Kenya. *Human Ecology*, 28, 19-51.

¹²⁹ Kirui, L. K., Jensen, N. D., Obare, G. A., Kariuki, I. M., Chelanga, P. K., & Ikegami, M. (2022). Pastoral livelihood pathways transitions in northern Kenya: The process and impact of drought. *Pastoralism*, 12(1), 23.

¹³⁰ Autio, A., Johansson, T., Motaroki, L., Minoia, P., & Pellikka, P. (2021). Constraints for adopting climate-smart agricultural practices among smallholder farmers in Southeast Kenya. *Agricultural Systems*, 194, 103284.

¹³¹ USAID. (n.d.). Utilizing Impact Incentives for Climate Finance and Financial Inclusion in Northern Kenya.

¹³² World Bank. (2023). Financial Inclusion Builds Resilience of Pastoralists to Drought.

¹³³ Ouma, C. (2017). Analysis on pastoralists financial products and models in Kenya.

products^{134,135}. Financial constraints and lack funds, carbon market incentives and market access¹⁴² are significant barriers. Capacity-building programs that include financial incentives and market linkage components can help overcome these barriers¹³⁶.

Socio-Economic Barrier: The many socio-economic and cultural barriers in the region hinder the adoption of new practices. Socio-economic barriers faced by pastoralists in Kenya's grasslands when attempting to adopt improved grazing practices encompass limited access to resources, economic vulnerability due to fluctuating livestock prices, and the lack of diversified income sources, as well as inadequate financial resources to invest in infrastructure and technologies.¹³⁷ The absence of essential infrastructure, challenges in accessing markets for livestock products, property rights and land tenure disputes, limited access to credit, deeply ingrained traditional practices and cultural beliefs, and the scarcity of extension services in remote areas also hinder adoption¹³⁸. Additionally, government policies and regulations that may not align with improved grazing practices, and the increasing impact of climate change further compound these challenges¹³⁹. Addressing these barriers necessitates a holistic approach involving policy changes, targeted investments, and community engagement to build trust and encourage the adoption of sustainable grazing practices while addressing the broader economic and social issues affecting pastoralist communities in Kenya. Through this project, Boomitra is trying to institutionalize all the components required to implement this project at large scale through local partners. This would only happen with carbon credit revenues.

Cultural and Social Barriers: Socially, cultural resistance plays a significant role, as many pastoral communities are deeply rooted in traditional grazing methods, viewing any shift towards rotational grazing as a threat to their identity and heritage. Gender dynamics further complicate this landscape; women's limited decision-making power within these communities often restricts their ability to influence the adoption of innovative practices like rotational grazing¹⁴⁰. equitable access to conservation's economic benefits both assets and incomes, gender inclusion particularly women in decision making, accountability of resources and inclusivity and participation of the sustainability of all practices in communally owned land¹⁴¹.

¹³⁴ Kenya Rangeland Study COSTS AND BENEFITS OF SUSTAINABLE RANGELAND MANAGEMENT PRACTICES IN NORTHERN KENYA. (n.d.). Retrieved August 5, 2024.

¹³⁵ Wafula, W. M., Wasonga, O. V., Koech, O. K., & Kibet, S. (2022). Factors influencing migration and settlement of pastoralists in Nairobi City, Kenya. *Pastoralism*, 12, 1-14.

¹³⁶ Creemers, J., & Aranguiz, A. A. (2019). Quick scan of Kenya's forage sub-sector. Netherlands East African Dairy Partnership (NEADAP), Working Paper.

¹³⁷ Rodriguez, J. M., Molnar, J. J., Fazio, R. A., Sydnor, E., & Lowe, M. J. (2009). Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable agriculture and food systems*, 24(1), 60-71.

¹³⁸ Wairimu Ng'ang'a, T., & Crane, T. A. (2020). Social differentiation in climate change adaptation: One community, multiple pathways in transitioning Kenyan pastoralism. *Environmental Science & Policy*, 114, 478-485.

¹³⁹ Fredrick M. Mngube, & Douglas N. Anyona. (n.d.). Land Cover Change and Its Socio-Economic Impact on the Residents of the Mara River, Kenya. Scientific Research. https://www.scirp.org/html/4-2360750_95341.htm

¹⁴⁰ Khalil, M. I., Cordovil, C. M., Francaviglia, R., Henry, B., Klumpp, K., Koncz, P., ... & Rainer11, N. (2021). 35. Grazing exclusion and rotational grazing. *Recarbonizing global soils—A technical manual of recommended sustainable soil management: Volume 3*

¹⁴¹ Kenya Rangeland Study COSTS AND BENEFITS OF SUSTAINABLE RANGELAND MANAGEMENT PRACTICES IN NORTHERN KENYA. (n.d.). Retrieved August 5, 2024.

This project highlights the challenges of adopting rotational grazing due to cultural shifts¹⁴² from nomadic to semi-nomadic lifestyles, leading to overgrazing and resistance to changing traditional grazing patterns¹⁴³. The project encourages community-led rotational grazing to restore soil health and improve livestock conditions¹⁴⁴. Cultural differences can hinder communication and understanding between ranchers¹⁴⁵. Families from diverse backgrounds may feel alienated or misunderstood, impacting their engagement with the educational system.^{146,147}.

Multiple study in Kenya, discusses the socio-cultural resistance to multi-species grazing¹⁴⁸ due to the deep-rooted customs of single species grazing. Integration of wildlife and livestock is often resisted due to concerns over disease transmission and competition for resources¹⁴⁹.

Institutional Barriers: Institutionally, the lack of supportive policies and governance structures hinders the promotion of sustainable grazing practices. Weak traditional and modern institutions fail to support effective land management, leading to unsustainable practices that exacerbate land degradation. The communal ownership of pastoral land, combined with increasing competition for resources, complicates the governance of grazing lands, making it difficult for communities to implement rotational grazing effectively^{150,151,152}

Lack of effective water management resources: In Kenya, the lack of effective water management resources significantly contributes to the degradation of grasslands, which in turn adversely affects livestock grazing activities. The arid and semi-arid lands (ASALs) of Kenya face severe water scarcity, where the demand for water often exceeds the available supply for both people and livestock. This situation is exacerbated by poor governance, competition for resources, and ineffective management practices, leading to conflicts over water and pasture resources.

The degradation of rangeland ecosystems is primarily driven by inadequate water resource management, which results in diminished land productivity and threatens the livelihoods of pastoral communities that rely heavily on livestock. As water sources dry up, the availability of forage decreases, forcing pastoralists

¹⁴² Secretariat of the Convention on Biological Diversity. 2010. Pastoralism, Nature Conservation and Development: A Good Practice Guide. Montreal, 40 + iii pages.

¹⁴³ Wairimu Ng'ang'a, T., & Crane, T. A. (2020). Social differentiation in climate change adaptation: One community, multiple pathways in transitioning Kenyan pastoralism. *Environmental Science & Policy*, 114, 478-485.

¹⁴⁴ Msuya, D. G. Pastoralism beyond Ranching and Its Vulnerabilities as a Farming System, Especially in Semi-arid Tropics of Africa.

¹⁴⁵ Suda, C. A. (2000). Gender, culture and environmental conservation in Western Kenya: contextualizing community participation and the choice of techniques. *Nordic Journal of African Studies*, 9(1), 18-18.

¹⁴⁶ P. A. Danaher. (2023) Mobilising effective schooling provision to support innovative education for occupationally mobile families and their children. *Compare: A Journal of Comparative and International Education* 53:4, pages 549-566.

¹⁴⁷ Autio, A., Johansson, T., Motaroki, L., Minoia, P., & Pellikka, P. (2021). Constraints for adopting climate-smart agricultural practices among smallholder farmers in Southeast Kenya. *Agricultural Systems*, 194, 103284.

¹⁴⁸ Otieno, S. G. (2005). Effects of domestic and wild herbivore utilisation on Herbaceous layer above ground primary production in Central Kenya Savanna (Doctoral dissertation, University of Nairobi).

¹⁴⁹ Leweri, C. (2022). Herding strategies under shifting rainfall conditions: implications for rangeland conservation and pastoralist livelihoods (Doctoral dissertation, NM-AIST).

¹⁵⁰ Kenya Rangeland Study COSTS AND BENEFITS OF SUSTAINABLE RANGELAND MANAGEMENT PRACTICES IN NORTHERN KENYA. (n.d.). Retrieved August 5, 2024.

¹⁵¹ Wafula, W. M., Wasonga, O. V., Koech, O. K., & Kibet, S. (2022). Factors influencing migration and settlement of pastoralists in Nairobi City, Kenya. *Pastoralism*, 12, 1-14.

¹⁵² Pas, A. (2018). Governing grazing and mobility in the Samburu lowlands, Kenya. *Land*, 7(2), 41.

to resort to unsustainable grazing practices. The mismanagement of water resources, coupled with climate change impacts, has led to the drying of seasonal rivers and boreholes, contributing to food insecurity and increased vulnerability among pastoralists.

The failure to implement integrated water management strategies limits the ability of communities to adapt to changing environmental conditions. For instance, the existing infrastructure often lacks functionality, and water-related interventions tend to be short-term solutions that do not address the underlying complexities of water demand and supply. As a result, pastoralists face challenges in accessing sufficient water for their livestock, leading to poor grazing activities and further degradation of grassland ecosystems.

Information gaps on efficient water management techniques hinder adoption. The study suggests integrating modern water conservation methods with traditional knowledge to improve water use efficiency in pastoral regions.

Step 2: Demonstrate that the adoption of the suite of proposed project activities is not common practice

The proposed project activities are not common in the project area. As per VM0042, it will be demonstrated that the activities are not common, and that adoption is less than the 20% threshold.

Although several studies have been conducted, there is a significant lack of data related to the adoption of these practices. The Government of republic of Kenya guidelines mention the encouragement of rotational grazing but highlight the inadequacies in legal frameworks and the lack of tracking, monitoring and evaluation of the implementation and progress, which hinder adoption of sustainable land and resource management¹⁵³. However, as specified in the VCS Standard v4.5 and the VM0042 v1.0 methodology, Boomitra consulted with an expert, with the assistance of an implementing partner, to gather relevant information. This information was then presented to assess the common practices within the VCS 3340 project.

Activity Name	% of adoption rate
Improved Grazing Practice	10%
Biodiversity Conservation-Lion proof lights	5%
Biodiversity Conservation- Creation of wildlife zones	1%
Biodiversity Conservation- Hiring and equipping rangers	1%
Biodiversity Conservation- Zoning of wildlife breeding areas	2%
Gabions (Water Management)	1%
Promotion of Capacity Building Programs	5%

¹⁵³ [National Environment Management Authority \(NEMA\) - Home. \(For a sustained Societal Attributes – Infrastructure, Environmental Resources and Public Safety\).](#)

As per the methodology, if the evidence on existing adoption rates for the combined activities are not available, the existing adoption rates (i.e., pre-project) of the individual expert's opinion. Below are the some of the studies provides the information about adoption rate that are in limited to the project scope.

The establishment of conservancies has begun to address some of these challenges to the land, by stemming some of the damage to the ecosystem and providing some income to landowners – however, tourism has many risks associated and for most pastoralists the income earned through tourism and land leasing is not adequate to sustain their livelihood¹⁵⁴. Traditional pastoralism has been increasingly viewed as an “economic activity ‘doomed to fail’ by younger and more educated Maasai and other community members, and this mindset has contributed to decreasing the prevalence and implementation of practices such as rotational grazing and will continue to reduce without any intervention. For example, within the Amboseli ecosystem, it is estimated that 71% of herders in the Kajiado district have attempted crop cultivation, as part of a move to more market-oriented and commercial production sources of revenue¹⁵⁵. Pastoralists in Laikipia who were hired as laborers for private ranches reported that they were often unwilling or unable to apply their knowledge regarding when and what routes to take to reach areas with better nutrients and wildlife density, and often avoided applying these best practices due to the top-down management and protocols, potential for risks, and large herd sizes¹⁵⁶. In the Mara 33% of households surveyed reported owning fewer livestock per capita than what is estimated as the minimum required to maintain a traditionally pastoral livelihood¹⁵⁷.

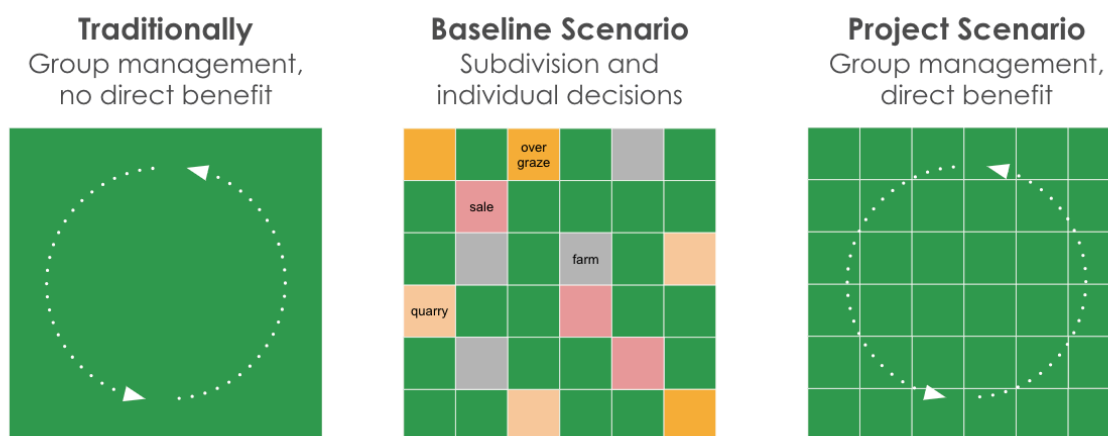


Figure 22: Representation of Baseline Scenario and Project Scenario

¹⁵⁴ Weldemichel, T. G., & Lein, H. (2019). “Fencing is our last stronghold before we lose it all.” A political ecology of fencing around the Maasai Mara National Reserve, Kenya. *Land Use Policy*, 87, 104075–104075.

¹⁵⁵ Okello, M. M., & D’amour, D. E. (2008). Agricultural expansion within Kimana electric fences and implications for natural resource conservation around Amboseli National Park, Kenya. *Journal of Arid environments*, 72(12), 2179-2192.

¹⁵⁶ Yurco, K. (2017). Herders and herdsmen: The remaking of pastoral livelihoods in Laikipia, Kenya. *Deleted Journal*, 7(1).

¹⁵⁷ Bedelian, C., & Ogutu, J. O. (2016, June). Trade-offs for climate resilient pastoral livelihoods in wildlife conservancies in the Mara Ecosystem, Kenya. *Trade-offs for climate resil*

The successful implementation of group management, with an individually received benefit, is essential to the long-term stewardship of grassland environments. However, this is still very rare in practice as elite capture is still dominant.

Finally, a recent study on water management, harvesting, and storage activities adoption shows a very low adoption rate by households – and with a specifically lower correlation of adoption by those who listed cattle keeping as their main source of livelihood (pastoralists that comprised 60.3% of the 204 non-adopters and 12.5% of adopters) and higher adoption rates by agro-pastoralists who listed livestock *and* crop production as a main sources of livelihood or who reported membership within farmer groups (84%+ of the 96 adopters for both categories)¹⁵⁸. Although most of the respondents in the study also acknowledged the benefits of water harvesting technologies, many did not have the resources, tools, or knowledge required to implement these new methods on their own without participating in a project such as this where they could receive additional revenue through carbon credit sales and participate in capacity building and training activities led by other pastoralists.

The primary project activity is rotational grazing, and this activity is relatively unknown in this region. No recent quantitative statewide or nationwide surveys exist, but an expert has given his opinion (attested with date) on the adoption rates of the project activities. Details of the expert opinion are provided separately for the VVB. As per his opinion, only 10% of pastoralists have adopted improved grazing practices like rotational grazing and grass banking in the region. Gabions and water management have adoption rates of approximately 1%. The wildlife forms an integral part of the project area but adoption rates of conservation of biodiversity like zoning of wildlife breeding areas is 2%, lion proof lighting is 5%, creation of wildlife zones is 1% and hiring and equipping of rangers is 1% as well. Thus, the 20% adoption rate threshold is met and each project activities is individually not common practice.

Without carbon finance, the ranchers would neither be incentivized to practice sustainable grazing, leaving their land in a degraded state, nor will they be able to receive scalable knowledge support to change their practices. Simply put, the project would not exist without carbon finance.

As referred in the Section 1.5.1 of this document, the additionality criteria for future added project activity instances will be in a line with requirements of VCS standard V4.5 Section 3.6.10.

Hence this project is additional, as it meets all the additionality requirements of the methodology.

3.6 Methodology Deviations

In this Project, we propose a deviation to use Equation 65 from VM0042 v2.0 to calculate uncertainty in place of the Equation 46 of VM0042 v1.0. This proposal is based on the clear benefits of improved accuracy and the assurance that the measurements of SOC increments remains both conservative and reliable. Equation 65 from VM0042 v2.0 is preferred over Equation 46 from VM0042 v1.0 due to its superior statistical accuracy and conservativeness while determining the uncertainty. In Equation 65, the

¹⁵⁸ Lutta, A. I., Oliver Vivian Wasonga, Nyangito, M. M., Falendra Kumar Sudan, & Robinson, L. W. (2020). Adoption of water harvesting technologies among agro-pastoralists in semi-arid rangelands of South Eastern Kenya. *ENVIRONMENTAL SYSTEMS RESEARCH*, 9(1).

variance of estimates is calculated based on the mean emission reductions across the entire project area, enhancing the precision of uncertainty deductions. This contrasts with Equation 46, which aggregates variances from multiple pools and gases without providing a clear framework for how they contribute to the overall uncertainty. The equation 65 employs uncertainty deduction based on a defined threshold in the estimated probability density function of the ERR for a given source. This enables a judgement of the extent to which the achieved removal or reduction by the project may be expected to be accurate.

By using Equation 65 from VM0042 v2.0 to calculate uncertainty in place of the Equation 46 of VM0042 v1.0 does not affect any from the criteria and procedures relating to monitoring or measurement set out in the methodology. This deviation will not negatively impact the conservativeness of quantification removals in this project except where this deviation result in increased accuracy in overall qualifications

4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As seen in Section 3.3, this project only includes Soil Organic Carbon stock change in the project boundary, which will be quantified with Quantification Approach 1 as given in VM0042, Version 1. Soil Organic Carbon levels are estimated using RothC model as described in the section 3.2 of PDD.

Soil organic Carbon (SOC) stocks are estimated under Quantification Approach 1, using Equation 2 below:

$$SOC_{bsl,i,t} = \phi SOC_{bsl,i,t}$$

Where

$SOC_{bsl,i,t}$	Carbon Stocks in the soil organic carbon pool in the baseline scenario for sample unit i at the end of period t ; tCO _{2e} /unit area
$\phi SOC_{bsl,i,t}$	Modeled soil organic carbon pool in the baseline scenario for sample unit i at the end of period t ; tCO _{2e} /unit area
i	Sample unit

As per methodology, baseline is modelled for each sample unit (each ranch in this project). As per the guidance provided in the table 6 of the methodology, baseline emissions are estimated. As discussed in section 3.2 of PD, RothC model needs certain inputs which needs to be collected from many valid

sources. One of the key inputs is Soil Organic Stock. This input is measured is using remote sensing technology and is determined for $t=0$ ¹⁵⁹.

The remote sensing system used in this project is calibrated using a ground-truth primary dataset sourced from the Land Degradation Surveillance Framework v4.0¹⁶⁰ system of the International Council for Research in Agroforestry (ICRAF), a CGIAR lab located in Nairobi Kenya. There are 616 data points in this dataset, all collected since 2017 and accessible through the ICRAF Dataverse¹⁶¹.

As described further in section 5.1 Kenya Grasslands ATBD, all of these physical ground-truth samples were collected since 2017. This dataset has geocoordinates, sampling depths, dates of sampling, soil organic carbon weight percentages and bulk densities. All samples used for training and testing were collected and analyzed using the same sample collection and measurement protocol, the LDSF framework¹⁶². The training dataset and the testing dataset were created by randomly splitting the primary dataset, with 90% of data points used for training and 10% of data points used for testing, but no other intentional differences exist between the train and test data. Additional details on this process may be found in section 5.1 of the Kenya Grasslands ATBD. Specifically, additional information on how sample error is accounted for in the remote sensing model calibration may be found in section 5.1.1 of the Kenya Grasslands ATBD and errors associated with this model are plotted in Figure 14 and Table 5 of the Kenya Grasslands ATBD.

The appropriateness of the remote sensing calibration dataset with respect to the initial project instances is further studied, in terms of the following factors: general spatial coverage of the project location, representation of climate zones present in the initial instances, representation of the soil textures present in the initial instances, matching land cover type (only grasslands in this project), and an appropriate range of soil carbon that is representative of typical grassland soil carbon ranges. This choice of factors is chosen based on the theoretical basis of the remote sensing technology used, which is described further in the remote sensing report.

The soil carbon ranges were studied to check for any numbers that fall out of realistic ranges (E.g. 0-5.0% for semi-arid grasslands, this is directly observed in the soil survey data), and any outliers were to be removed from the dataset to ensure accuracy. No samples were removed as no outliers were found.

The table below shows the distributions of different climate zones (from the IPCC classification¹⁶³) in the calibration dataset and initial project instances.

Climate Zone	% of Initial Project polygons	% of Calibration Dataset
Tropical Montane	100	27.78
Tropical Dry	0	69.75

¹⁵⁹ The specific measurement approach is available in depth in the accompanying CarbonFocus Algorithm Theoretical Basis Document available at validation to the VVB. There are no project emissions from any of the project activities of the project.

¹⁶⁰ <http://landscapeportal.org/blog/2015/03/25/the-land-degradation-surveillance-framework-ldsrf/>

¹⁶¹ <https://data.worldagroforestry.org/>

¹⁶² ¹⁶² <http://landscapeportal.org/blog/2015/03/25/the-land-degradation-surveillance-framework-ldsrf/>

¹⁶³ <https://www.ipcc-nggip.iges.or.jp/public/2019rf/corrigenda1.html>

Warm Temperate Dry	0	2.46
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Table 14: Distribution of the climate zone for the initial project polygons and calibration datasets

The figure below shows the spatial extent of the calibration dataset and project farm locations, with respect to the grouped project boundary and the IPCC climate zones:

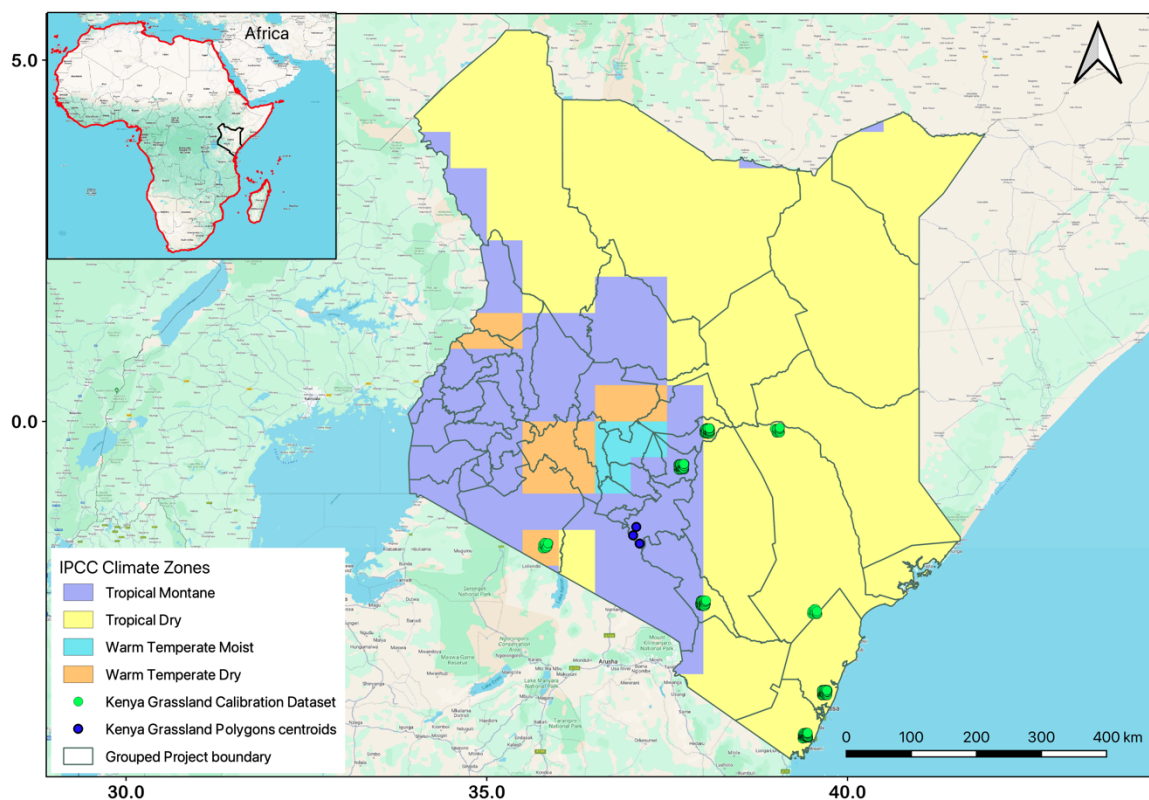


Figure 23: Spatial extent of the IPCC climate zones in the project region, with the calibration dataset and project ranch locations overlaid

The table below shows the distributions of different soil textures in the calibration dataset and initial project instances.

Soil Texture	% of Initial Project polygons	% of Calibration Dataset
Clay	0.0	11.38
Sandy Clay	0.0	0.47
Sandy Clay Loam	0.0	71.83
Clay Loam	100	12.32
Loam	0.0	2.93
Sandy Loam	0.0	1.05

Table 15: Distributions of different soil textures in the calibration dataset and initial project instances.

The figure below shows the spatial extent of the soil textures in the region, with the calibration dataset and project ranch locations overlaid:

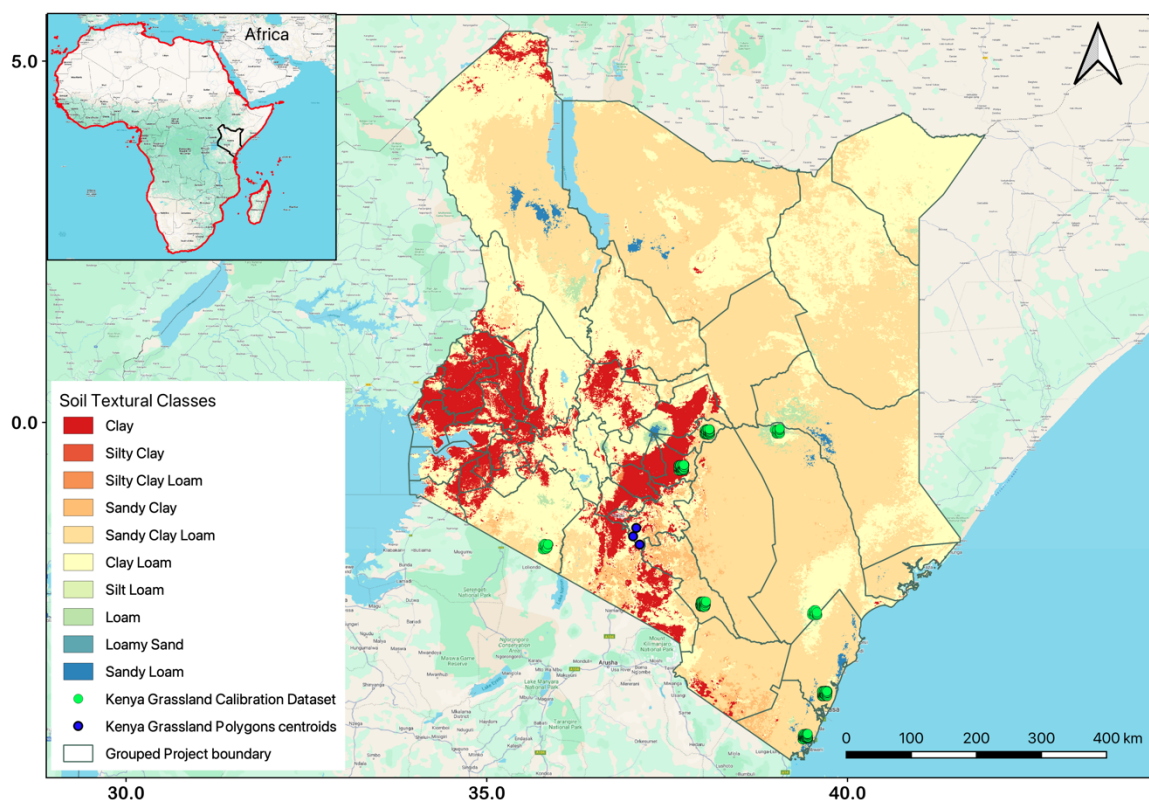


Figure 24: Spatial extent of the soil textures in the region, with the calibration dataset and project ranch locations overlaid

The above tables and figures show that the calibration dataset is representative of the climate zones and soil textures found in the initial project instance and covers the grouped project location. All of these attributes establish that the calibration dataset used fits the requirements of the initial project instance, for training the remote sensing technology to produce the soil organic carbon stock input for the RothC model. In the future, for new project instances added to the project, it is required to check that the project instances fall within the grouped project boundaries, and that the project instances are also represented in terms of their climate zone and soil texture within the available calibration dataset. These are present as eligibility criteria for this grouped project. New calibration data may be added during verifications of the project for the representation of new soil textures that are not covered currently in the initial calibration datasets available at the time of validation. Thus, new project instances that have soil textures not represented in the initial calibration datasets available at validation may still be added to the project in subsequent verifications if suitable calibration data for those soil textures is shown and similarly

substantiated for representativeness as in the above. Both ICRAF and Boomitra engage in ongoing soil sample collection on the ground. New calibration datasets for a new soil texture being added to the project will be obtained as and when data is collected for the new soil texture and is available for use.

In addition to the primary dataset of soil data used for calibration, the remote sensing technology used in this project utilizes the following input data sources for producing soil carbon stock values for the project activity instances: ESA satellite data (Sentinel satellite bands), NASA satellite data (SMAP products). Further details are available in the remote sensing report (ATBD) available to the VVB and Verra at the time of validation. The satellite data sources used have full planetary coverage, and thus also cover the entire grouped project boundaries, and additionally have long-duration mission support from ESA/NASA, so they will be usable for any additional project activity instances added in the future as well. Thanks to redundancy in the spectral bands used in for our satellite data based models, in the event of the loss of a satellite or the inability to retrieve data during a critical period, we can rely on comparable data from other satellite sources. To make use of these data sources we will either train a transformation function to interconvert satellite sources or retrain our models using a new source, whichever is found to be more appropriate and accurate in assessing soil carbon stock estimates.

The performance of the remote sensing technology itself is described further in Section 4.4.1 of this project description.

Other soil parameters for the RothC model are determined from published soil maps, with known uncertainty. Climate variables parameters are sourced from a synthetic weather station. The model prediction interval is monthly, so all parameters are collected and submitted to the model with month frequency. The following table outlines the model input parameters and their sourcing method.

Input Data	Source Used	Timing
Soil organic carbon stock at t=0 (tons C/ha)	Boomitra's remote sensing technology is used to determine soil organic carbon weight percentage and bulk density, with known uncertainty, at t=0, and the product of the two values followed by unit interconversion provides the soil organic carbon stock. The approach and its uncertainty are described further in Section 4.4.1. This data source meets the requirements of Table 6 in the methodology, which stipulates that SOC stock must be "Directly measured at t=0 or (back-) modeled to t=0 from measurements collected within +/-5 years of t=0, or determined for t=0 via emerging technologies (e.g., remote sensing)."	Ex-ante
Monthly rainfall (mm)	ERA5-Land weather data from the European Center for Medium Range Weather Forecasts (ECMWF), which has data from 1950 ¹⁶⁴ . This data source meets the requirements of Table 6 in the methodology, which stipulates that	Continuously Monitored Ex-ante

¹⁶⁴ Copernicus Climate Data Store. Copernicus Climate Data Store.
<https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means?tab=overview>

Input Data	Source Used	Timing
	climatic variables must follow that “Measurements are taken at the closest continuously monitored weather station, not exceeding 50 km of the sample field, or from a synthetic weather station”. As described in the literature, ERA5 is a form of synthetic weather station and is state-of-the-art for providing accurate climatic variables ¹⁶⁵ .	
Monthly open pan evaporation (mm)	ERA5-Land weather data from the European Center for Medium Range Weather Forecasts (ECMWF), which has data from 1950 ¹⁶⁶ . This data source meets the requirements of Table 6 in the methodology, which stipulates that climatic variables must follow that “Measurements are taken at the closest continuously-monitored weather station, not exceeding 50 km of the sample field, or from a synthetic weather station”. As described in the literature, ERA5 is a form of synthetic weather station and is state-of-the-art for providing accurate climatic variables ¹⁶⁷ . This data source meets the requirements of Table 6 in the methodology, which stipulates that	Continuously Monitored Ex-ante
Average monthly mean air temperature (o C)	ERA5-Land weather data from the European Center for Medium Range Weather Forecasts (ECMWF), which has data from 1950. This data source meets the requirements of Table 6 in the methodology, which stipulates that climatic variables must follow that “Measurements are taken at the closest continuously-monitored weather station, not exceeding 50 km of the sample field, or from a synthetic weather station”. As described in the literature, ERA5 is a form of synthetic weather station and is state-of-the-art for providing accurate climatic variables ¹⁶⁷ .	Continuously Monitored Ex-ante
Clay content of the soil	Determined using peer-reviewed global soil maps from International Soil Reference and Information Center ¹⁶⁸ . This data source meets the requirements of Table 6 in the methodology, which stipulates that soil	Ex-ante

¹⁶⁵ Muñoz-Sabater, J., Dutra, E., Agustí-Panareda, A., Albergel, C., Arduini, G., Balsamo, G., Boussetta, S., Choulga, M., Harrigan, S., Hersbach, H., Martens, B., Miralles, D. G., Piles, M., Rodríguez-Fernández, N. J., Zsoter, E., Buontempo, C., and Thépaut, J.-N.: ERA5-Land: a state-of-the-art global reanalysis dataset for land applications, Earth Syst. Sci. Data, 13, 4349–4383, <https://doi.org/10.5194/essd-13-4349-2021>, 2021.

¹⁶⁶ Copernicus Climate Data Store. Copernicus Climate Data Store. <https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means?tab=overview>

¹⁶⁷ Muñoz-Sabater, J., Dutra, E., Agustí-Panareda, A., Albergel, C., Arduini, G., Balsamo, G., Boussetta, S., Choulga, M., Harrigan, S., Hersbach, H., Martens, B., Miralles, D. G., Piles, M., Rodríguez-Fernández, N. J., Zsoter, E., Buontempo, C., and Thépaut, J.-N.: ERA5-Land: a state-of-the-art global reanalysis dataset for land applications, Earth Syst. Sci. Data, 13, 4349–4383, <https://doi.org/10.5194/essd-13-4349-2021>, 2021.

¹⁶⁸ ISRIC World Soil Information. Soilgrids - global gridded soil information. [www.isric.org](https://www.isric.org/explore/soilgrids). <https://www.isric.org/explore/soilgrids>

Input Data	Source Used	Timing
	properties (other than soil carbon & bulk density) must be “Directly measured or determined from published soil maps, with known uncertainty”. ISRIC’s soil map is a published soil map that also has a known uncertainty layer for each parameter, including the clay content of soil.	
An estimate of the decomposability of the incoming plant material - the DPM/RPM ratio	Determined from the scientific literature, and substantiated in the Model Validation Report.	Ex-ante
Soil cover (Bare/Vegetated)	This project takes place on native grassland vegetation, and the vegetation cover exists throughout the year (vegetation is not uprooted as part of the project), so the soil cover is taken to be vegetated continuously.	Ex-ante
Monthly input of plant residues	Determined from calibrations per specific practice category and crop functional group, as given in the Model Validation Report.	Continuously Monitored Ex-ante
Monthly input of farmyard manure (FYM)	Determined from the reported count of livestock in each sample unit, and literature values for the production of manure per day for the given type of livestock ¹⁶⁹ .	Ex-ante
Depth of soil layer sampled	30cm, as required by the methodology.	Ex-ante

Table 16: Inputs to the models and their sources

To test and validate the baseline RothC scenario, we selected literature data that closely matched the vegetation type (grassland) and IPCC climate zones of our sample units (ranches). This data represents the current management practices typically employed in the project region and IPCC climate zones for grazing. By aligning our baseline scenario data with these specific characteristics, we ensure that the model accurately represents the baseline state of the sample units. Additional information on the specific schedule of activities that constitute “baseline management” can be found in section 3.4 of this PD.

For further details on the baseline emission calculation approach with RothC, a draft Model Validation Report (MVR) is provided to the VVB and VCS during validation and VCS project review. The draft Model Validation Report also contains additional information on the correlation between the specific baseline literature data used and the project polygons (sample units).

The full baseline emissions calculation process is summarized in the schematic below:

¹⁶⁹ University of Massachusetts Amherst. (2020, April 13). *Manure inventory*. Center for Agriculture, Food, and the Environment. <https://ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/manure-inventory>

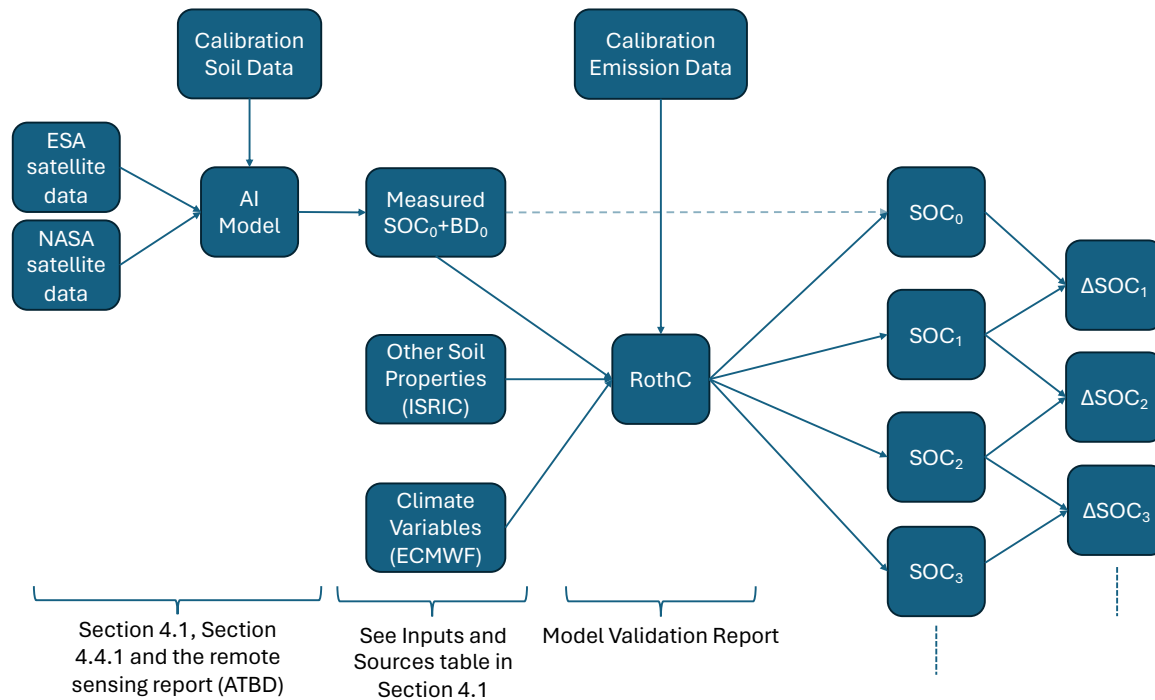
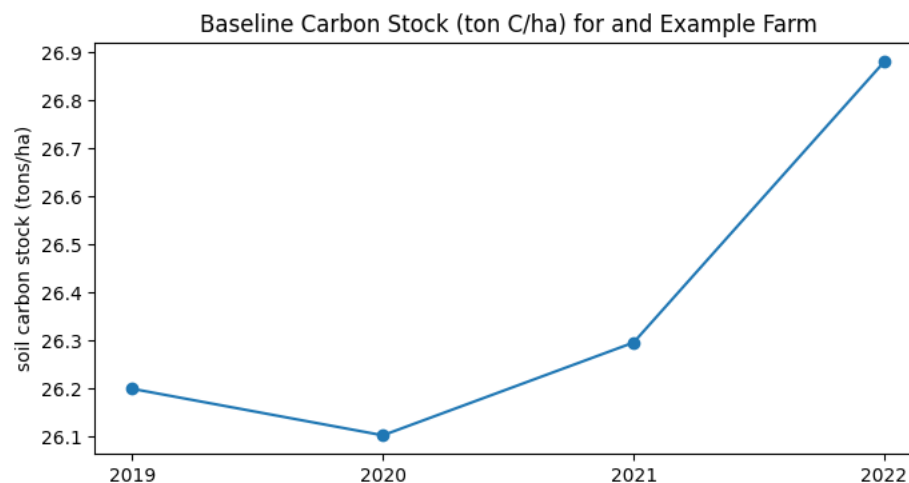


Figure 24. Baseline emission calculation process, integrating the remote sensing AI model to measure soil organic carbon and bulk density at $t=0$ and initializing the calibrated RothC model, which, along with the appropriate Table 16 inputs, to generate soil carbon stock levels for each year, as used in Equation 2 of the methodology.

Consider an example of one of the ranches in the project, where the average annual temperature is 18.9°C and the average rainfall is 815mm per year. The clay content is 33%. The Roth-C documentation gives 0.67 as a suitable value for DPM/RPM in native grasslands. The soil is vegetated year-round with grass, and the soil is studied to a 30cm depth, along with 0.5-ton C/ha/yr of livestock excreta (FYM) and 0.13-ton C/ha/yr in plant residue input. The soil carbon stock is simulated to be:



In this example, the ranch would have gained 0.68 tons/ha over the first monitoring period, in the baseline scenario.

These types of calculations, following the Fig 24 schematic, are carried out individually for every sample unit in the project.

Annual calculation results for the first instance for the first monitoring period and beyond are summarized in the 'estimated baseline emissions or removals' column of the table for instance 1 ERRs in Section 4.4.3. The values in that table for future monitoring periods are calculated based on the average results across the first monitoring period.

4.2 Project Emissions

As seen in Section 3.3, this project only includes Soil Organic Carbon stock change in the project boundary, which will be quantified with Quantification Approach 1 as given in VM0042. According to the methodology, Soil Organic Carbon stocks in the project scenario as described in section 4.1 where subscript *bsl* is substituted with *wp*. However, if any activity contributes or have emissions during project implementation and monitoring will be reported in the subsequent monitoring cycles.

Quantification Approach 1 is a 'measure and model' approach, and in this project, as noted in Section 4.1, the RothC model is used for the emission calculation. RothC model inputs for the project scenario are collected as per the guidance provided in the Table 7 of the methodology. All the model input are the same as the Table 16 mentioned in Section 4.1 of this document, which also provides more details on their sourcing. There is one more parameter (agriculture management activities) that is monitored ex post with survey methods. Information on management activities are collected via consultation with the landowner of the sample unit (ranch).

The following table outlines the model input parameters and their sourcing method.

Input Data	Source Used	Timing
Soil organic carbon stock	Boomitra's remote sensing technology is used to determine soil organic carbon weight percentage and bulk density, with known uncertainty, at t=0, and the product of the two values followed by unit interconversion provides the soil organic carbon stock. The approach and its uncertainty is described further in Section 4.4.1. This data source meets the requirements of Table 6 in the methodology, which stipulates that SOC stock must be "Directly measured at t=0 or (back-) modeled to t=0 from measurements collected within +/-5 years of t =0, or determined for t=0 via emerging technologies (e.g., remote sensing) with known uncertainty."	Determined at project start (re-measured every 5 years or less)

Input Data	Source Used	Timing
Monthly rainfall (mm)	ERA5-Land weather data from the European Center for Medium Range Weather Forecasts (ECMWF), which has data from 1950 ¹⁷⁰ . This data source meets the requirements of Table 6 in the methodology, which stipulates that climatic variables must follow that “Measurements are taken at the closest continuously-monitored weather station, not exceeding 50 km of the sample field, or from a synthetic weather station”. As described in the literature, ERA5 is a form of synthetic weather station and is state-of-the-art for providing accurate climatic variables ¹⁷¹ .	Continuously Monitored Ex-post
Monthly open pan evaporation (mm)	ERA5-Land weather data from the European Center for Medium Range Weather Forecasts (ECMWF), which has data from 1950 ¹⁷¹ . This data source meets the requirements of Table 6 in the methodology, which stipulates that climatic variables must follow that “Measurements are taken at the closest continuously-monitored weather station, not exceeding 50 km of the sample field, or from a synthetic weather station”. As described in the literature, ERA5 is a form of synthetic weather station and is state-of-the-art for providing accurate climatic variables ¹⁷¹ .	Continuously Monitored Ex-post
Average monthly mean air temperature (o C)	ERA5-Land weather data from the European Center for Medium Range Weather Forecasts (ECMWF), which has data from 1950 ¹⁷¹ . This data source meets the requirements of Table 6 in the methodology, which stipulates that climatic variables must follow that “Measurements are taken at the closest continuously-monitored weather station, not exceeding 50 km of the sample field, or from a synthetic weather station”. As described in the literature, ERA5 is a form of synthetic weather station and is state-of-the-art for providing accurate climatic variables ¹⁷¹ .	Continuously Monitored Ex-post
Clay content of the soil	Determined using peer-reviewed global soil maps from International Soil Reference and Information Center ¹⁷² . This data source meets the requirements of Table 6 in the methodology, which stipulates that soil	Ex-ante

¹⁷⁰ Copernicus Climate Data Store. Copernicus Climate Data Store. <https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means?tab=overview>

¹⁷¹ Muñoz-Sabater, J., Dutra, E., Agustí-Panareda, A., Albergel, C., Arduini, G., Balsamo, G., Boussetta, S., Choulga, M., Harrigan, S., Hersbach, H., Martens, B., Miralles, D. G., Piles, M., Rodríguez-Fernández, N. J., Zsoter, E., Buontempo, C., and Thépaut, J.-N.: ERA5-Land: a state-of-the-art global reanalysis dataset for land applications, Earth Syst. Sci. Data, 13, 4349–4383, <https://doi.org/10.5194/essd-13-4349-2021>, 2021.

¹⁷² ISRIC World Soil Information. Soilgrids - global gridded soil information. [www.isric.org](https://www.isric.org/explore/soilgrids). <https://www.isric.org/explore/soilgrids>

Input Data	Source Used	Timing
	properties (other than soil carbon & bulk density) must be “Directly measured or determined from published soil maps, with known uncertainty”. ISRIC’s soil map is a published soil map that also has a known uncertainty layer for each parameter, including the clay content of soil.	
An estimate of the decomposability of the incoming plant material - the DPM/RPM ratio	Determined from the scientific literature and substantiated in the Model Validation Report.	Ex-ante
Soil cover (Bare/Vegetated)	This project takes place on native grassland vegetation, and the vegetation cover exists throughout the year (vegetation is not uprooted as part of the project), so the soil cover is taken to be vegetated continuously.	Ex-ante
Monthly input of plant residues	Determined from calibrations per specific practice category and crop functional group, as given in the Model Validation Report.	Continuously Monitored Ex-post
Monthly input of farmyard manure (FYM)	Determined from the reported count of livestock in each sample unit, and literature values for the production of manure per day for the given type of livestock ¹⁷³ .	Ex-post
Depth of soil layer sampled	30cm, as required by the methodology.	Ex-ante

Table 17: Inputs to the models and their sources

For further details on the project emission calculation approach with RothC, a draft Model Validation Report (MVR) is provided to the VVB and VCS during validation and VCS project review.

The full process used to calculate the project emissions follows the same steps as given in the schematic (Fig 24) in Section 4.1, with the difference that the RothC model used is the version calibrated for the project scenario.

The RothC model estimates for the project scenario will be routinely recalibrated and revalidated and ‘true-upped’ as soil organic carbon stock measurements will be done with the remote sensing system for each sample unit every 5 years or more frequently. The project also plans to have at least one new measurement in every monitoring period, so the model may be properly recalibrated and true-upped in every monitoring period, which will be at least as frequent as every 5 year, or more frequently. As noted in the Monitoring Plan, the project plans to have monitoring periods of two years.

Our approach to bias correction in the improved practice project RothC model scenario involves a careful calibration process to ensure accurate estimates of Emission Reductions (ERR). Specifically, we fit the carbon input parameter of the RothC model to align with soil carbon measurements obtained via remote sensing, at the beginning and end of the project monitoring period. This method effectively accounts for discrepancies between RothC estimations and remote sensing data, ensuring that the model's output reflects the actual changes in soil carbon resulting from the project activities. By integrating these remote

¹⁷³ University of Massachusetts Amherst. (2020, April 13). *Manure inventory*. Center for Agriculture, Food, and the Environment. <https://ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/manure-inventory>

sensing measurements into our calibration, we address potential biases and enhance the reliability of our ERR estimates.

In the case of the first monitoring period, the measured soil organic carbon stock on sample unit level is available twice - a few months prior to the project start and a few months prior to the end of the first monitoring period. These values are used to appropriately run the RothC model across the entire first monitoring period. The RothC model is thus used to produce an output soil carbon stock for the monitoring period's start date, and likewise also an output stock for the monitoring period's end date, and for each intervening year. The difference between these RothC model outputs by years of the monitoring period represents the project scenario SOC stock changes for each year, in accordance with Quantification Approach 1. When a given sample unit starts its first project activities after the monitoring period start date, the first RothC output is produced for its activity start date instead of the monitoring period start date.

Annual calculation results for the first instance for the first monitoring period and beyond are summarized in the 'estimated project emissions or removals' column of the table for instance 1 ERRs in Section 4.4.3. The values in that table for future monitoring periods are calculated based on the average results across the first monitoring period.

The average baseline carbon change in the literature samples is +0.17 tons/ha/yr compared to a +0.36 tons/ha/yr in carbon change in the project (see Model Validation Report and ER sheet). The project baseline gains more than 2 times the carbon of the relevant literature is conservatively modeled.

4.3 Leakage Emissions

There are no direct or indirect leakages expected from this project activity. The proposed activity is completely in-situ in nature, which does not contribute to indirect leakages or new emissions elsewhere. As clearly described in the project activity description section of the PD, the activity proposed is purely to bring behavioral change in the practices followed in the baseline. The project scenario does not involve any such activity that leads to new emissions elsewhere.

The methodology also assumes no leakage if certain conditions are met:

- 1) No new application of manure from outside the project area (i.e., manure applied in the project from outside of the project area, that was not previously applied in the historical baseline period), The project activity does not involve any such application of manure from outside the project area. Sustainable grazing encourages animals to spread out, leading to more even manure distribution across the pasture and reducing emissions from manure decomposition. Rotational grazing distributes manure more evenly and allows for rest periods, mitigating the uneven deposition and anaerobic conditions that promote emissions¹⁷⁴. Hence, logically proves the requirement of need of synthetic fertilizer or displacement of livestock for the manure or application of new type manure from outside the project area. All the manure is produced within the project area and sustainable practices studies provide that it improves the soil health and

¹⁷⁴ Kellie. (2024, May 8). Rotational Grazing: The Sustainable Choice - Corral Technologies. Corral Technologies.

provide with plant nutrients¹⁷⁵. Improved grazing practices in the Kenyan region have been shown to significantly enhance livestock productivity and provide long-term economic benefits to pastoralists. According to studies, rotational grazing helps mitigate the adverse effects of climate variability in arid regions, providing long-term resilience and economic advantages. These practices contribute to healthier herds, resulting in fewer veterinary expenses, reduced maintenance costs, and no fertilizer costs, along with increased pasture productivity.

Improved rotational grazing practices enhance rangeland conditions and livestock carrying capacity. These improvements lead to better livestock health and growth rates, supporting sustainable pastoral livelihoods. The benefits of rotational grazing extend to various types of livestock, including cattle, sheep, and goats, making it a crucial strategy for improving agricultural productivity in regions like Kenya¹⁷⁶. No productivity declines. As noted in Section 2.5, productivity declines are not expected to occur, according to the academic literature. Regardless, as required by the methodology, productivity will be measured every ten years and changes in productivity will be quantified as per Eq 29 in the methodology.

- 2) No displacement of livestock outside of the project boundary. The entire legal area of every ranch participating in the project is included in the project. The ranchers do not graze their livestock in any area outside of their ranch. The land in the project scenario remains in agricultural (livestock) production only. By including the entire legal area of each participating ranch in the project and maintaining the number of livestock within the project boundary, we ensure that there is no leakage from livestock displacement. All ranchers have herders' forces associated with the livestock during the grazing implementation and enforces no displacement occurs. This training provided to these herders' act as a robust and transparent method to avoid any livestock displacement results to leakage. This approach aligns with the requirements of VM0042, ensuring that our project's emission reductions are credible and accurately represent the environmental benefits of the improved grazing practices.

Furthermore, as noted in Section 2.5, livestock numbers are not expected to decline with the project activity, according to the academic literature. Regardless of the possibility of any such declines, this project also does not claim credit for reductions in N₂O or CH₄ emission from reductions in enteric emission due to no significant change in the livestock numbers. which is positive can considered good impact of the project activities on the livestock health. Thus, this leakage accounting is zero. A separate Excel workbook shared to demonstrate the productivity calculations.

Ranch Name	Productivity in Baseline Period	Productivity in Project Period	Change in productivity	Change in productivity % equation no. 29(vm0042 v1.0)
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¹⁷⁵ Nash, J., Grever, U., Bockel, L., & Galford, G. L. (2016). Resilience and Economic Growth in Arid Lands-Accelerated Growth in Kenya: Mitigation co-benefits of herd size and feed quality management. CCAFS Info Note.pdf

¹⁷⁶ A.Z. Sangedu, D.D. Maleko, "Rangeland condition and livestock carrying capacity under the traditional rotational grazing system in northern Tanzania," *Livestock Research for Rural Development*, 2018.

	Pbsl	PWP	PWP-Pbsl	ΔP
Kasanga	1401	1401	0	0.00%
Lisa ranch & game sanctuary	3044	3051	7	0.22%
Machakos	1066	1117	51	4.75%
			Productivity	1.66%

Hence, LE_t is set to zero.

The productivity of each livestock depends on the mass of each animal. The FAO provides extensive reports on livestock and productivity that address changes in livestock rates and their impact on productivity. The average change in the rate of livestock population will result in a change in productivity. Hence, changes in the rate of livestock numbers are sufficient to calculate the productivity decline in projects involving livestock. Overall stocking density¹⁷⁷ is essential to define the proper combination of land, time, and number of animals to ensure the sustained, long-term productivity of the pasture. The optimum number of animals on the pasture makes efficient use of the forage^{178,179 180}

In the project area livestock productivity is not intended or expected not to be reduced by more than 5% due to the adoption of regenerative agricultural practices (See Section 3.2 for more details).

Any potential decline in productivity that may occur during the adoption or implementation of regenerative practices is accounted for using the procedure detailed in Section 8.4.3 of the methodology. The productivity (Pwp) will be monitored annually, with the survey scheduled according to the start date of each project activity instance (ranch), depending on the number of livestock types in the area. Since the land belongs to individual owners, agricultural land market leakage is not considered. In the event of any potential decline in productivity, according to calculations using Equation 29, crop/livestock productivity declines by more than 5% due to a short-term change, step 1 of section 8.4.3 is repeated, excluding the first three years of project data, to adjust productivity. If the adjusted productivity is within 5% of the baseline, no further action is required as per the methodology. However, if a decline greater than 5% is still observed, further action is taken by completing step 3 of section 8.4.3.

4.4 Uncertainty Quantification

¹⁷⁷ McSherry, M. E., & Ritchie, M. E. (2013). Effects of grazing on global grassland biomass and carbon storage. *Nature*, 507(7491), 476-479.

¹⁷⁸ FAO. (2016). Grassland and Pasture Management. Food and Agriculture Organization of the United Nations

¹⁷⁹ FAO. (2018). The State of Food and Agriculture 2018: Migration, Agriculture and Rural Development. Food and Agriculture Organization of the United Nations.

¹⁸⁰ FAO. (2020). Livestock and Climate Change. Food and Agriculture Organization of the United Nations.

Uncertainty deductions are estimated and applied separately for each ERR source within the project boundary. This deduction is estimated using a probability of exceedance method as follows, using equation 65 of VM0042 V2.0 (see the latest version of the VCS Methodology Requirements Section 2.4)

$$UNC_{\bar{\Delta}_{\bullet},t} = Uncertainty \times t_{\alpha=0.666}$$

$$Uncertainty = \frac{\sqrt{s_{\bar{\Delta}_{\bullet},t}^2}}{\bar{\Delta}_{\bullet},t} \times 100$$

Where,

$UNC_{\bar{\Delta}_{\bullet},t}$	Uncertainty deduction for gas or pool • to be applied in verification period t (%)
$Uncertainty$	Half-width of the one standard deviation interval as a percentage of the mean of the ERR estimate for gas or pool • in verification period t (%)
$\bar{\Delta}_{\bullet},t$	Mean estimated emissions reduction for gas or pool • across the entire project area in year t (t CO ₂ e/ha)
$s_{\bar{\Delta}_{\bullet},t}^2$	Variance of the estimate of mean emission reductions from gas or pool • at time t.
$t_{\alpha=0.666}$	Critical value of a one-sided student's t-distribution at significance level $\alpha = 0.666$ (66.6%) with degrees of freedom appropriate to the sampling design used. Equal to approximately 0.4307 at large sample sizes (dimensionless)

The equation 65 employs uncertainty deduction based on a defined threshold in the estimated probability density function of the ERR for a given source. This enables a judgement of the extent to which the achieved removal or reduction by the project may be expected to be accurate.

This project uses quantification approach 1 in which key sources of uncertainty accounted for are sample error and, where models are applied (Quantification Approach 1), measurement error of model inputs and model prediction error. Uncertainty in area estimation is addressed via complete (and accurate) GIS boundaries of the project area, applying QA/QC procedures specified in the parameter table for Ai.

Since Quantification Approach 1, as applied in this project, utilizes RothC outputs for the determination of the project and baseline carbon stocks, the uncertainty must be propagated in an appropriate and conservative manner to the resultant combined uncertainty of the RothC output carbon stock. In this project, for the case of the soil carbon stock, given the project design and the requirements of the methodology, we must combine the error in the RothC inputs, after propagating through the RothC, and the inherent model prediction error in the RothC model itself as determined in VMD0053, to arrive at a combined error. The RothC input errors are discussed further in the 'Model Input Measurement Error' section below, and as presented there, the main error that must be propagated forward is the remote sensing measurement error for ongoing soil carbon stock measurement.

Model prediction error

If both the project emissions and baseline emissions fall under Case B and paired modeled and direct-re-measured sites in an experimental sampling regime subject to control and treatment scenarios are available for quantification of the model prediction error, then, following 8.6.1 section VM0042 v1.0, the model prediction error may be given as per the Equation 47:

$$S_{\text{struct},\Delta\bullet,t} = s_{\bullet}\sqrt{2(1 - \rho_{\bullet})}$$

Where:

- $S_{\text{struct},\Delta\bullet,t}$ (Approximate) standard error in $\Delta\bullet$ ($\Delta\bullet$ = emission reductions in gas and pool $\bullet$) due to model prediction error at time t ; t CO₂e/unit area
- $s_{\bullet}$ Standard deviation of the residuals ($\bullet_{\text{measured}} - \bullet_{\text{modeled}}$). $\bullet$ = modeled or measured emission or stock change in gas and pool $\bullet$ over a fixed interval); t CO₂e/unit area
- $\rho_{\bullet}$ Correlation coefficient of (i) model errors in the project scenario and (ii) model errors in the baseline scenario in gas and pool $\bullet$ over a fixed interval; dimensionless
- $\bullet$ Gas or pool

This method, for this specific paired experimental sampling regime, allows for the total calculation of model error across both the project and baseline scenarios. It is assumed that the standard deviation $s_{\bullet}$ of the residuals ($\bullet_{\text{measured}} - \bullet_{\text{modelled}}$) is the same in the control and treatment scenarios.

For other situations, when paired modelled and direct re-measured sites in an experimental sampling regime subject to control and treatment scenarios are not available, the model prediction error is just the appropriately calculated $S_{\text{struct},\Delta\bullet,t} = s_{\bullet}$ for the respective baseline or project scenario.

The calculation of $s_{\bullet}$ is detailed in the Model Validation Report for both the baseline and project scenarios. A draft Model Validation Report is provided to the VVB and VCS at the time of validation and project review. As per the draft Model Validation Report, $s_{\bullet} = 3.615$ tons CO₂e/ha/yr for the baseline scenario.

Data for quantifying model prediction error may be sourced from studies conducted external to the project area, and should be from the same datasets used to validate the model (as detailed in VMD0053 “Model Calibration and Validation Guidance for the Methodology for Improved Agricultural Land Management”).

If the amount of data for quantifying model prediction error varies significantly among crops, soil texture, and climate zones then a model prediction error could be estimated for groups of similar sites. That way, a model prediction error can be assigned to each sample unit i : $S^2_{\text{struct},\Delta\bullet,i,t}$. Then $S^2_{\text{struct},\Delta\bullet,t}$ is the model error variance for the population, estimated from the $S^2_{\text{struct},\Delta\bullet,i,t}$ with an areal averaging:

$$s_{struct,\Delta^*,t}^2 = \sum_i \frac{A_i^2}{A^2} s_{struct,\Delta^*,i,t}^2$$

For this project, the biogeochemical model is run separately for each individual ranch, but there is only one crop functional group – pasture – and one predominant practice category – grazing effects – so $s_{struct,\Delta^*,i,t}^2$ is a constant on a ranch level.

Model input measurement error

Measurement errors of model inputs are captured by a combination of the (1) model prediction error noted previously (for the case of the climate variables and the soil properties, other than soil carbon stock) and (2) the known uncertainty associated with the remote sensed soil carbon stock on a sample unit level. As detailed in the Model Validation Report, the same model inputs (other than remote-sensed SOC) are used during calibration/validation as are during model propagation for the project’s sample units. For this reason, the model prediction error contains the elements of the model input errors of the climate variables and the soil properties. Beyond these steps, QA/QC procedures for model inputs ensure that model inputs are sufficiently accurate and that measurement errors are uncorrelated with each other along with no other material errors being left unaccounted.

The uncertainties of the RothC model inputs are captured by a combination of the (1) model prediction error noted previously (for the case of the climate variables and the soil properties, other than soil carbon stock) and (2) the uncertainty associated with the remote sensed soil carbon stock on a sample unit level measured using Bayesian PPD analysis (Section 4.4.1.3). As detailed in the Model Validation Report, the same model inputs (other than remote-sensed SOC) are used during calibration/validation as are during model propagation for the project’s sample units. For this reason, the model prediction error, calculated over multiple locations and times, samples the input error distributions and results in increased model output uncertainty compared with the hypothetical case of perfect inputs. Thus the input uncertainties are propagated directly, in the matching climate and soil conditions of the literature validation set, instead of applying an globally calculated uncertainty for each input. Beyond these steps, QA/QC procedures for model inputs ensure that model inputs are sufficiently accurate and that measurement errors are uncorrelated with each other along with no other material errors being left unaccounted.

QA/QC procedures and data downscaling procedures (if any) for the model inputs are shared in the table below:

Input Data	QA/QC procedure
Soil organic carbon stock	The training data for the remote sensing-based Boomitra technology must be QA/QC’d for proper domain coverage as detailed in the accompanying remote sensing report and in Section 4.1 of this document. Furthermore, the whole system itself is QA/QC’d with new validation datasets on a regular basis as noted in the monitoring plan. The SOC is

Input Data	QA/QC procedure
	calculated on a field level already, so no downscaling is necessary.
Monthly rainfall (mm)	As discussed in previous sections, ERA5-Land data is used for this parameter. It is extensively QA/QC'd by the ECMWF, the producer of the dataset ¹⁸¹ . ERA5-Land has uncertainty estimates for this parameter from a 10-member Ensemble of Data Assimilations (EDA) approach, which are also reviewed to ensure consistency ¹⁸² . ERA5-Land has a resolution of 9km. Given that the nearest calibrated physical weather stations can often be much farther than 9km from the sample units, ERA5-Land still provides higher resolution data than physical weather stations available today in the project area. The value of the grid position that the sample unit falls within is directly used. There may be errors due to the lack of sufficient resolution to the sample unit level, but these errors are captured in the model prediction error as the same resolution weather data is used in the calibration and validation of the RothC model.
Monthly open pan evaporation (mm)	See above approach for ERA5-Land, which is also used for this input
Average monthly mean air temperature (o C)	See above approach for ERA5-Land, which is also used for this input
Clay content of the soil	The published uncertainty layer from ISRIC Soilgrids for the parameter is reviewed, ensuring that the error is less than 20% of the actual parameter value. The ISRIC data is calculated to a field resolution since ISRIC provides 30m resolution maps – ISRIC's interpolation (downscaling) of soil data for arriving at field-level values is state-of-the-art and ensures the best possible accuracy in determining this parameter in the absence of field sampling.
An estimate of the decomposability of the incoming plant material - the DPM/RPM ratio	This is a literature constant and hence there is no QA/QC necessary
Soil cover (Bare/Vegetated)	The procedures of Box 1 in the methodology will be used to acquire the highest quality data for this parameter (Sample surveys will be carried out), with further substantiation in the Model Validation Report.
Monthly input of plant residues	The calibration/validation procedures in the model validation report provide for the QA/QC. This data is calculated to a field resolution

¹⁸¹ A presentation on ECMWF QA/QC protocols is available here: https://climate.copernicus.eu/sites/default/files/2022-09/S3_ChunxueYang_V2.pdf

¹⁸² The ERA5 uncertainty is documented here: <https://confluence.ecmwf.int/display/CKB/ERA5%3A+uncertainty+estimation>

Input Data	QA/QC procedure
	through the procedure in the model validation report.
Monthly input of farmyard manure (FYM)	The QA/QC procedure for livestock numbers, detailed in the monitoring plan, is the main QA/QC in determining this parameter. This data is calculated to a field resolution.
Depth of soil layer sampled	This is a project-level constant and hence there is no QA/QC necessary

Table 18: QA/QC of the model inputs

Further details on the quantification of remote sensed soil carbon stock measurement error on a sample unit (field/farm) level for a given measurement time, $s_{meas,SOC,t,i}^2$, are provided in Section 4.4.1 and accompanying documentation for the VVB and VCS Team. This measurement error must be further propagated through the RothC as described in the Combined Error subsection below.

Bias Correction

For the baseline scenario, bias correction can be accomplished by adjusting the RothC baseline change in carbon stock by the average bias measured from our literature validation set as documented in the Model Validation Report. However, as shown in the table in the “Pooled Measurement Uncertainty and Bias” Section of the MVR, our average bias on the literature dataset is 0.41 t/ha/year, indicating that our baseline RothC model bias is overestimating soil carbon stock gains. Subtracting this bias from our baseline scenario results on our project sites would in turn result in adding the bias to the calculation of emissions reduction, increasing the overall emissions reduction estimate of the project. Therefore, we believe it is more conservative in this case to refrain from adjusting the baseline scenario literature estimated bias in the ERR calculations.

Sample error

There is no sampling error in this project, because the full population distribution of soil carbon levels across the farms is measured through remote sensing on a pixel level, for every pixel across the project area. Each pixel is also a full measurement of the ground area corresponding to the pixel. There may be sample errors inherent in the creation of the remote sensing algorithms used for determination of SOC stock, particularly in the accuracy of the calibration dataset used and any spatialization pre-processing used to match point sampling data with satellite data, and these are separately covered in Section 4.4.1 and the measurement error determination.

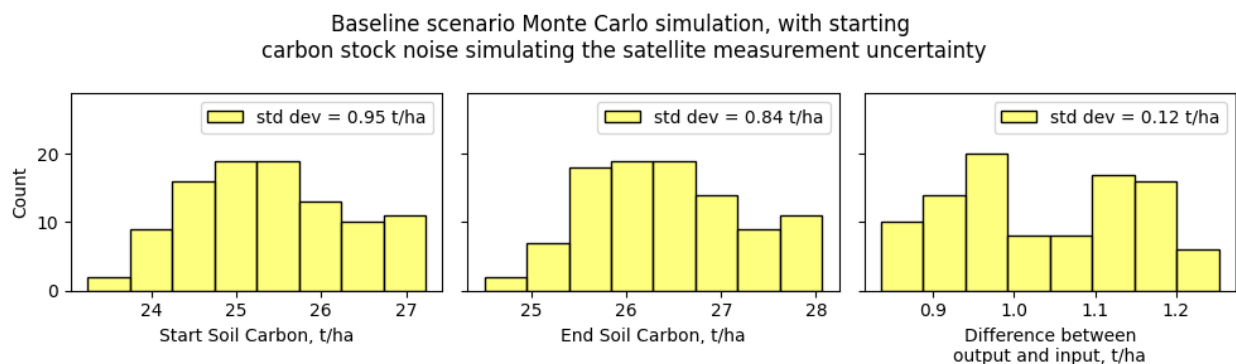
Combined error

The combined error must include both the remote sensing soil carbon uncertainty and RothC model prediction uncertainty, with the remote sensing uncertainty propagated through the RothC model as well, since the remote sensing soil carbon is an input to the RothC, and the RothC output is ultimately used for the GHG ERR calculations, under Quantification Approach 1.

The SOC measurement input error must be included and propagated through the RothC model through the use of Bayesian Monte Carlo methods (as specified in the guidance in VM0042 v2.0 Section 8.6.1.2.2).

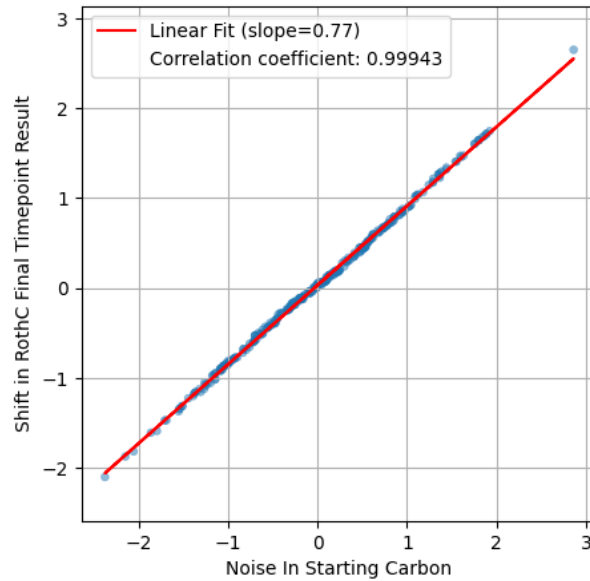
Bayesian Monte Carlo (MC) simulations of the input remote-sensed soil organic carbon measurements following a distribution as per their established uncertainty (Section 4.4.1) are fed into the RothC model, with the resultant output distributions of SOC stock for the start of the monitoring period and each ensuing year collected. The difference in these distributions is the simulated stock change distribution with fixed RothC model parameters, and taking the standard deviation of this difference distribution provides the uncertainty contribution from the error in the input. This resultant uncertainty added to the RothC model prediction error determined as per the requirements of VMD0053.

First consider an example of an individual sample unit in the first instance in this project. The distribution of initial soil carbon is sampled with 100 simulations and fed into the RothC model to produce a simulated output distribution after 3 years of forward propagation (the length of monitoring period 1):



The left histogram is the input distribution, and the center panel is the output distribution after 3 years of RothC forward propagation, with the right histogram is the difference between the two. The input and output distributions are highly correlated with a correlation of 0.9996, which also leads the difference distribution to have a small variance of just 0.014 (t/ha)². It can be observed that this variance is small compared to the variance due to the baseline scenario model prediction error as calculated in the draft Model Validation Report, 0.83 (t/ha)², representing a contribution of only 1.6% to the variance in the baseline emissions. This type of analysis may be repeated across the project sample units, by propagating the input uncertainty distribution through RothC and observing the difference in outputs, and their correlation to the difference in the original input to the RothC relative to the mean. For the sake of notation, we refer to this propagated uncertainty contribution as $s_{RS-bsl-MC,i,t}$, denoting the uncertainty of the remote sensing input propagated through the baseline RothC model run via MC simulations.

Across all the sample units of instance 1, for the first monitoring period, the following shift in the final RothC output is observed with respect to the simulated fluctuation in the soil carbon input across the Monte Carlo simulations for each sample unit:



Observe that there is 0.9994 correlation coefficient between the simulated input noise and the resultant shifts in the final RothC across all sample units, which is similar to the 0.9996 observed for the single sample unit example above. Thus, for the first instance, and based on the RothC calibration and validation outlined in the draft Model Validation Report, the sensitivity of the RothC to observed uncertainties in the input soil carbon levels (as per the uncertainty shown in Section 4.4.1) is small.

In the first monitoring period, for the baseline scenario:

$$s_{\Delta,i,t,bsl}^2 = s_{RS-bsl-MC,i,t}^2 + s_{struct,\Delta,i,t}^2 = s_{RS-bsl-MC,i,t}^2 + s_{bsl}^2 \bullet$$

For the project scenario, a similar uncertainty propagation must be carried out, but with the RothC model run of the project scenario, resulting in a term $s_{RS-proj-MC,i,t}$.

$$s_{\Delta,i,t,proj}^2 = s_{RS-proj-MC,i,t}^2 + s_{struct,\Delta,i,t}^2 = s_{RS-proj-MC,i,t}^2 + s^2 \bullet_{proj}$$

Note that the $s_{RS-proj-MC,i,t}^2$ may be distinct from $s_{RS-bsl-MC,i,t}^2$ because the RothC model is run differently between the project and baseline scenarios. Additionally, with the regular recalibration and true-up of the project scenario RothC model, the term $s_{RS-bsl-MC,i,t}^2$ will also acquire some of the errors arising from the recalibration process itself, which are not present in the $s_{RS-bsl-MC,i,t}^2$. For example, the repeat measurements of remote-sensed soil organic carbon stock have their own uncertainty associated with them (as shown in Section 4.4.1), and these become absorbed into the way that the outputs in the RothC are generated, when the MC simulation is generated. With recalibration and true-up, the project-level RothC MC simulation of the SOC stock will be less correlated (lower covariance) from year to year than it is in the baseline scenario. This contributes to a distinct and potentially higher $s_{RS-proj-MC,i,t}^2$ than $s_{RS-bsl-MC,i,t}^2$, as this additional error is properly incorporated through the MC simulation. The final

combined uncertainty for a given sample unit is the summation of the variances of the baseline and project scenarios for that sample unit:

$$s_{\Delta,i,t}^2 = s_{\Delta,i,t,proj}^2 + s_{\Delta,i,t,bsl}^2$$

This equation may be expanded to:

$$s_{\Delta,i,t}^2 = s_{\Delta,i,t,proj}^2 + s_{\Delta,i,t,bsl}^2 = s_{RS-proj-MC,i,t}^2 + s^2 \bullet_{proj} + s_{RS-bsl-MC,i,t}^2 + s^2 \bullet_{bsl}$$

Observe that there are 2 MC simulation terms, one for baseline and project scenario respectively. They may also be combined together if the MC simulations are extended one step further beyond just the individual baseline or project scenario to the net carbon stock change calculation (eg. Eq 33 in VM42 v1.0). In that case, the variance of the net stock change distribution can be called $s_{RS-MC,i,t}^2$ and the combined uncertainty for a sample unit may be written as:

$$s_{\Delta,i,t}^2 = s_{RS-MC,i,t}^2 + s^2 \bullet_{proj} + s^2 \bullet_{bsl}$$

Finally, to obtain the total combined error across the project, we assume the independence of sample units, since they are independent ranches/fields managed independently in this project as defined in Section 5.3.11. Thus the errors are combined together to a project level:

$$s_{\Delta,t}^2 = \frac{1}{n^2} \sum_i s_{\Delta,i,t}^2$$

Where, n is the number of sample units. $s_{\Delta,t}^2$ is then used in Equation 46 of the methodology to compute the uncertainty deduction, as provided at the beginning of this Section 4.4.

4.4.1 Boomitra Technology to determine Soil Organic Carbon Stock with Remote Sensing

Boomitra has developed a technology to determine SOC weight percentage and bulk density levels using emerging technologies such as remote sensing. Satellite remote sensing offers low-cost measurement technological capability by allowing measurements on a field level to be taken at a very low cost (if using public, freely available satellite data), and multiple measurements to be taken from a given field at regular intervals. High resolutions satellites today are able to measure every land area on earth to 3-30m resolution and nearly every 2 weeks or more frequently. This quantity of data presents a great opportunity for frequent and accurate measurements to be made.

Boomitra's remote sensing SOC and bulk density measurement technology can be interpreted as a further extension of recent work in the SOC remote sensing field, utilizing data across many different sources. It also contributes a new scientific outlook to the field with an approach that enables the ability to sense information at appreciable depths throughout the top 30cm or more of the soil, as required by the chosen VCS methodology. Utilizing certain data and satellite bands under Boomitra's scientific framework enables direct observation and measurement of soil organic carbon, at the level of a satellite pixel. The framework utilizes soil physical properties that we propose are directly measurable at reasonable depths into the soil with certain satellite data. In turn, the soil carbon levels and bulk density

are known to have a causal relationship with these properties (ie. change in soil carbon causes change in these physical properties).

Note that we propose that the framework of the technology is thus different from typical data-driven soil mapping exercises wherein a large number of environmental covariates are used to fit the best possible ML model that optimizes for accuracy but may not have any causal relationships demonstrated, and may not directly be used dynamically (Eg. ISRIC Soilgrids, the state-of-the-art soil map used for clay inputs to RothC in this project, uses over 400 covariates in such a data driven model, and is a static soil map^{Error! Bookmark not defined.}). The remote sensing report provided to the VVB and Verra outlines these theoretical framework steps and the associated assumptions, along with data-driven justifications of these assumptions in the context of this project.

In practice, real world conditions result in signal noise caused by: imaging nuances specific to the cameras on a given satellite; any above-ground biomass and its associated seasonality; and lastly, unrelated fluctuations in the soil itself, such as moisture levels, which are strongly affected by rain or the absence of it. Mercury thermometers also have variation caused by the geometry of the device. Thus, just as a given mercury thermometer has empirically calibrated temperature markings to produce accurate readings, a combination of data across many satellites, followed by machine learning techniques training on a diverse set of calibration data, help to reduce noise in the calculations, improving the accuracy of measuring soil organic carbon stock. These machine learning systems need to be trained and calibrated for each geographical region – the aforementioned underlying theoretical assumptions and controlling the noise usually only hold in a demonstrable manner within a given defined region. This includes a soil data processing workflow from data collection to calibrating and validating the satellite-based soil carbon measurement. Ground data such as real soil test data from different credible sources are collected for each geography, such as the ICRAF LDSF dataset described in detail in Section 4.1. With the help of this data, machine learning systems are calibrated and trained to minimize errors while estimating absolute SOC levels and their resulting changes over time. This processing workflow is detailed further in the remote sensing report provided to the VVB and VCS.

Boomitra's bulk density estimation is generated via a pedotransfer function between steady state bulk density and organic carbon using soil samples directly from the WOSIS dataset that have both bulk density and soil organic carbon values measured, following the methodology outlined in Sections 4.1.8 of the ATBD with results detailed in Section 5.1 of the ATBD. Pedotransfer functions between organic carbon and bulk density are an established tool in soil science to convert between closely related soil parameters¹⁸³. Sand and silt concentrations, elevation (SRTM) and organic carbon were used as covariates to predict bulk density with an Extra Tree Regressor model using 555 samples of WOSIS data with performance of RMSE=0.21 on a held out test dataset.

¹⁸³ Ramcharan, A., Hengl, T., Beaudette, D. and Wills, S., 2017. A Soil Bulk Density Pedotransfer Function Based on Machine Learning: A Case Study with the NCSS Soil Characterization Database. *Soil Science Society of America Journal*, 81(6), pp.1279-1287.

4.4.1.1 Sources of Uncertainty

The methodology requires emerging technologies such as remote sensing to have a ‘known uncertainty’ when being used in the project for soil carbon stock quantifications. Remote sensing has different sources of uncertainty than SOC stock estimates from conventional soil sampling measurements. Assuming effective field sampling followed by dry combustion lab testing, individual soil samples themselves may have SOC wt% uncertainties of 0.02wt%¹⁸⁴. However, when it comes to estimating SOC stocks across sample units, uncertainty becomes much higher due to sampling error – the uncertainty generated by measuring only specific areas within the much larger project through conventional soil sampling. Getting to an observability of 0.01wt% changes, with dry combustion testing, would require 100 samples or more, using the conventional sampling error guidance in Section 8.6.1 of VM0042v1. On the other hand, remote sensing, which measures every 10mx10m pixel in the project area, does not experience this particular form of sampling error, but rather experiences greater errors in point-level measurements of the SOC. The subsequent paragraphs provide methods and sample results on quantifying these uncertainties, and a comparison to conventional soil sampling and testing strategies.

The total uncertainty of the remote sensing may be quantified by fully listing the different sources of uncertainty and carrying out various methods to both minimize and quantify the resultant uncertainty in the measured SOC and bulk density values.

Machine learning models, such as the one utilized in the context of the Boomitra remote sensing technology, have three sources of uncertainty:

1. Noise in input data: If the inputs to the machine learning model have inherent noise to them, then the outputs will also have a carry-through effect, with the resulting test-set uncertainties increased relative to perfect inputs. In the case of the models in this document, this refers to satellite sensor measurement noise. Given the levels of calibration of the public satellites used in this work, this noise can generally be assumed to be random error from the sensors. In both the Frequentist and Bayesian uncertainty calculations derived in the following two sections, the model inputs contain a direct sampling of the input error distribution. In the case of the frequentist approach (Section 4.4.1.2), calculated on a pixel-wise basis, each pixel comparison with a soil sample measurement contains one realization of input noise. When averaged over many pixel-to-soil pairs, the output error contains a broad sampling of the input error distribution propagated through the model directly. In the Bayesian analysis (Section 4.4.1.3) the uncertainty is calculated end-to-end following the method used for emissions reductions, with many pixel per ranch and multiple measurements in time. Each pixel in space and time is run through the remote sensing ensemble of 100 models, thus sampling the input error distribution many times, and directly propagating the input

¹⁸⁴ “Total Organic Carbon - Combustion Method.” Ucdavis.edu, 2017, anlab.ucdavis.edu/analysis/Soils/322. Accessed 29 July 2024. <https://anlab.ucdavis.edu/analysis/Soils/322>

- uncertainty through the PPD analysis. The input uncertainties are thus propagated and represented in the remotes sensing uncertainties.
2. Incomplete coverage of the domain: If the training data used to calibrate the model is not sufficiently representative of the domain for which the model is to make predictions, these kinds of uncertainties can occur. In the case of this work, the source of this uncertainty is from calibration soil samples not being fully representative of the region of interest for which the model is to be applied. This uncertainty is to be minimize through choosing the right underlying training datasets to calibrate the model and can be substantiated through analysis of the training datasets themselves to see if they cover the necessary ranges in soil carbon, soil textures, cropping types and climate zones found in the region of interest. Typically, large governmental or private soil surveys of an entire region tend to approximate the coverage of the domain reasonably well and can minimize this source of uncertainty. In this work, as detailed in Section 5 of the accompanying remote sensing report and Section 4.1 of this document, the primary training data source used spans the geographical region, suggesting that the dataset does cover the full range of the domain of interest. Further justifications on domain coverage are provided in Section 5 of the accompanying remote sensing report. report and in Section 4.1 of this document. Another related source of incomplete coverage of the domain may arise from model drift, causing the correct domain of the model itself to shift with time. Model drift in machine learning systems may be caused by: input covariate drift, concept drift or label drift¹⁸⁵. Given that the calibration soil survey data is QA/QC'd to be representative of the full range of anticipated conditions in carbon, label drift, or representation of the soil carbon levels in the calibration dataset, is not likely to occur. As noted in Section 4.1 and in the remote sensing report, the full quantification of soil carbon and bulk density uses NASA & ESA satellite band data and soil texture data (only for bulk density) as covariates. Soil textures are unlikely to change over human lifetimes¹⁸⁶. However, satellites can surely change in their imaging due to changes in orbits and changes in the onboard measurement devices. For this reason, it is important to always use properly normalized data produced by NASA & ESA for each satellite and each band that accounts for these changes to the satellites, and is known to be intercomparable across different times of imaging. This work uses the properly normalized data, as noted in the remote sensing report. Finally, concept drift could occur if the relationship originally learned by the machine learning model itself changes with time. Specifically in this work, as noted earlier, the relationship being learned is between a directly satellite-measurable soil physical property and the soil

¹⁸⁵ Y. Xu and D. Klabjan, "Concept Drift and Covariate Shift Detection Ensemble with Lagged Labels," in 2021 IEEE International Conference on Big Data (Big Data), Orlando, FL, USA, 2021 pp. 1504-1513.

¹⁸⁶ <https://ohioline.osu.edu/factsheet/anr-0136>

carbon. Concept drift can thus occur if there are changes to the soil structure and composition over time that are not already connected to the learned relationship to soil carbon and the original domain represented by the calibration set. Thus sources of concept drift may include (1) systemic changes over time that are unrelated to the project itself, and (2) the project activities themselves, which are the key change in the project areas from the baseline scenario. The primary systemic change unrelated to the project may be climate change. Soils in the grasslands of the region have reached their current state over several millenia of evolution, including the presence of livestock ranching for the last several hundred years. However, climate change could potentially enhance or hurt vegetation growth, lead to higher or lower levels of average yearly precipitation, higher or lower average temperatures and so on. These effects will directly affect soil carbon, but may not affect other aspects of soil structure and composition in an unrelated way in the term of the project, with the exception of average moisture levels. Moisture is a large component of soil composition and will surely fluctuate over time with climate change. For this reason, the technology includes an approach to minimize the effects of moisture through carefully choosing specific times of the year for repeatable measurement, as discussed further in the remote sensing report. Thus, the effects of systemic changes over time are minimized through careful choices for the process steps in the measurement. On the other hand, project activities of transitioning to improved grazing may have unexpected effects on soil structure and composition. The key effect may be from the localized increase in stocking density that rotational grazing creates in a given paddock, leading to potentially greater soil compaction within that paddock due to livestock hoof action. This soil compaction is completely separate from the soil carbon change, but would be a key form of concept drift for the technology when a practice shift to rotational grazing is happening. However, this source of drift is not applicable to this specific project region due to the very low stocking rates present relative to what is needed to cause compaction (stocking rates are high enough to cause overgrazing, but an order of magnitude too low to cause soil compaction from animal hooves). Refer to this previous footnote for a deeper discussion and justification. Thus, through proper QA/QC and controls, errors due to incomplete coverage of the domain are minimized.

3. Imperfect models: Finally, the model itself may be imperfect due to being unable to fully capture the variations in its training data. This is an element of any model that is a reduction of a more complicated underlying system. In this work, imperfect models can be due to an underlying nature of the machine learning architecture and training process used itself (eg. linear models, decision tree algorithms, neural networks with gradient descent, etc.), or even from the targets in the training data (eg. SOC of soil samples trained on) or from the associated pre-processing steps. The ICRAF LDSF soil samples used for training in this work

have gone through the same analytical lab technique. There may also be errors introduced from the potential (unknown) slight variations in sample collection procedures carried out by different individual technicians that undertook the soil survey, that result in random errors in the data points. Similarly, one specific pre-processing step that leads to imperfect models is the spatialization approach taken to match point measurement data of soils that are used for calibrating the satellite models to the pixels extracted from satellite data, since the satellite pixels do not directly match to points but rather to areas corresponding to the pixel size. As discussed further in the accompanying remote sensing report's Section 5, this work matches satellite data to the ICRAF LDSF data for training by identifying the collocated satellite pixels, which represent an area larger than the point locations sampled, and thus the exact spatial variability seen by the pixels is ultimately not represented in the sample point data, which also leads to an imperfect model. Given that nearby soils are correlated, the effect is not expected to be large, but this pre-processing step is certainly an error source. Ultimately this general source of error (imperfect models) is accounted in the different uncertainty techniques using the analysis of model outputs (which implicitly incorporate this error, in frequentist and Bayesian approaches), as seen in subsequent subsections.

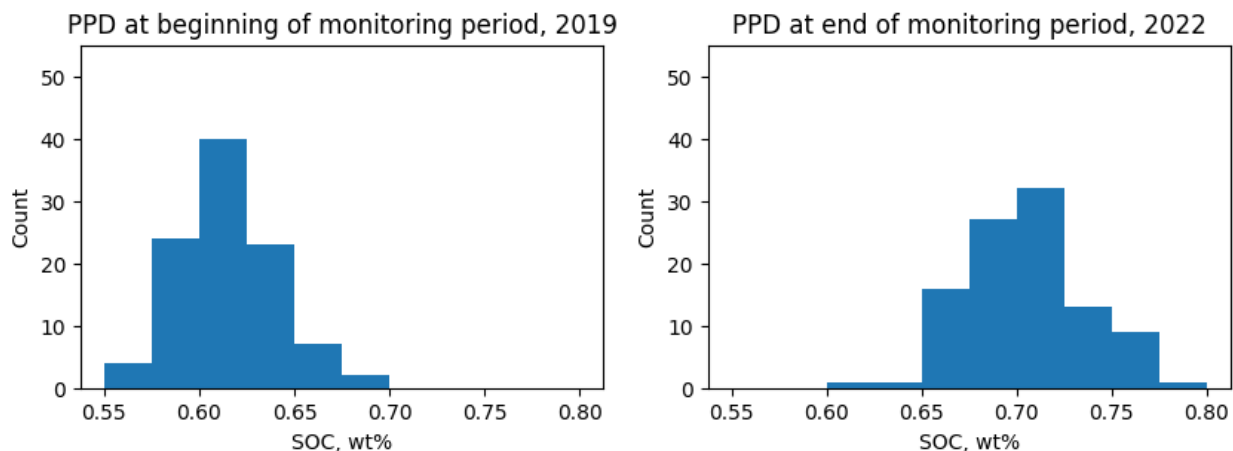
There are two approaches to computing uncertainty across these sources 1 and 3 above in a conservative manner: the frequentist approach and the Bayesian approach.

4.4.1.2 Bayesian Approach

We calculate the variance of soil carbon measurements using a Bayesian approach involving Monte Carlo simulations of the output of the machine learning model. In this approach, for each 'simulation', the model is repeatedly trained with subsets of the training data and made to perform predictions of individual pixels in the underlying field that is being studied. The repeated training of the model creates a posterior distribution of the model's internal parameters that accounts for the modeling error and the input data noise. Then, using the posterior distributions of the models alongside the inputs of the validation dataset, a posterior predictive distribution of the validation predictions is produced. Thus, for each predicted value, we may compute a variance of its predictive posterior distribution to determine the uncertainty of that specific value. The individual predictive posterior distributions can also be averaged together across a series of pixels found in a given sample unit of interest to arrive at the predictive posterior distribution of the mean soil carbon of that sample unit. Taking the variance of this distribution provides an accurate calculation of the uncertainty in the SOC stock and may be used directly as the uncertainty of SOC stock for the sample unit.

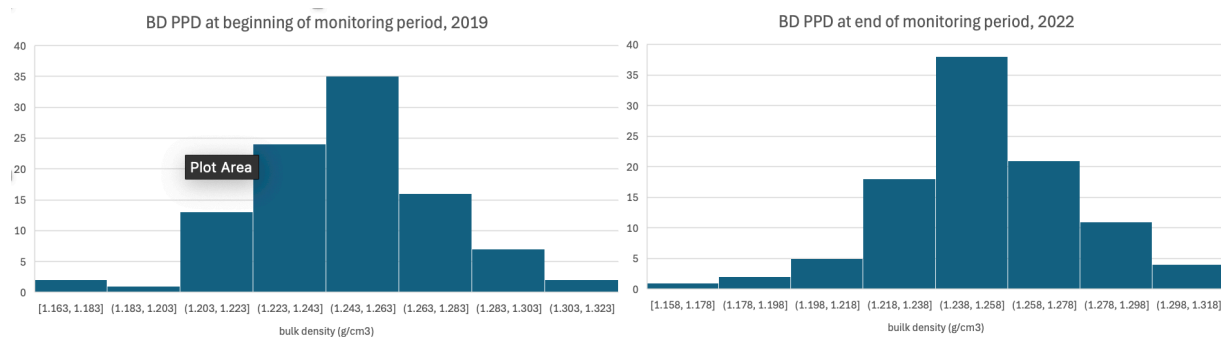
In Section 5.1.4 of the remote sensing report provided to the VVB and VCS, there is an example presented of the Bayesian approach with 100 Monte Carlo simulations for one of the project sample units (field)

across the first monitoring period (3 years), the results of which are summarized here, generating the following Posterior Predictive Distributions¹⁸⁷ of SOC:



The above figures represent SOC wt% at the beginning and end of the first monitoring period for an example field from the project. Observe that the distributions are visibly separated from one another, in terms of their respective centers and variance. The PPD at the beginning of the monitoring period has a standard deviation of 0.024 and the PPD at the end has a standard deviation of 0.032.

Similarly, the bulk density model is put through a similar 100 MC simulations resulting in a similar set of 100 before-after pairs as shown in the following figures.



Pairs of MC simulations of SOC and PD are then combined into 100 SOC stock MC simulations. The SOC stock (tons CO₂e/hectare) PPDs at start and end have standard deviations of 3.32 and 4.36 tons CO₂e/hectare, respectively, with a covariance of 7.15 (tons CO₂e/hectare)² between the initial and final distributions (see Model Prediction Error, in Section 4.1 above. When this analysis is carried out, the uncertainty of both the bulk density and SOC wt% are directly incorporated during the calculation of the PPD for SOC stock in tons CO₂e/hectare. These uncertainty values can then be used as the standard error in subsequent uncertainty propagation calculations where this farm's data incorporated, to calculate final ERRs. This type of analysis can be done on every farm using Bayesian methods.

¹⁸⁷ In Bayesian Statistics, the Posterior Predictive Distribution is the distribution of output values (here, SOC), conditional on the distribution of the input values. See "[Posterior Predictive Distribution](#)". SAS. Retrieved 19 July 2014.

Experimental studies with intensive conventional soil sampling on field level report anywhere from 4 ton CO₂e/hectare to 16 ton CO₂e/hectare standard errors in SOC stock increase measured^{188,189,190}

Further descriptions, methods and calculations for Bayesian approaches are given in Section 4.2.4 and Sections 5.1.2 of the remote sensing report and the end-to-end uncertainty spreadsheet provided to the VVB and VCS teams.

4.5 Estimated GHG Emission Reductions and Carbon Dioxide Removals

Estimated net gross removals are quantified using Equation 31 of VM0042, version 1.0:

$$ER_t = (A_o \times (\overline{\Delta CO_2 Soil_t} + \overline{\Delta C_{CH_4 t}} + \overline{\Delta C_{N_2O, t}}) - LE_t) \times (1 - UNC_t)$$

Where:

ER_t	Estimated net GHG emissions reductions and removals in year t; t CO ₂ e
A_o	Project Area, Unit Area
$\overline{\Delta CO_2 Soil_t}$	Areal average carbon dioxide emission reductions from soil organic carbon pool in year t; t CO ₂ e/unit area
$\overline{\Delta C_{CH_4 t}}$	Areal average methane emission reductions in year t; t CO ₂ e/unit area
$\overline{\Delta C_{N_2O, t}}$	Areal average nitrous oxide emission reductions in year t; t CO ₂ e/unit area
LE_t	Leakage in year t, equal to zero; t CO ₂ e
UNC_t	Uncertainty deduction in year t; fraction between 0 and 1

This project only accounts for soil organic carbon stock changes. Hence the areal average carbon dioxide emission removals from CH₄ and N₂O **are zero**.

Carbon dioxide emission reductions are quantified as per equation 32 of methodology as shown below.

$$\overline{\Delta CO_2_t} = \overline{\Delta CO_2 soil_t} + \overline{\Delta CO_2 ff_t} + \overline{\Delta C_{TREE, t}} + \overline{\Delta C_{SHRUB, t}}$$

¹⁸⁸ Deluz Cédric, Nussbaum Madlene, Sauzet Ophélie, Gondret Karine, Boivin Pascal. (2020). Evaluation of the Potential for Soil Organic Carbon Content Monitoring With Farmers. *Frontiers in Environmental Science*, 8. <https://doi.org/10.3389/fenvs.2020.00113>

¹⁸⁹ Goidts, E., Van Wesemael, B., and Crucifix, M. (2009). Magnitude and sources of uncertainties in soil organic carbon (SOC) stock assessments at various scales. *European Journal of Soil Science*, 60, 723-739. <https://doi.org/10.1111/j.1365-2389.2009.01157.>

¹⁹⁰ S. R. Sherpa, D. W. Wolfe, H. M. van Es, Sampling and data analysis optimization for estimating soil organic carbon stocks in Agroecosystems. *Soil Science Society of America Journal*. 80, 1377–1392 (2016).

Where,

$\overline{\Delta CO_2}_t$	Areal average carbon dioxide emission reductions in year t; t CO ₂ ^e /unit area
$\overline{\Delta CO_2}_{soil,t}$	Areal average carbon dioxide emission reductions from soil organic carbon pool in year t CO ₂ ^e /unit area
$\overline{\Delta CO_2}_{ff,t}$	Areal average carbon dioxide emission reductions from fossil fuel combustion in year t CO ₂ ^e /unit area
$\overline{\Delta C}_{TREE,t}$	Areal average carbon dioxide emission reductions from tree biomass in year t CO ₂ ^e /unit area
$\overline{\Delta C}_{SHRUB,t}$	Areal average carbon dioxide emission reductions from shrub biomass in year t CO ₂ ^e /unit area

This project only accounts for soil organic carbon stock changes. Hence the areal average carbon dioxide emission removals from increasing **tree biomass, shrub biomass and fossil fuel combustions are zero.**

Carbon dioxide emission reductions from the soil organic carbon pool for sample unit i in year t are quantified for Quantification Approach 1 as mentioned equation 33.

$$\Delta CO_2 Soil_{i,t} = (SOC_{wp,i,t} - SOC_{wp,i,t-1}) - (SOC_{bsl,i,t} - SOC_{bsl,i,t-1})$$

Where,

$\Delta CO_2 Soil_{i,t}$	Carbon dioxide emission reductions from soil organic carbon pool for sample unit i in year t; t CO _{2e} /unit area
$SOC_{wp,i,t}$	Carbon stocks in the soil organic carbon pool in the project scenario for sample field i at the end of year t; t CO _{2e} /unit area
$SOC_{wp,i,t-1}$	Carbon stocks in the soil organic carbon pool in the project scenario for sample field i at the end of year t-1; t CO _{2e} /unit area
$SOC_{bsl,i,t}$	Carbon stocks in the soil organic carbon pool in the baseline scenario for sample field i at the end of year t; t CO _{2e} /unit area
$SOC_{bsl,i,t-1}$	Carbon stocks in the soil organic carbon pool in the baseline scenario for sample field i at the end of year t-1; t CO _{2e} /unit area
i	Sample unit

The initial SOC is the same in both the baseline and project scenarios at the outset of the project ($SOC_{wp,i,0} = SOC_{bsl,i,0}$) as a result, the above equation simplifies to

$$\Delta CO_2 Soil_{i,t} = SOC_{wp,i,t} - SOC_{bsl,i,t}$$

4.5.1 Estimated Reductions and Removals

An accompany spreadsheet is available providing details on the calculation of the values present in the below table. Since the biogeochemical model validation report is presented at each verification stage, and it is central to the calculation of baseline emissions or removals in this project, the baseline emissions or removals every year is estimated using field trial literature data, including some of the same field trials that will be used for biogeochemical model calibration and validation. The reduction, removal, and total VCUs estimated in the table below include the uncertainty deductions and buffer subtractions as calculated in the Emissions Reduction Projection sheet:

Table 19: Yearly Estimated Reductions and removal

Vintage period	Estimated baseline emissions (tCO ₂ e) (a)	Estimated project emissions (tCO ₂ e) (b)	Estimated leakage emissions (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e) (c)	Estimated removal VCUs (tCO ₂ e) (c)
10-Jan-2019 to 31-Dec-2019	-	-	-	-	-
1-Jan-2020 to 31-Dec-2020	(481.79)	15,742.46	0	0	5,245
1-Jan-2021 to 31-Dec-2021	8,893.49	25,079.53	0	0	5,210
1-Jan-2022 to 31-Dec-2022	21,117.43	36,135.41	0	0	4,297
1-Jan-2023 to 31-Dec-2023	9,843.04	25,652.47	0	0	4,907
1-Jan-2024 to 31-Dec-2024	9,843.04	25,652.47	0	0	4,907
1-Jan-2025 to 31-Dec-2025	9,843.04	25,652.47	0	0	4,907
1-Jan-2026 to 31-Dec-2026	9,843.04	25,652.47	0	0	4,907
1-Jan-2027 to 31-Dec-2027	9,843.04	25,652.47	0	0	4,907
1-Jan-2028 to 31-Dec-2028	9,843.04	25,652.47	0	0	4,907
1-Jan-2029 to 31-Dec-2029	9,843.04	25,652.47	0	0	4,907

Vintage period	Estimated baseline emissions (tCO ₂ e) (a)	Estimated project emissions (tCO ₂ e) (b)	Estimated leakage emissions (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e) (c)	Estimated removal VCUs (tCO ₂ e) (c)
1-Jan-2030 to 31-Dec-2030	9,843.04	25,652.47	0	0	4,907
1-Jan-2031 to 31-Dec-2031	9,843.04	25,652.47	0	0	4,907
1-Jan-2032 to 31-Dec-2032	9,843.04	25,652.47	0	0	4,907
1-Jan-2033 to 31-Dec-2033	9,843.04	25,652.47	0	0	4,907
1-Jan-2034 to 31-Dec-2034	9,843.04	25,652.47	0	0	4,907
1-Jan-2035 to 31-Dec-2035	9,843.04	25,652.47	0	0	4,907
1-Jan-2036 to 31-Dec-2036	9,843.04	25,652.47	0	0	4,907
1-Jan-2037 to 31-Dec-2037	9,843.04	25,652.47	0	0	4,907
1-Jan-2038 to 31-Dec-2038	9,843.04	25,652.47	0	0	4,907
1-Jan-2039 to 09-Jan-2039	215.74	562.25	0	0	107
Total	187,233.57	487,959.12	0	0	93,371

Note:

(a) Baseline Emissions that would have happened without project scenario (values within brackets are negative)

(b) Project carbon removals after implementing project activities

(c) Net emission reductions, removals, or totals after uncertainty deductions and deducting the buffer credits

$\overline{\Delta C_{CH4,t}}$ and $\overline{\Delta C_{N2O,t}}$ are zero, and not included in the table above

(Please refer ER Sheet for complete calculation details)

In order to calculate the number of Verified Carbon Units (VCU) that may be issued, the buffer credits are estimated using VCS non permanence tool. The number of buffer credits identified at the time of validation is 15%.

The number of that may be issued in year t is calculated as per equation shown below.

$$VCU_t = ER_t - Buffer_t$$

Where,

VCU_t	Number of VCU in year t; t CO ₂ e
ER_t	Estimated net GHG emissions reductions and removals in year t; t CO ₂ e
$Buffer_t$	Number of buffer credits to be contributed to the AFOLU pooled buffer account in year t; t CO ₂ e

For projects that are not required to assess permanence risk, complete the table below for the project crediting period:

For projects required to assess permanence risk:

i) Provide the requested information using the table below:

State the non-permanence risk rating (%)	15%
Has the non-permanence risk report been attached as either an appendix or a separate document?	☒ Yes ☐ No
For ARR and IFM projects with harvesting, state, in tCO ₂ e, the Long-term Average (LTA).	Not Applicable. There are no ARR and IFM activities involved in this project.
Has the LTA been updated based on monitored data, if applicable?	Not applicable
State, in tCO ₂ e, the expected total GHG benefit to date.	Not Applicable
Is the number of GHG credits issued below the LTA?	Not Applicable

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	AR	
Data unit	Percent	
Description	Weighted average adoption rate	
Source of data	Attested statement from an expert in the region	
Value applied	Activity Name	% of adoption rate
	Improved Grazing Practice	10%
	Biodiversity Conservation-Lion proof lights	5%
	Biodiversity Conservation-Creation of wildlife zones	1%
	Biodiversity Conservation-Hiring and equipping rangers	1%
	Biodiversity Conservation-Zoning of wildlife breeding areas	2%
	Gabions (Water Management)	1%
	Promotion of Capacity Building Programs	5%
	As per the methodology footnote 12, if the evidence on existing adoption rates for the combined activities are not available, the existing adoption rates (i.e., pre-project) of the individual activities to estimate the combined activity adoption rate.	
Justification of choice of data or description of measurement methods and procedures applied	As per Section 7 of the methodology, when evidence is not available on a single proposed activity in the region from any of the indicated sources, the project proponent can seek the opinion of an expert. An expert has provided his opinion with signed and dated attestation on the practices. Details of the expert will be provided to the VVB during validation.	
Purpose of Data	Common practice assessment	
Comments	NA	

Data / Parameter	$Area_{an}$
Data unit	Hectare
Description	Area of proposed project-level adoption of each activity

Source of data	Management plans, Rancher records, project activity commitments
Value applied	9033
Justification of choice of data or description of measurement methods and procedures applied	As per section 7 of the methodology, when evidence is not available on a single proposed activity in the region from any of the sources listed in the methodology, the Project Proponent can seek the opinion of an expert on the subject. An expert has provided his opinion with signed and dated attestation statement on the practices. Details of the expert will be provided to the VVB during validation. The complete area of each participating ranch is included
Purpose of Data	Common practice assessment
Comments	The project intends to adopt rotational grazing all over the project location.

Data / Parameter	EA_{an}
Data unit	Percent
Description	Adoption rate of the n largest most common proposed project activity in the region
Source of data	Attested statement from an expert in the region
Value applied	10%
Justification of choice of data or description of measurement methods and procedures applied	As per Section 7 of the methodology, when evidence is not available on a single proposed activity in the region from any of the indicated sources, the project proponent can seek the opinion of an expert. An expert has provided his opinion with signed and dated attestation on the practices. Details of the expert will be provided to the VVB during validation.
Purpose of Data	Common practice assessment
Comments	NA

Data / Parameter	A_0
Data unit	Hectares
Description	Project area
Source of data	Measured in project area
Value applied	9033
Justification of choice of data or description of measurement methods and procedures applied	The measurement methods and procedures for determining the project area for units Area and Ai comply with Sections 3.11.1 and 3.11.2 of the VCS Standard v4.5. To include new project activity instances, geospatial field boundary mapping techniques are used to demarcate the project area with multiple points, creating polygons in KML files. These KML files precisely delineate the project zone where reductions and removals are quantified, and exclude non-eligible areas such as roads, water bodies, waterways, forests, rock formations, settlements, and other areas not part of the project as defined by the standard and methodology. The delineation of the project area incorporates a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data, all of which are geo-registered with corner points, clear landmarks, or other intersection points. The area of each field is calculated using the equal area projection EPSG:6933 in the QGIS software package. By using these advanced geospatial techniques, we accurately calculate the eligible area of the ranches under this project, ensuring compliance with VCS standards. These KML files are available for validation, encompassing all project instances and delineating the smallest administrative land divisions involved.
Purpose of Data	Calculation of baseline and project emissions
Comments	The value mentioned in this table is overall project area which can be included in the project. This table will be updated when new instances are added to the grouped project (instance wise).

Data / Parameter	$P_{bsl,p}$									
Data unit	Livestock productivity (change in livestock rate -Population of grazing livestock in the baseline scenario)									
Description	Average productivity of livestock p during the historical baseline period									
Source of data	Baseline survey or ranch level reported data as per the Box 1 in the methodology.									
Value applied	Livestock population rate: <table border="1"> <thead> <tr> <th rowspan="2">Rancher name</th><th>Productivity in Baseline Period</th></tr> <tr> <th>P_{bsl}</th></tr> </thead> <tbody> <tr> <td>Kasanga</td><td>1401</td></tr> <tr> <td>Lisa ranch & Game Sanctuary</td><td>3044</td></tr> <tr> <td>Machakos</td><td>1066</td></tr> </tbody> </table>	Rancher name	Productivity in Baseline Period	P_{bsl}	Kasanga	1401	Lisa ranch & Game Sanctuary	3044	Machakos	1066
Rancher name	Productivity in Baseline Period									
	P_{bsl}									
Kasanga	1401									
Lisa ranch & Game Sanctuary	3044									
Machakos	1066									
Justification of choice of data or description of measurement methods and procedures applied	The data will be collected through the surveys with project participating ranchers. The change in the rate of livestock numbers was reported by the ranchers in the baseline scenario. As per the section 8.4.3 Equation 29									
Purpose of Data	Determination of changes in the livestock productivity for future market leakage analysis									
Comments	None									

Data / Parameter	$P_{bsl,i,t}$
Data unit	Head
Description	Population of grazing livestock in the baseline scenario of type I in sample unit i in year t

Source of data	Rancher data							
	Rancher name	2016	2017	2018	2019	2020	2021	
	Kasanga	1500	1353	1350	1353	1495	1355	
	Lisa ranch & Game Sanctuary	3070	3023	3020	3023	3090	3040	
	Machakos	1124	1037	1037	1037	1229	1084	
Value applied	Varies from ranch to ranch. See accompanying spreadsheet of list of ranches for a list of values and analysis for Instance 01.							
Justification of choice of data or description of measurement methods and procedures applied	Data collected using rancher attestation forms and management plans. A spreadsheet is provided to the VVB whenever new ranches are added during the incorporation of a new project instance at the time of verification. At verification, these estimates will be refined in the monitoring report based on the livestock herd census registers established and maintained at the implementing partner level. The monitoring protocol document evidence of a historical management record, as a valid data source according to Box 1 of VM0042.							
Purpose of Data	Calculation of baseline emissions. However, it is not used for any calculations in this project, since this project only involves carbon removals i.e., SOC stock change.							
Comments	This value is used to check if there is any drastic reduction in the livestock stocking rates in the project scenario as compared to the baseline scenario.							

Data / Parameter	Days _{bsl,l,i,t}
Data unit	Days

Description	Average grazing days per head in the baseline scenario inside sample unit i for each livestock type l in year t .
Source of data	Rancher field data
Value applied	365
Justification of choice of data or description of measurement methods and procedures applied	Entire ranches are individually enrolled, and ranchers attest that they are enrolling a complete ranch. The prevailing practice in the region is for all livestock owned by a given rancher to graze solely on an individual ranch. Thus, the average grazing days per head in a given year is 100% of the days in a year – 365 days.
Purpose of Data	Calculation of baseline emissions. However, it is not used for any calculation in this project, since this project only involves carbon removals i.e., SOC stock change.
Comments	This value is used to check if there is any drastic reduction in the livestock stocking rates in the project scenario as compared to baseline scenario.

Data / Parameter	DPM/RPM
Data unit	fraction
Description	An estimate of the decomposability of the incoming plant material
Source of data	RothC model default value
Value applied	0.67
Justification of choice of data or description of measurement methods and procedures applied	Recommendation given in the official RothC model documentation for an unimproved native grassland.
Purpose of Data	To estimate baseline emissions
Comments	Default value provided by the model

Data / Parameter	OD
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Data unit	cm
Description	Depth of Soil layer sampled
Source of data	Methodology
Value applied	30 cm
Justification of choice of data or description of measurement methods and procedures applied	As per methodology requirement this parameter is fixed to 30 cm
Purpose of Data	To estimate baseline emissions
Comments	NA

5.2 Data and Parameters Monitored

Data / Parameter	AR
Data unit	<i>Percent</i>
Description	Weighted average adoption rate
Source of data	Filed Monitoring data
Description of measurement methods and procedures to be applied	Not Applicable
Frequency of monitoring/recording	Whenever new instances are added
Value applied	Ex post (less than 20%)
Monitoring equipment	No monitoring equipment is required to monitor this parameter.
QA/QC procedures to be applied	Internal audit of the data collected yearly. See monitoring plan section.
Purpose of data	Common practice assessment
Calculation method	Measurement

Comments	NA
Data / Parameter	$Area_{an}$
Data unit	Unit area (hectares or acres)
Description	Area of proposed project-level adoption of each activity
Source of data	Rancher records and project activity commitments
Description of measurement methods and procedures to be applied	The measurement methods and procedures for determining the project area for units Area and Ai comply with Sections 3.11.1 and 3.11.2 of the VCS Standard v4.5. To include new project activity instances, geospatial field boundary mapping techniques are used to demarcate the project area with multiple points, creating polygons in KML files. These KML files precisely delineate the project zone where reductions and removals are quantified, and exclude non-eligible areas such as roads, water bodies, waterways, forests, rock formations, settlements, and other areas not part of the project as defined by the standard and methodology. The delineation of the project area incorporates a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data, all of which are geo-registered with corner points, clear landmarks, or other intersection points. By using these advanced geospatial techniques, we accurately calculate the eligible area of the ranches under this project, ensuring compliance with VCS standards. These KML files are available for validation, encompassing all project instances and delineating the smallest administrative land divisions involved.
Frequency of monitoring/recording	Whenever a new instance is added
Value applied	Ex post
Monitoring equipment	No monitoring equipment is required to monitor this parameter. However, geospatial techniques will be used to estimate this parameter.
QA/QC procedures to be applied	Delineation of the sample unit area may use a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data. Any imagery or GIS

	datasets used must be geo-registered referencing corner points, clear landmarks or other intersection points. Internal audit of the data collected every year once See monitoring plan section.
Purpose of data	Common practice assessment
Calculation method	Measured
Comments	NA

Data / Parameter	EA_{an}
Data unit	Percent
Description	Adoption rate of the n largest most common proposed project activity in the region
Source of data	Field data collected and Expert opinion
Description of measurement methods and procedures to be applied	Not applicable
Frequency of monitoring/recording	Whenever a new instance is added
Value applied	Ex post
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Delineation of the sample unit area may use a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data. Any imagery or GIS datasets used must be geo-registered referencing corner points, clear landmarks or other intersection points. Internal audit of the data collected once every year. See monitoring plan section.
Purpose of data	Common practice assessment

Calculation method	Not applicable
Comments	NA
Data / Parameter	A_i
Data unit	Unit area
Description	Area of sample unit i
Source of data	Determined in project area
Description of measurement methods and procedures to be applied	The measurement methods and procedures for determining the project area for units Area and A_i comply with Sections 3.11.1 and 3.11.2 of the VCS Standard v4.5. To include new project activity instances, geospatial field boundary mapping techniques are used to demarcate the project area with multiple points, creating polygons in KML files. These KML files precisely delineate the project zone where reductions and removals are quantified, and exclude non-eligible areas such as roads, water bodies, waterways, forests, rock formations, settlements, and other areas are not part of the project as defined by the standard and methodology. The delineation of the project area incorporates a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data, all of which are geo-registered with corner points, clear landmarks, or other intersection points. By using these advanced geospatial techniques, we accurately calculate the eligible area of the ranches under this project, ensuring compliance with VCS standards. These KML files are available for validation, encompassing all project instances and delineating the smallest administrative land divisions involved.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years.
Value applied	Ex post
Monitoring equipment	There is no monitoring equipment
QA/QC procedures to be applied	Delineation of the sample unit area may use a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data. Any imagery or GIS

	datasets used must be geo-registered referencing corner points, clear landmarks or other intersection points. Internal audit of the data collected every year once See monitoring plan section.
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not applicable
Comments	NA

Data / Parameter	i
Data unit	Dimensionless
Description	Sample unit: defined area that is selected for measurement and monitoring, such as a field
Source of data	Determined in project area
Description of measurement methods and procedures to be applied	The sample unit is determined prior to verification. The measurement methods and procedures for determining the project area for units Area and Ai comply with Sections 3.11.1 and 3.11.2 of the VCS Standard v4.5. To include new project activity instances, geospatial field boundary mapping techniques are used to demarcate the project area with multiple points, creating polygons in KML files. These KML files precisely delineate the project zone where reductions and removals are quantified, and exclude non-eligible areas such as roads, water bodies, waterways, forests, rock formations, settlements, and other areas not part of the project as defined by the standard and methodology. The delineation of the project area incorporates a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data, all of which are geo-registered with corner points, clear landmarks, or other intersection points. By using these advanced geospatial techniques, we accurately calculate the eligible area of the ranches under this project, ensuring compliance with VCS standards. These KML files are available for validation, encompassing all project instances and delineating the smallest administrative land divisions involved.

Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Delineation of the sample unit area may use a combination of GIS coverages, ground survey data, remote imagery (satellite or aerial photographs), or other appropriate data. Any imagery or GIS datasets used must be geo-registered referencing corner points, clear landmarks or other intersection points. Internal audit of the data collected once every year. See monitoring plan section.
Purpose of data	Calculation of baseline and project emissions
Calculation method	NA
Comments	NA

Data / Parameter	j
Data unit	Dimensionless
Description	Type of fossil fuel combusted
Equations	Equation , Equation 4
Source of Data	Determined in sample unit i
Description of measurement methods and procedures to be applied	See Box 1. Of VM0042 v1.0, Fossil fuel type is determined prior to verification
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
QA/QC procedures to be applied	See Box 1. Of VM0042 v1.0
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not Applicable

Comments	None
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Data / Parameter	L
Data unit	Dimensionless
Description	Type of livestock
Source of data	Determined in sample unit <i>i</i>
Description of measurement methods and procedures to be applied	Rancher data collection.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	Surveys will be conducted and validated by the project manager before reporting for verification.
Purpose of data	This parameter is not used for any calculation. However, it is monitored to see any drastic reduction in the livestock stocking rate to estimate leakage in the project scenario.
Calculation method	NA
Comments	NA

Data / Parameter	•
Data unit	Dimensionless
Description	Gas or pool
Source of data	Determined in sample unit <i>i</i>
Description of measurement methods and procedures to be applied	NA

Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	NA
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not applicable
Comments	NA

Data / Parameter	SF
Data unit	Dimensionless
Description	Type of Synthetic N Fertilizer
Equations	Equation 14
Source of data	Determined in sample unit <i>i</i>
Description of measurement methods and procedures to be applied	See Box 1. Of VM0042 v1.0, Synthetic Fertilizer type is determined prior to verification
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
QA/QC procedures to be applied	See Box 1. Of VM0042 v1.0
Purpose of data	Calculation of baseline and project emissions
Calculation method	Not Applicable
Comments	None

Data / Parameter	fSOC _{bsl,i,t}
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Data unit	t CO ₂ e/unit area								
Description	Modeled soil organic carbon stocks pool in the baseline scenario for sample unit i at time t								
Source of data	Modeled in the project area								
Description of measurement methods and procedures to be applied	Using Remote sensing technique along with RothC model procedure (Calculation method noted in the CarbonFocus Algorithm Theoretical Basis Document) $SOC_{bsl,i,t} = f_{soc} (Var A_{bsl,i,t}, Var B_{bsl,i,t}, \dots)$ Where, <table> <tr> <td>$SOC_{bsl,i,t}$</td><td>Modeled soil organic carbon stocks pool in the baseline scenario for sample unit i at time t (t CO₂e/unit area)</td></tr> <tr> <td>f_{soc}</td><td>Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO₂e/unit area)</td></tr> <tr> <td>$Var A_{bsl,i,t}$</td><td>Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)</td></tr> <tr> <td>$Var B_{bsl,i,t}$</td><td>Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)</td></tr> </table> See Table 16: Inputs to the models and their sources for variable sources in the PDD.	$SOC_{bsl,i,t}$	Modeled soil organic carbon stocks pool in the baseline scenario for sample unit i at time t (t CO ₂ e/unit area)	f_{soc}	Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO ₂ e/unit area)	$Var A_{bsl,i,t}$	Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)	$Var B_{bsl,i,t}$	Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)
$SOC_{bsl,i,t}$	Modeled soil organic carbon stocks pool in the baseline scenario for sample unit i at time t (t CO ₂ e/unit area)								
f_{soc}	Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO ₂ e/unit area)								
$Var A_{bsl,i,t}$	Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)								
$Var B_{bsl,i,t}$	Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)								
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years								
Value applied	Ex post								
Monitoring equipment	Remote sensing and RothC model								
QA/QC procedures to be applied	Standard QA/QC procedures for soil inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs available from published handbooks, such as those published by FAO and available on the FAO Soils								

	Portal ¹⁹¹ , or from the IPCC GPG LULUCF 2003 is recommended. Refer Section 5.3.9 of the PD.
Purpose of data	Calculation of baseline emissions
Calculation method	NA
Comments	The soil organic carbon stocks at time t=0 are calculated based on directly measured soil organic carbon content and bulk density at t=0 or (back-) modeled to t =0 from measurements collected within +/-5 years of t =0, or determined for t=0 via emerging technologies (remote sensing¹⁹²) with known uncertainty and must be used in both the baseline and with-project scenario for the length of the project. Soil organic carbon stocks in the baseline scenario for sample unit i must be reported every 5 years or less. Uncertainty is known to be 4.36 tons CO₂e/hectare as derived in Section 4.4.1.2.

Data / Parameter	SOC _{bsl,i,t}
Data unit	t CO ₂ e/unit area
Description	Areal-average soil organic carbon stocks in the baseline scenario for sample unit i in year t
Source of data	Remote sensing along with RothC model
Description of measurement methods and procedures to be applied	Using Remote sensing technique along with RothC model procedure (Calculation method noted in the CarbonFocus Algorithm Theoretical Basis Document) $SOC_{bsl,i,t} = f_{soc} (Var A_{bsl,i,t}, Var B_{bsl,i,t},)$

¹⁹¹ "Sampling and Laboratory Techniques | FAO SOILS PORTAL | Food and Agriculture Organization of the United Nations 2017. Accessed 6 Aug. 2024.

¹⁹² Calculation method noted in Boomitra CarbonFocus Algorithm Theoretical Basis Document

	Where,	
	$SOC_{bsl,i,t}$	Modeled soil organic carbon stocks pool in the baseline scenario for sample unit i at time t (t CO ₂ e/unit area)
	f_{soc}	Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO ₂ e/unit area)
	Var A _{bsl,i,t}	Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)
	Var B _{bsl,i,t}	Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)
	See Table 16: Inputs to the models and their sources for variable sources.	
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years	
Value applied	Ex post	
Monitoring equipment	Remote sensing and RothC model	
QA/QC procedures to be applied	Standard QA/QC procedures for soil inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs available from published handbooks, such as those published by FAO and available on the FAO Soils Portal¹⁹¹, or from the IPCC GPG LULUCF 2003 is recommended. Refer Section 5.3.13 of the PD.	
Purpose of data	Calculation of baseline emissions	
Calculation method	NA	
Comments	The soil organic carbon stocks at time t=0 are calculated based on directly measured soil organic carbon content and bulk density at t=0 or (back-) modeled to t =0 from measurements collected within +/-5 years of t =0, or determined for t=0 via emerging	

	technologies (remote sensing ¹⁹³) with known uncertainty and must be used in both the baseline and with-project scenario for the length of the project. Soil organic carbon stocks in the baseline scenario for sample unit i must be reported every 5 years or less.
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Data / Parameter	SOC _{wp,i,t}								
Data unit	t CO ₂ e/unit area								
Description	Areal-average soil organic carbon stocks in the project scenario for sample unit i in year t								
Source of data	Measured in the project area								
Description of measurement methods and procedures to be applied	Remote sensing along with RothC model (Calculation method noted in the CarbonFocus Algorithm Theoretical Basis Document) $fSOC_{wp,i,t} = f_{soc} (Var A_{wp,i,t}, Var B_{wp,i,t}, \dots)$ Where, <table> <tr> <td>fSOC_{wp,i,t}</td><td>Modeled carbon stocks pool in the baseline scenario for sample unit i at time t (t CO₂e/unit area)</td></tr> <tr> <td>f_{soc}</td><td>Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO₂e/unit area)</td></tr> <tr> <td>Var A_{bsl,i,t}</td><td>Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)</td></tr> <tr> <td>Var B_{bsl,i}</td><td>Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)</td></tr> </table> See Table 16: Inputs to the models and their sources for variable sources. Soil sampling protocols and practices mentioned in the methodology are followed to collect the data.	fSOC _{wp,i,t}	Modeled carbon stocks pool in the baseline scenario for sample unit i at time t (t CO ₂ e/unit area)	f _{soc}	Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO ₂ e/unit area)	Var A _{bsl,i,t}	Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)	Var B _{bsl,i}	Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)
fSOC _{wp,i,t}	Modeled carbon stocks pool in the baseline scenario for sample unit i at time t (t CO ₂ e/unit area)								
f _{soc}	Model predicting carbon dioxide emissions from the soil organic carbon pool (t CO ₂ e/unit area)								
Var A _{bsl,i,t}	Value of model input variable A in the project scenario for sample unit i at time t (units unspecified)								
Var B _{bsl,i}	Value of model input variable B in the project scenario for sample unit i at time t (units unspecified)								

¹⁹³ Calculation method noted in Boomitra CarbonFocus Algorithm Theoretical Basis Document

Frequency of monitoring/recording	Monitoring and re-measurement conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	Remote sensing and RothC model
QA/QC procedures to be applied	Standard QA/QC procedures for soil inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs available from published handbooks, such as those published by FAO and available on the FAO Soils Portal¹⁹⁴ or from the IPCC GPG LULUCF 2003 is recommended. Refer Section 5.3.13 of the PD.
Purpose of data	Calculation of project emissions
Calculation method	This has been calculated using RothC model and remote sensing which has been discussed in detail in the CarbonFocus Algorithm Theoretical Basis Document. The RothC model is initialized with the initial soil carbon values from the satellite remote sensing algorithm. It is run forward using weather timeseries to the final timepoint. The soil carbon input is calibrated using the final carbon stock from the satellite remote sensing measurement, and the vintages are calculated by the change in RothC model carbon stocks.
Comments	The soil organic carbon stocks at time t=0 are calculated based on directly measured soil organic carbon content and bulk density at t=0 or (back-) modeled to t =0 from measurements collected within +/-5 years of t=0, or determined for t=0 via emerging technologies with known uncertainty, and must be used in both the baseline and with project scenario for the length of the project. Soil organic carbon stocks in the project scenario for sample unit i must be reported every 5 years or less.
Data / Parameter	SOC _{wp,i,t-1}

¹⁹⁴ "Sampling and Laboratory Techniques | FAO SOILS PORTAL | Food and Agriculture Organization of the United Nations." Fao.org, 2017. Accessed 6 Aug. 2024.

Data unit	t CO ₂ e/unit area
Description	Areal-average soil organic carbon stocks in the project scenario for sample unit <i>i</i> in year <i>t</i>
Source of data	Modeled and Measured in the project area
Description of measurement methods and procedures to be applied	See SOC _{wp,i,t} above.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
QA/QC procedures to be applied	See SOC _{wp,i,t} above.
Purpose of data	Calculation of project emissions
Calculation method	This has been calculated using RothC model and remote sensing which has been discussed in detail in the CarbonFocus Algorithm Theoretical Basis Document.
Comments	NA

Data / Parameter	$f_{CH4soil_{bsl,i,t}}$
Data unit	t CH ₄ /unit area
Description	Modeled methane emissions from the soil organic carbon pool in the baseline scenario for sample unit <i>i</i> at time <i>t</i>
Equations	Equation 4
Source of data	Modeled in the project area
Description of measurement methods and procedures to be applied	Modeled methane emissions in the baseline scenario are determined according to the equation: $f_{CH4soil_{bsl,i,t}} = f_{CH4soil}(Var\ A_{bsl,i,t}, Var\ A_{bsl,i,t}, \dots)$ where, $f_{CH4soil_{bsl,i,t}} = \text{Modeled methane emissions from the soil organic carbon pool in the baseline scenario for sample unit } i \text{ at time } t \text{ (t CH}_4\text{/unit area)}$

	$f_{CH4soil}$ = Model predicting methane emissions from the soil organic carbon pool $Var A_{bsl,i,t}$ = Value of model input variable A in the project scenario for sample unit i at time t (units unspecified) $Var B_{bsl,i,t}$ = Value of model input variable B in the project scenario for sample unit i at time t (units unspecified) See Box 1 of VM0042 v1.0 for sources of data and description of measurement methods and procedures to be applied to obtain values for model input variables.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
QA/QC procedures to be applied	Standard QA/QC procedures for soil inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs available from published handbooks, such as those published by FAO and available on the FAO Soils Portal, or from the IPCC GPG LULUCF 2003 is recommended.
Purpose of data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	The soil organic carbon stocks at time t=0 is directly measured at t=0 or (back-) modeled to t =0 from measurements collected within +/-5 years of t =0, or determined for t=0 via emerging technologies (e.g., remote sensing) with known uncertainty, and must be used in both the baseline and with- project scenario for the length of the project.

Data / Parameter	$f_{N2Osoil\ bsl,i,t}$
Data unit	t N2O/unit area
Description	Modeled nitrous oxide emissions from the soil organic carbon pool in the baseline scenario for sample unit i at time t
Equations	Equation 10
Source of data	Modeled in the project area

Description of measurement methods and procedures to be applied	Modeled nitrous oxide emissions in the baseline scenario are determined according to the equation: $fN2O_{soil_{bsl,i,t}} = fN2O_{soil} (Var A_{bsl,i,t}, Var A_{bsl,i,t}, ...)$ where, $fN2O_{soil_{bsl,i,t}}$ = Modeled nitrous oxide emissions from the soil organic carbon pool in the baseline scenario for sample unit i at time t (t N2O/unit area) $fN2O_{soil}$ = Model predicting nitrous oxide emissions from the soil organic carbon pool $Var A_{bsl,i,t}$ = Value of model input variable A in the project scenario for sample unit i at time t (units unspecified) $Var A_{bsl,i,t}$ = Value of model input variable B in the project scenario for sample unit i at time t (units unspecified) See Box 1 of VM0042 v1.0 for sources of data and description of measurement methods and procedures to be applied to obtain values for model input variables.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
QA/QC procedures to be applied	Standard QA/QC procedures for soil inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs available from published handbooks, such as those published by FAO and available on the FAO Soils Portal, or from the IPCC GPG LULUCF 2003 is recommended.
Purpose of data	Calculation of baseline emissions
Calculation method	Not Applicable
Comments	The soil organic carbon stocks at time t=0 is directly measured at t=0 or (back-) modeled to t=0 from measurements collected within +/-5 years of t=0, or determined for t=0 via emerging technologies (e.g., remote sensing) with known uncertainty, and must be used in both the baseline and with- project scenario for the length of the project.

Data / Parameter	$\bar{\Delta} \bullet, t$ and $\bar{\bullet} \bullet t$
Data unit	t CO ₂ e/unit area
Description	Average emission reductions from pool or source $\bullet$, or stock of pool $\bullet$, in year t
Source of data	calculated values in the project area
Description of measurement methods and procedures to be applied	NA
Frequency of monitoring/recording	Calculations and recording must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	
QA/QC procedures to be applied	Calculation method noted in Boomitra CarbonFocus Algorithm Theoretical Basis Document
Purpose of data	Calculation of emission reductions
Calculation method	Calculation method noted in Boomitra CarbonFocus Algorithm Theoretical Basis Document
Comments	NA

Data / Parameter	$FFC_{bsl,j,i,t}$
Data unit	Litres
Description	Consumption of fossil fuel type j (gasoline or diesel) for sample unit i in year t
Equations	Equation 4
Source of data	See box 1 of VM0042 v1.0
description of measurement methods and procedures applied	Fossil fuel consumption can be monitored, or the amount of fossil fuel combusted can be estimated using fuel efficiency (for example l/100 km, l/t-km, l/hour) of the vehicle type and the appropriate unit of use for the selected fuel efficiency (for example km driven if efficiency is given in l/100 km).

Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
QA/QC procedures to be applied	Guidance provided in IPCC, 2003 Chapter 5 or IPCC, 2000 Chapter 8 must be applied
Purpose of data	Calculation of project emissions
Calculation method	Fuel efficiency factors can be obtained from the 2019 Refinement to the IPCC 2006 Volume 2 Chapter 3
Comments:	For all equations, the subscript bsl must be substituted by wps to make clear that the relevant values are being quantified for the project scenario.

Data / Parameter	$P_{wp,l,i,t}$
Data unit	Head
Description	Population of grazing livestock in the project scenario of type l in sample unit i in year t
Source of data	Project participant survey once every 2 years
Description of measurement methods and procedures to be applied	Record numbers of grazing livestock by type.
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	Information will be monitored via direct consultation with, and substantiated with a written attestation from, the rancher or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices must be supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).

Purpose of data	Calculation of project emissions
Calculation method	NA
Comments	NA

Data / Parameter	Days _{wp,l,i,t}
Data unit	Days
Description	Average grazing days per head in the project scenario inside sample unit <i>i</i> for each livestock type <i>l</i> in year <i>t</i>
Source of data	Project participant survey
Description of measurement methods and procedures to be applied	Record livestock grazing days by type
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	Information will be monitored via direct consultation with, and substantiated with a written attestation from, the rancher or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices must be supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).
Purpose of data	Calculation of project emissions
Calculation method	NA
Comments	NA

Data / Parameter	LE _t
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Data unit	tCO2e
Description	Leakage in year t ;
Source of data	Project participant survey
Description of measurement methods and procedures to be applied	Leakage is equal to zero per the applicability conditions and Section 8.4 of this methodology
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	0
Monitoring equipment	NA
QA/QC procedures to be applied	NA
Purpose of data	Calculation of project emissions
Calculation method	NA
Comments	See leakage section of this PDD

Data / Parameter	ΔP
Data unit	Percent
Description	Change in productivity
Source of data	Project participant survey
Description of measurement methods and procedures to be applied	NA
Frequency of monitoring/recording	Every 10 years
Value applied	0
Monitoring equipment	NA

QA/QC procedures to be applied	NA
Purpose of data	Determination of livestock productivity for leakage analysis
Calculation method	NA
Comments	See leakage section of this PDD

Data / Parameter	P
Data unit	Numbers
Description	Determine the change in the population of the livestock to calculate average increase or decrease of the productivity.
Source of data	Project participant survey
Description of measurement methods and procedures to be applied	The productivity (Pwp) will be monitored annually, with the survey scheduled according to the start date of each project activity instance (ranch), depending on the number of livestock types in the area.
Frequency of monitoring/recording	Each year monitoring survey
Value applied	Ex post
Monitoring equipment	Monitoring survey
QA/QC procedures to be applied	Section 5.3 of PD
Purpose of data	Calculation of livestock productivity
Calculation method	Not applicable
Comments	No comment

Data / Parameter	Pwp,p
Data unit	Productivity (e.g., kg) per hectare
Description	Average productivity for product p during the project period

Source of data	Farm productivity (e.g., yield) records						
Description of measurement methods and procedures to be applied	Measured using locally available technologies (e.g., mobile weighing devices, commercial scales, storage volume measurements, fixed scales, weigh scale tickets, etc.)						
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years						
Value applied	Rancher name	2016	2017	2018	2019	2020	2021
	Kasanga	1500	1353	1350	1353	1495	1355
	Lisa ranch & Game Sanctuary	3070	3023	3020	3023	3090	3040
	Machakos	1124	1037	1037	1037	1229	1084
Monitoring equipment	Not applicable						
QA/QC procedures to be applied	Information will be monitored via direct consultation with, and substantiated with a written attestation from, the farmer or landowner of the sample unit. Any quantitative information (e.g., discrete or continuous numeric variables) on agricultural management practices must be supported by one or more forms of documented evidence pertaining to the selected sample unit and relevant monitoring period (e.g., management logs, receipts or invoices, farm equipment specifications).						
Purpose of data	Determination of project productivity for market leakage analysis						
Calculation method	Not applicable (measured)						
Comments	The values presented are for ex-ante calculation purposes and may be refined within the monitoring report prior to verification.						

Data / Parameter	Buffer _t
Data unit	tCO _{2e}
Description	Number of buffer credits to be contributed to the AFOLU pooled buffer account in year t

Source of data	The number of buffer credits to be contributed to the AFOLU pooled buffer account must be determined by applying the latest version of the <i>VCS AFOLU Non-Permanence Risk Tool</i>
Description of measurement methods and procedures to be applied	NA
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event if less than five years
Value applied	Ex-post
Monitoring equipment	
QA/QC procedures to be applied	The number of buffer credits to be contributed to the AFOLU pooled buffer account will be determined by applying the latest version of the <i>VCS AFOLU Non-Permanence Risk Tool</i> for every verification.
Purpose of data	Calculation of project emissions
Calculation method	The number of buffer credits to be contributed to the AFOLU pooled buffer account will be determined by applying the latest version of the <i>VCS AFOLU Non-Permanence Risk Tool</i>
Comments	NA

Data / Parameter	Sustainable development Goal 2: Zero Hunger
Data unit	%
Chosen parameter Description	Zero Hunger: 2.4: Sustainable Food Production and Resilient Agricultural Practices. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality. The Parameters used for monitoring are • Quality forage availability and quality.

	Livestock Health Assessment in terms of height, weight, health conditions, and disease prevalence.
Source of data	Monitoring surveys
Description of measurement methods and procedures to be applied	The project activity improves soil quality by increasing Soil Organic Carbon (SOC). Higher SOC content leads to better productivity and improved soil fertility, making agricultural production more climate resilient.
Frequency of monitoring/recording	Before every monitoring period
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	Monitoring staff will be trained to monitor this parameter
Purpose of data	To evaluate SDG impact
Calculation method	Increased pasture productivity: The following parameters are taken into consideration: There will be an improvement in good quality forage availability to the cattle and this quality forage will improve the overall health of the cattle. Ranchers have certain methods to assess the health of the cattle in terms of height, weight, health conditions, etc. Healthy cattle bring a better price for the rancher when sold. Overall, ranchers will have better returns on cattle selling. This will be accounted by doing a monitoring survey.
Comments	A qualitative analysis of this parameter will be done through surveys

Data / Parameter	Sustainable development Goal 6: Clean Water and sanitation
Data unit	NA
Chosen parameter Description	6.6: Protect and Restore Water-Related Ecosystems By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes The parameters used to monitor are as follows:

	Improvement in Water availability
Source of data	Monitoring surveys
Description of measurement methods and procedures to be applied	Increases in soil organic matter improve soil aggregates and structural stability, which help water infiltration into the soil by increasing soil aeration. This reduces excess runoff.
Frequency of monitoring/recording	Before every monitoring period
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	Monitoring staff will be trained to monitor this parameter
Purpose of data	To evaluate SDG impact
Calculation method	- Water Availability and Quality: Measurement of the quantity and accessibility of water resources in a specific area. - Baseline Comparison: A comparison of current water conditions to a predefined baseline or historical data to determine any improvements or changes over time.
Comments	A qualitative analysis of this parameter will be done through the surveys

Data / Parameter	Sustainable development Goal 8: Decent Work and economic growth
Data unit	Currency
Chosen Parameter Description	8.6 Promote Youth Employment, Education, and Training By 2020, substantially reduce the proportion of youth not in employment, education or training The parameter used to monitor are as follows: Personnel Count: The count of individuals employed for the execution and supervision of the activity

	Baseline Comparison: Comparing current employment conditions for youth to historical data or a predefined baseline.
Source of data	Employment records
Description of measurement methods and procedures to be applied	The project provides employment to local communities during the implementation and monitoring process
Frequency of monitoring/recording	Before every monitoring period
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	Employment records maintained by implementation partner
Purpose of data	To evaluate SDG impact
Calculation method	Number of people employed to implement and monitor the activity.
Comments	Total salaries paid to the employees will be reported

Data / Parameter	Sustainable Development Goal 13 Carbon Action
Data unit	CO _{2e} and US\$
Chosen parameter Description	13.2: Integrate climate change measures into national policies, strategies, and planning The parameter required to monitor are as follows: - Total greenhouse gas emissions per year. - Amount of carbon finance mobilized for to implement carbon project
Source of data	Verification report and audit report
Description of measurement methods	Please refer Section 4 of the PD for Carbon Removals and Audited Financial Statements for Mobilization of Carbon Revenues.

and procedures to be applied	
Frequency of monitoring/recording	At the time of each verification stage
Value applied	Ex post
Monitoring equipment	NA
QA/QC procedures to be applied	A professional with relevant background will conduct a survey in project area to study the impact on this SDG
Purpose of data	To evaluate the impact of SDG
Calculation method	Sample Study by trained expert in that domain
Comments	NA

Data / Parameter	Sustainable development Goal 15 Life on Land
Data unit	NA
Chosen parameter Description	15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world The parameter required to monitor are as follows: Change in Vegetation Cover
Source of data	Study by trained expert in that domain
Description of measurement methods and procedures to be applied	Through rotational grazing practices, vegetation is allowed to grow and stay on the ground for more time, thereby allowing for degraded grasslands to be gradually restored, and reversing desertification.
Frequency of monitoring/recording	Before every monitoring period
Value applied	Ex post
Monitoring equipment	NA

QA/QC procedures to be applied	A professional with relevant background will conduct a survey in project area to study the impact on this SDG
Purpose of data	To evaluate the impact of SDG
Calculation method	Sample Study by trained expert in that domain
Comments	• Land Use Change: Analyzing changes in land use patterns and their impact on land degradation and restoration efforts. • Sustainable Land Management Practices: Evaluating the implementation of Sustainable Grassland Management Practices, including rotational grazing, agroforestry in adjacent areas, and sustainable forage cropping, to promote soil health and ecosystem sustainability. • Baseline Comparison: Comparing current conditions with historical data or a predefined baseline to track changes in land degradation and restoration efforts. • Economic and Social Impacts: Evaluating the economic and social impacts of land degradation and restoration efforts on communities and livelihoods. • Land Tenure and Property Rights: Assessing the security of land tenure and property rights for communities and individuals, which can influence land management practices. • Biodiversity Conservation: Monitoring the conservation of biodiversity in degraded areas, including the protection of endangered species and habitats. • Land Degradation Rate: Measuring the rate of land degradation in affected areas, often quantified by factors like soil erosion, salinization, or loss of vegetation cover.

SDG 13: Climate Action is covered in the other parameters and hence is not required to be reported separately.

5.3 Monitoring Plan

The monitoring process involves measuring, recording, storing, aggregating, collating, and reporting data as per VCS methodology requirements. Adaptive management plan includes plan to mitigate the potential

risks to the project or any other risks associated with the project. The monitoring process, complying with VCS methodology, involves data measurement, recording, and reporting. Boomitra oversees project management and training while ground partners monitor pastoralists/rancher activities on ground, conduct surveys, and assist in audits. Rigorous QA/QC procedures ensure accurate and conservative GHG removal measurement. Capacity-building programs involve pastoralists/ranchers in data collection and planning. Advanced technology, including apps and cloud-based systems, aids information verification. Land and ranching activity (monitoring) parameters are collected and verified. Data is securely stored in encrypted cloud storage for at least two years post-project completion. A diverse monitoring team, including project managers, field workers, and IT professionals, ensures precise data collection and reporting. Boomitra has created a monitoring process as per the requirements. The detailed overall monitoring process is outlined below.

5.3.1 Organizational structure and responsibilities

As discussed in section 1.12.1 of this PDD, the overall project is managed by Boomitra with the help of implementation partners on the ground. Boomitra, as project proponent, will support the ground team in every aspect of the project implementation and monitoring. Boomitra will be responsible to do the following activities:

- Identify the monitoring parameters and device the monitoring plan.
- All activities related to Quantification Approach 1 of the methodology (including remote sensing measurement of soil carbon stocks)
- Provide trainings to ground staff on collection of monitoring data.
- Set up QA/QC procedures for internal audit.
- Device policies required for oversight and accountability of monitoring activities.
- Preparing monitoring reports and other relevant reports for issuance

Ground partners are responsible for below mentioned activities.

- Contact and visit ranchers regularly (at minimum twice a year) to monitor the activities undertaken by them.
- Record the monitoring parameter data collected as a part of regular visit in database.
- Conduct trainings, workshops, awareness creation activities to the ranchers.
- Conduct surveys as per sampling plan requirements (decided by Boomitra)
- Assist Boomitra and VVB to undertake third party audit

Overall monitoring has been split into two parts. Part one consists of the data capturing at ranch level and part two consists of data capturing from digital sources. Part one again divided into two parts which have permanent ranch level management activity monitoring through sample surveys and second part

sample surveys to evaluate SDG parameters. at ranch level, data required to RothC model such as input of plant residues and input of farmyard manure (FYM) along with rotational grazing pattern within the ranch. In addition to the locally monitored field data, available datasets are used to parameterize the Roth-C models, e.g. climate data and soil data.

5.3.2 Policies for oversight and accountability of monitoring activities

The MRV plan will be updated as and when latest scientific approaches are available to increase the overall effectiveness of existing practices systematically. The latest high quality satellite images are procured to calculate carbon removals and to assess any serious changes in LULC parameters.

5.3.3 Procedures for internal auditing and Quality Assurance/Quality Control

A quality assurance/quality control (QA/QC) plan will be implemented to ensure the net anthropogenic GHG removals by sinks are measured and monitored precisely, credibly, verifiably and transparently. QA/QC control includes steps to control the errors in project boundary, stratification, sampling, measurement, data entry, data analysis, and data maintenance and archiving. This plan covers procedures as described below for:

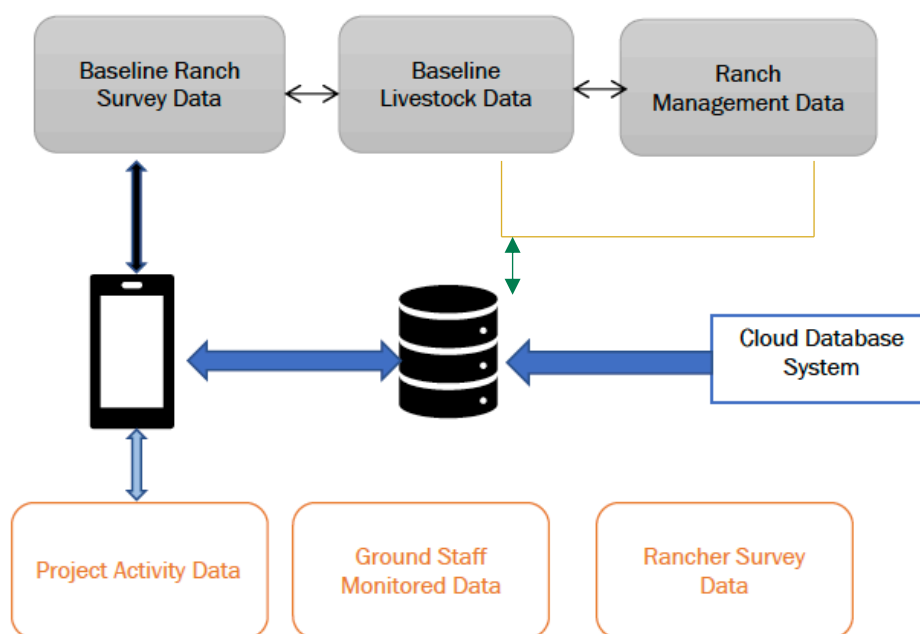
1. Collecting reliable field measurements and verifying methods used to collect field data;
2. Verifying data entry and analysis techniques;
3. Data maintenance and archiving;

Boomitra has a rigorous QA/QC system to ensure the long-term accuracy of the data that is collected, to ensure a robust data storage and to create a systematic data management structure. This will be reviewed biennially during internal audits to guarantee the quality of data collected as part of the monitoring process.

In particular, during the first month of project, the monitoring plan and financial plan has been developed and a format for data collection has been defined. Operational plans are developed and updated, the representatives(ground co-ordinators) from the partners working with ranchers collect data based on the given template and send them monthly to the Implementation Partner-Coordination/Project Managers of the partners. Information is passed by the ground co-ordinators to the data managers at the organizational level. They analyse the data based on the operational planning and share the information with Project Manager at Boomitra. Regarding financial planning, the Project Manager updates and approves monthly financial plans, and the monthly accounting process serves as a cross-reference to ensure proper expenditure tracking. The Project Manager is able to analyse the problems and discuss with the representatives(ground co-ordinators) and their responsible solutions to cope with the raised issues in line with donors procedure and within the project framework. In case of cases that need a revision of the project framework or financial plan, the Project Manager request for a meeting to present the problem and the suggested solutions, then submitting a formal request of variation or amendment as for donors procedures.

5.3.4 Land Unique ID

Each ranch will be clearly demarked using geospatial techniques and will be assigned a unique land ID for easy identification. All the activities undertaken are well-documented in a cloud database. Boomitra is in the process of developing both mobile app and web-based tools and applications for data aggregation. On the ground, wherever mobile phone/computer access is not available, ranchers will maintain a diary to record project activity data, and our ground staff will collect this data and upload it to the database. The proposed monitoring process is based on the latest technology, which can be scaled up at ease. App and cloud-based systems will provide relevant information on a project level, such as: ranch and ranch owner name, latitude and longitudinal boundaries of the grazing land, current livestock population, paddocks, dates related to project activities, etc. All these details can be easily exported to a spreadsheet for validation and verification.



According to methodology requirements, land specific parameters such as i ; l ; A_i ; $P_{wp,i,t}$ and $P_{bsl,i,t}$ are collected directly from the individual ranchers, along with a host of parameters describing their management practices, which are all attested as accurate by the individual private landowners for private ranches. An example of the data collection form that is completed and signed by the ranchers with the support of the ground implementation staff is provided separately. Literature searches are used and/or planned to be used extensively for other sets of parameters such as AR , EA_{an} , RP_{wp} , RP_{bsl} . Peer-reviewed scientific literature and/or official state government or federal government documents are used as a first priority. In the absence of literature, statements from local experts may be used as evidence.

The procedures for measurement and monitoring of $SOC_{bsl,i,t}$, $SOC_{bsl,i,t_previous}$, $SOC_{wp,i,t}$, and $SOC_{wp,i,t_previous}$ are noted in the CarbonFocus Algorithm Theoretical Basis Document (ATBD).

All of the aforementioned parameters in this section are measured for every ranch (for the rancher-specific info), or even on a sub-acre level within a ranch (for SOC, for example) in some cases. Beyond these, there are a few parameters that are planned to be sampled: $P_{wp,p}$; $P_{bsl,p}$. $P_{wp,p}$ only needs to be measure and used along with $P_{bsl,p}$ every 10 years for the productivity change analysis. A sufficient amount of random sampling (as per the prevailing sample procedures at that time) is taken to ensure that the average productivity measured in the project instance at the time of productivity evaluation has a 95% confidence interval whose half-width falls within 15%. Individual ranch values are determined by consultation with randomly sampled ranchers. These are then averaged with equal weighting to determine $P_{wp,p}$ or $P_{bsl,p}$.

Finally, the remaining parameters are computed using the equations provided in Section 4.

5.3.5 Anticipated frequency of monitoring and anticipated definition of “year”

The anticipated frequency of monitoring is every two years, and a year is defined from Jul 1 to Jun 30.

5.3.6 10-year baseline re-evaluation plan,

An interview will be held with a local expert on what is common practice outside of the carbon project, in order to evaluate whether the baseline scenario is still applicable. If it is determined otherwise, the baseline scenario will be changed to match the scenario outlined by the local expert.

Regional agricultural production data will be sourced from peer-reviewed scientific literature and/or official state government or federal government documents as a first priority. If these are unavailable, then a local expert’s statement will be used as evidence. As discussed in the Section 3.4 all the qualitative and quantitative factors will be measured through survey in consultation with the baseline sampled farmers and same will be reported as per the section 3.1.3 of VCS standard v4.5.

5.3.7 Monitoring Plan for Livestock Rate

The monitoring plan will focus on assessing the rate of decline in livestock productivity due to the adoption of regenerative practices. First, the productivity (P_{wp}) will be evaluated annually, following the procedures outlined in Section 8.4.3 of the methodology. Surveys will be scheduled based on the start date of each project activity instance (ranch) to ensure accurate data collection. The number of livestock will be recorded at each monitoring interval to track any changes in population. Additionally, the number of displaced livestock will be documented to understand the impact of grazing practices. Data on key productivity parameters, such as reproductive rates and sales rate, will be collected to assess overall health and performance. The monitoring team will conduct regular assessments to identify any potential declines in productivity. Findings will be analyzed to determine if adjustments to grazing practices are necessary. Reports will be generated to communicate results to stakeholders and guide future management decisions. Continuous feedback from herders will be integrated into the monitoring process to enhance effectiveness.

Any potential decline in productivity that may occur during the adoption or implementation of regenerative practices is accounted for using the procedure detailed in Section 8.4.3 of the methodology. The productivity (P_{wp}) will be monitored annually, with the survey scheduled according to the start date of

each project activity instance (ranch), depending on the number of livestock types in the area. Since the land belongs to individual owners, agricultural land market leakage is not considered. In the event of any potential decline in productivity, according to calculations using Equation 29, crop/livestock productivity declines by more than 5% due to a short-term change, step 1 of section 8.4.3 is repeated, excluding the first three years of project data, to adjust productivity. If the adjusted productivity is within 5% of the baseline, no further action is required as per the methodology. However, if a decline greater than 5% is still observed, further action is taken by completing step 3 of section 8.4.3.

5.3.8 Monitoring of Livestock rate and Productivity

The project will closely monitor the number of livestock and any displacement of animals due to grazing practices. Data will be collected on the total livestock population within the designated grazing paddocks. Hired herders will play a crucial role in ensuring that livestock remain within the designated grazing areas, minimizing displacement. Regular assessments will be conducted to track the health and productivity of the livestock, including metrics such as weight gain and reproductive success. The project will also monitor the grazing patterns to ensure that the land is utilized sustainably. Any instances of overgrazing or underutilization will be documented for further analysis. The impact of the project activities on livestock productivity will be evaluated to identify trends and necessary interventions. Feedback from herders will be essential in adjusting grazing practices to optimize livestock health. The collected data will be analyzed periodically to inform stakeholders and guide management strategies. Overall, this comprehensive monitoring approach will support the project's goal of enhancing livestock productivity while promoting sustainable grazing practices.

The project's productivity averages must be based on data collected over the previous 10 years. In other words, productivity averages cannot include data that is more than 10 years old. If productivity has improved, remained constant, or declined by less than 5% for any livestock product, no further action is needed. However, if a reduction in productivity of greater than 5% is observed in one or more livestock products, Steps 2 and 3 provided in Section 8.4.3 of the methodology must be completed. If the productivity decline is limited to a specific combination of factors, then that combination becomes ineligible for future crediting. As presented in the methodology, if a 10% decline in livestock weight gain is observed and it is determined that the decline is linked to inadequate grazing management practices, then those practices would no longer be eligible for future crediting. If the project proponent is unable to isolate the source(s) of decline through stratification, then the entire livestock product becomes ineligible for future crediting. The monitoring team will conduct regular assessments to ensure compliance with these guidelines. Data collection will be systematic and will focus on identifying trends and factors influencing productivity. This comprehensive approach will support the project's goal of maintaining sustainable livestock productivity while adhering to the established criteria.

5.3.9 Monitoring plan for excluded GHG emissions

The project has a clear and structured monitoring plan to ensure that the excluded GHG emission sources, as described in section 3.3, remain de minimis throughout the crediting period, in accordance

with VM0042 methodology. This plan involves continuous monitoring, verification through surveys, and cross-referencing data sources to confirm that these emissions do not exceed the threshold requiring inclusion in the project boundary.

Monitoring Emissions from Livestock (Refer 5.3.7 and 5.3.8):

Livestock-associated emissions, including enteric fermentation and manure deposition, have been excluded because there are no significant fluctuations in the livestock numbers during the course of the project. To ensure that livestock emissions remain de minimis, the project will: Conduct regular farmer surveys and attestations to track livestock numbers and productivity (refer section 5.1 for the parameters that will be monitored); Maintain baseline and project scenario livestock data, ensuring that any changes remain statistically insignificant; Include livestock monitoring results in the monitoring report to confirm that emissions from manure deposition remain negligible.

Monitoring Emissions from Fossil Fuel Combustion:

To verify this: Ranchers will be surveyed annually on fuel usage; Any changes in ranch mechanization rates will be documented to ensure that fuel-based emissions remain below de minimis thresholds; Rental machinery use records if any will be reviewed to ensure consistency between baseline and project conditions.

Monitoring Nitrogen-Fixing Species & Nitrogen Fertilizer Use:

During Baseline Survey, all respondents have mentioned that no crop production, compost, and synthetic N fertilizers are used or practiced in the ranches in the baseline scenario. Any area defined as cropland is considered non-eligible area and excluded from the eligible project areas. The project does not promote any kind of planting or crop production. To confirm that emissions remain negligible: The project will track these parameters through periodic field assessments and farmer surveys; and additionally, Nitrogen fertilizer usage data will be collected annually.

Monitoring Biomass Burning:

According to the baseline survey, all ranches are privately owned and well managed, with no observed biomass burning or reported incidents. The project actively promotes biomass retention and sustainable residue management to ensure that emissions from biomass burning remain de minimis. Satellite imagery and remote sensing data will be used to detect any biomass burning activities, while randomized field inspections by local implementation partners will verify whether any incidents occur during the project. Additionally, annual surveys will assess changes in ranchers' grassland management practices to ensure alignment with project objectives.

This robust monitoring plan is in place to track, verify, and document the status of excluded GHG emission sources, ensuring that they remain below the de minimis threshold throughout the crediting period. The Monitoring report will include findings from surveys, field assessments, satellite monitoring, and farmer attestations, allowing for early detection of any changes that could require corrective actions.

5.3.10 Quality assurance and quality control (QA/QC) procedures

Data collected from the ranchers with their own attestation will be screened for basic accuracy with simple checks – such as comparisons to the ranges reported by other ranchers. For example, if 500

cattle are stated to be maintained on 20,000 acres by one ranch and 5,000 cattle are stated to be maintained on 10,000 acres by an adjacent ranch, there would be concerns of data quality, which will then require the monitoring team to revisit the affected ranches to re-confirm accuracy of the collected data.

The equations utilized in this project for quantifications of net greenhouse gas reductions and removals are all converted to computer code and this computer code is tested with sample data repeatedly before real data is supplied for the quantifications required by the project. Once the quantifications for the real data are produced, a further series of sanity checks are used to determine accuracy. Some of these include checking whether the final credits quantified per acre fall near the typical ranges expected for grassland carbon reductions and removals.

In order to QA/QC the remote sensing technology utilized in this project for SOC stock and bulk density determinations, new validation datasets are collected prior to each verification of the project. These validation datasets consist of soil organic carbon weight percent (SOCwt%) and bulk density (BD) measured from physical soil samples. Then, the remote sensed numbers determined with the Boomitra technology are compared with these numbers to compute a root mean squared error to be the uncertainty of the Boomitra technology at the current verification event, for the SOCwt%, BD, and total SOC stock (tons CO₂e/acre).

In the case of the SOCwt%, soil samples are taken from demarked geocoded locations at a depth of 30cm with augers and then transported within 2-3 days to the collection facility of the testing lab used, for a dry combustion analysis of SOCwt%. In the case of BD, measurements are made near the field by the ground team, using the soil samples immediately after sampling.

Soil sampling locations are selected using a stratification based on the soil texture types found within the project areas. The reason for this type of stratum is that the purpose of the soil sampling is primarily for the QA/QC of the remote sensing technology. Based on the scientific framework presented in Section 3 of the remote sensing report provided to the VVB and Verra, some of the main parameters affecting the physical process (See Fig 2 in the report) are the parameters having to do with the soil texture. Hence, we must ensure during soil sampling that all the soil textures in the project are individually sampled to the necessary level. In practice, the project area polygons are masked in a GIS tool by a soil texture layer computed using state-of-the-art peer-reviewed ISRIC soil data maps¹⁹⁵ to develop a soil-texture based stratum:

¹⁹⁵ Soilgrids.org

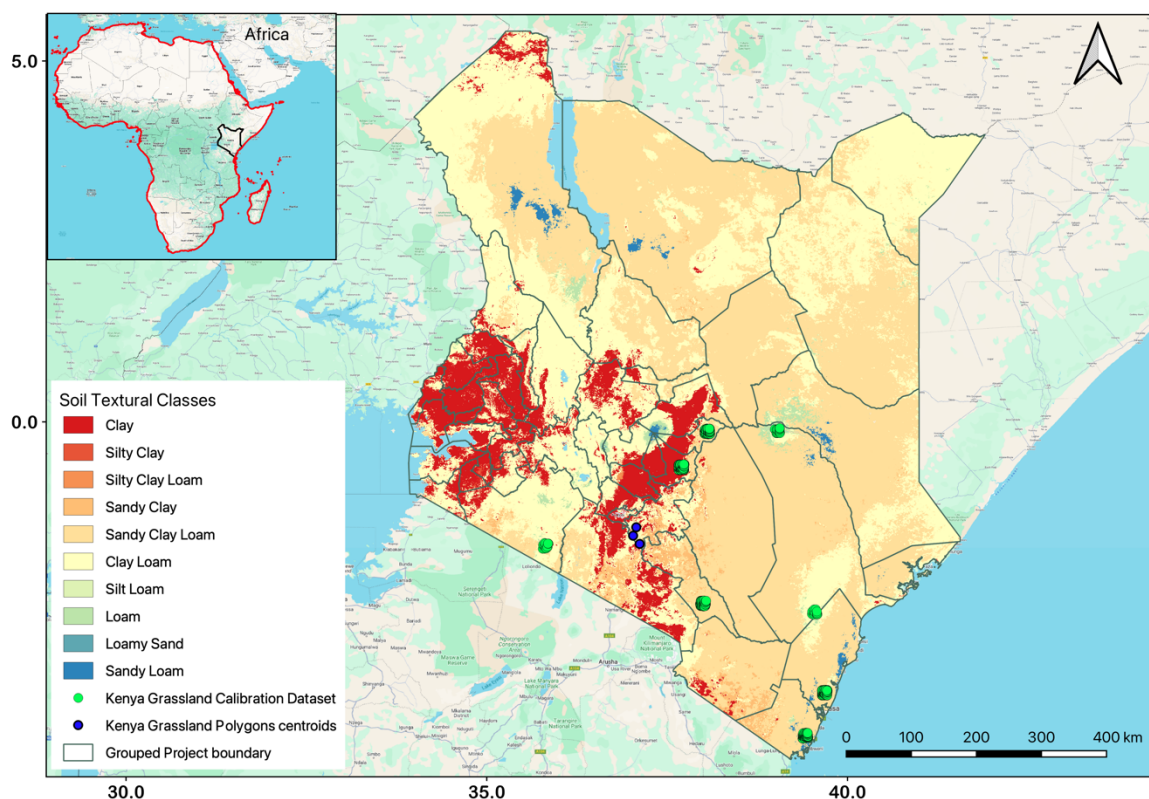


Figure 25. Soil textures in the project region

Within each such soil texture stratum found within the project, the required number of soil sample locations is selected randomly with GIS software. The specific number of soil samples within each strata is determined as per the equations of Section 4.2.5 of the remote sensing report – the number is selected to ensure that a statistically significant correlation can be measured between the remote sensing measurements and the conventional sampling. It is necessary to establish such a statistically significant correlation in order to ensure that the outputs of the Boomitra remote sensing technology will ensure an accurate and conservative calculation of ERRs.

An SOP for the specific soil sampling techniques carried out by the ground sampling team is provided as a supplementary document for review.

The soil testing lab must be selected based on its ability to make determinations of soil carbon levels in an accurate manner, as seen through third-party accreditations or otherwise through consistency of results and minimization of errors. Ideally, the same lab is used throughout the crediting period of the project. In this project, for the first monitoring period, we have used Crop Nutrition Laboratory Services Ltd (Cropnuts). Cropnuts is recognized as East Africa's leading agricultural testing laboratory, known for its commitment to high-quality services and innovative agronomy solutions. The laboratory is ISO/IEC

17025 accredited by the Kenya Accreditation Service (KENAS), ensuring compliance with international standards for testing and calibration laboratories¹⁹⁶.

Further information related to the QA/QC procedures related off to the pixel-level soil carbon measurement are outlined in detail in the CarbonFocus Algorithm Theoretical Basis Document (ATBD), in Section 4.2.5 and Section 5.1.3.

Finally, all of these procedures and processes are independently checked by separate teams within Boomitra and ground partners. For example, data collection by ground partners may be periodically (at least once in a year) checked by Boomitra teams traveling to the project area. Similarly, soil carbon quantifications produced by a single member of the Boomitra geospatial team are re-run and checked by another member for redundancy.

5.3.11 Data archiving procedures

All data is directly archived in an encrypted format using cloud storage services provided by Amazon Web Services (AWS), Google Cloud Platform (GCP) or Microsoft Azure. All of these cloud service providers guarantee 99.9%+ uptime and data availability. In most cases, when ranchers interact with Boomitra through our apps, data is automatically uploaded to the cloud seamlessly. In some instances where data is manually collected by ground staff, the data is later transferred to the cloud for storage. Furthermore, all ancillary processing required for monitoring that uses computer code, including QA/QC data, is conducted purely using the cloud services of the aforementioned companies and is subsequently also stored in the cloud. The RothC model validation datasets, models, and associated code will also be archived and stored using these cloud services, to allow for calculation of model prediction error in the future.

Rancher-specific information that is not an image is stored in an encrypted cloud database – currently AWS DynamoDB, a NoSQL database, is used. AWS offers excellent data portability and data transfer methods between internal and external resources, so even in the event of an update to data formats, AWS will have the support. All information that is in image format is stored as PNG, JPEG or TIFF files with AWS Simple Cloud Storage (AWS S3) in encrypted buckets or the Microsoft/Google cloud in encrypted folders. A change in image data formats is not anticipated over the course of this project. Further project-specific text documentation, such as this PDD and ancillary process description documentation is also stored in encrypted buckets or folders in the PDF format, to allow continued portability and support into the future without any anticipated updates to electronic file formats.

Each stored dataset will be identified by unique prefix within the cloud storage bucket (cloud equivalent of a hard drive) using words that clearly describe the date, content, and applicability to project and instance. All data will be kept for at least two years after the end of the last project crediting period, which could be up to 2038 if there is only one crediting period, or 2118 if all 4 extensions to the crediting period are used.

¹⁹⁶ [Cropnuts: Crop Nutrition Laboratory Services Ltd - Kenya and across Africa](#)

5.3.12 Monitoring Team

The monitoring team follows the project implementation structure shown in Section 1.12 Project Organizational Setup. The same parties involved in the implementation and project management are also involved in the monitoring. The ground implementation staff work with ranchers directly and collect any necessary inputs required from the ranchers through direct consultation with the ranchers, along with getting their attestation for their inputs. The regional managers ensure that the monitoring is occurring correctly in their regions of interest and the director/CEO/chairman/president of the ground partner organization ensures that monitoring is streamlined for the monitoring undertaken by that ground partner. Simultaneously the IT team of the ground partner or of Boomitra ensures that information can be collected efficiently from the ground through apps, spreadsheets and other means. Finally, the monitoring of soil carbon is conducted by Boomitra's geospatial data science team, utilizing other inputs from the ground and following the process outlined in the CarbonFocus Algorithm Theoretical Basis Document.

Title	Responsible entity	Roles and responsibilities
Project Manager	Implementation partner	1. Field monitoring 2. Leakage monitoring 3. Review data received from the field worker 4. Record control 5. QA/QC procedures 6. Report the status of the project activities regularly to Boomitra
Field Workers	Implementation partner	1. Monitoring the activities implemented by ranchers 2. Training ranchers 3. Data collection from ranchers 4. QA/QC procedures 5. Documentation management
IT professional	Implementation partner/ Boomitra	1. Store the data securely 2. QA/QC procedures 3. Documentation management 4. Generate the reports required for reporting
Accountant	Implementation partner/ Boomitra	Manage all the financial activities related the project
Regional Manager	Boomitra	Manage all the project activities related to project

Carbon Project Lead	Boomitra	Prepare reports related to MRV and conduct third party audit
Geospatial Data Scientist	Boomitra	Geospatial analysis of the rancher areas, estimate the carbon removal as per registered PDD

Boomitra's Carbon Project Development Lead, Boomitra's COO and Boomitra's CEO ensure that all processes occur smoothly throughout the entire monitoring process for the entire grouped project.

5.3.13 Project Activity Monitoring

Rotational grazing is the principal project activity promoted in this project along with livestock management, water management and multi-species grazing (wildlife and livestock) activities. As discussed in the section 1.12, rotational grazing includes moving livestock through a series of paddocks so that the initial paddock has recovered enough to allow the rotation to resume when they have finished grazing the last pasture in the series. Hence, paddock demarcation is one of the main activities to be monitored. At present, all the information on paddock demarcation for rotational grazing has been recorded manually in the notebook at the ranch level with the help of the Intervention Coordinator and Origination Partner. It has been planned, with the help of Carbon Finance, to digitize all data collection related to rotational grazing.

Many ranchers do not have a permanent fencing system. Wired fences are made temporarily, and these fences are kept moving throughout the year. Since there is no permanent fencing system, it is not easy to geotag the paddocks permanently. However, it has been decided to monitor the rotational grazing pattern by geotagging the paddocks whenever grazing is happening, through a mobile application. This enables the establishment of a correlation between rotation grazing and the time of year where the grazing has been done.

In order to monitor project activities and leakage from it, local representative from the Intervention Coordinators will visit at least twice in year to record the livestock count and paddocking systems adopted. In addition, a logbook will be maintained at the rancher's place to record the livestock count regularly and the same will be updated in the digital rancher dashboard. If there is any substantial decrease in the livestock counts, the reason for the decrease will be recorded and verified by one of the representatives of the Intervention Coordinator and Origination Partner.

Ranchers systematically monitor other critical parameters such as soil moisture, vegetation health in paddocks, water levels in streams and ponds, and livestock. This multifaceted approach encompasses routine visual inspections, and the analysis of satellite imagery. By extending the monitoring scope to include grasslands, paddocks, and water management, ranchers gain a holistic understanding of ecosystem dynamics and resource utilization. This comprehensive strategy enables proactive identification of leakage issues (ex: cattle grazing beyond the specified paddocks) and water scarcity challenges, fostering the preservation and resilience of diverse grassland ecosystems. Moreover, integrating water management practices within the monitoring framework empowers

ranchers/pastoralists to optimize irrigation efficiency, mitigate runoff, and conserve precious water resources, thereby ensuring the long-term viability and sustainability of their ranching enterprises. Implement a systematic schedule for regular monitoring to track changes in the wildlife species populations and habitats over time. This includes bi-annual field surveys, continuous camera trap monitoring, and periodic aerial surveys. Data collected will include species counts, habitat condition assessments, and behavioral observations. This data collection will be facilitated with the help of the Intervention Coordinators and Origination Partners. Analyze the collected data to identify trends, potential threats, and the effectiveness of mitigation measures. Use statistical methods and geographic information systems (GIS) to assess changes in species populations and habitat conditions. Regular reports will be prepared and shared with stakeholders, including local communities, conservation organizations, and government authorities, to ensure transparency and informed decision-making. Establish an adaptive management framework to respond to the findings from the monitoring activities. If negative impacts or unexpected changes are detected, adjust project activities and mitigation measures accordingly. This might involve altering construction schedules, enhancing habitat protection measures, or implementing additional conservation actions. Continuous feedback loops will ensure that monitoring results directly inform project management and conservation strategies.

5.3.14 Sample Design

As discussed above, measurements are done for each project participant rancher separately, which implies 100% of participating ranch area is used for emission reduction calculation. No sampling approach will be used in ER estimation. Hence, there is no requirement for this project to adopt any sampling techniques for project areas.

Boomitra does not foresee any nonconformance on the monitoring plan with regard SOC measurement since 100% of the project area is covered in the monitoring plan.

5.3.15 Modeling Plan

The RothC model is chosen for this project. RothC has been shown to be applicable in grasslands around the world, for various management conditions including continuous grazing^{197,198} and rotational grazing^{199,200}. Several peer-reviewed field trial datasets exist for the proper validation of the model within

¹⁹⁷ Smith, S. W., Vandenberghe, C., Hastings, A., Johnson, D., Pakeman, R. J., Wal, R. van der, & Woodin, S. J. (2013, December 6). Optimizing carbon storage within a spatially heterogeneous upland grassland through sheep grazing management - ecosystems. SpringerLink. Smith, S. W., Vandenberghe, C., Hastings, A., Johnson, D., Pakeman, R. J., van, & Woodin, S. J. (2013). Optimizing Carbon Storage Within a Spatially Heterogeneous Upland Grassland Through Sheep Grazing Management. *Ecosystems*, 17(3), 418–429.

¹⁹⁸ Jebari, A., Álvaro-Fuentes, J., Pardo, G., Almagro, M., & Prado, A. del. (n.d.). Estimating soil organic carbon changes in managed temperate moist grasslands with Rothc. PLOS ONE. URL: <https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0256219>

¹⁹⁹ Author links open overlay panelDe Li Liu a c, a, c, b, AbstractRecently, Bolinder, M. A., Chan, K. Y., Farage, P. K., Janssen, P. H. M., Jeffrey, S. J., Kemmitt, S. J., Lal, R., Lima, A. M. N., Liu, D. L., Moore, A. D., Paul, K. I., Smith, P., Bertora, C., Brumme, R., ... Coleman, K. (2011, August 4). Simulation of soil organic carbon dynamics under different pasture managements using the ROTHC carbon model. *Geoderma*. <https://www.sciencedirect.com/science/article/pii/S0016706111001947>

²⁰⁰ Poeplau, C. (2016, August 24). Estimating root: Shoot ratio and soil carbon inputs in temperate grasslands with the ROTHC model - plant and Soil. SpringerLink. <https://link.springer.com/article/10.1007/s11104-016-3017-8>

the climate zones and soil textures found in this project^{201,202}. The baseline conditions include continuous grazing in native grasslands, and these are well represented in the potential model validation datasets available. Furthermore, the number of livestock present on each ranch at the start date of activities on that ranch is collected and attested by each participating rancher, which is the necessary information required from the rancher to successfully initiate the model. A practice or combination of practices on participating ranches are recorded in consultation with the ranchers and used to specify the baseline schedule of activities used to initialize the RothC model. The consultations with ranchers to establish the baseline schedule of grassland management activities are conducted in accordance with the VM0042 Methodology, specifically following Box 1, Option 3. This approach involves determining the baseline schedule through direct consultation with the ranchers and substantiating the information with a signed attestation from the landowner of the sample field for the relevant period. During these consultations, both quantitative and qualitative data were collected to provide a comprehensive understanding of past grazing practices. The process included in-depth discussions with the ranchers to gather detailed information, which was subsequently verified and formalized through the landowner's attestation. This is further elaborated in Section 3.4. Livestock numbers are also monitored on a yearly period from the ranchers. The other required input variables are either acquired from the literature or publicly available datasets, as noted in their respective parameter tables. The improved-practice (with project) scenario used with RothC is based on ranch reported grazing practices and updated each measurement period.

The remote sensed soil carbon stock is used only as an input to the RothC model. The remote sensed soil carbon stocks are used by the RothC model to produce an output of soil carbon stock for the start of every monitoring period (or the start date of the project activity in the sample unit, whichever is later), and an output at the end of every monitoring period, along with an output for each of the intervening year. These outputs are then used the modeled SOC stock values in the subsequent equations of the methodology. In the special case of the project scenario, repeat remote sensed measurements of soil carbon stocks will be available at a frequency of 5 years or more frequently, and will be used to recalibrate and true-up the RothC whenever they are available.

Further information on the modeling plan is also available in the draft Model Validation Report provided to the VVB and Verra for review at the time of validation, and the full Model Validation Report that will be reviewed at the time of verification.

Beyond the Model Validation Report and meeting the requirements of VMD0053, since this project uses remote sensing of soil carbon and bulk density as one of the inputs to the RothC, the propagation of remote sensing error through RothC shown in Section 4.4 ('Combined Error') must be carried out in every verification. Accordingly, then, the appropriate uncertainty propagation equations noted in that sections must be used for uncertainty calculations and final GHG ERR calculations.

²⁰¹ Byrnes, R. C., Eastburn, D. J., Tate, K. W., & Roche, L. M. (2018). A Global Meta-Analysis of Grazing Impacts on Soil Health Indicators. *Journal of Environmental Quality*, 47(4), 758–765.

²⁰² Abdalla, M., Hastings, A., Chadwick, D. R., Jones, D. L., Evans, C. D., Jones, M. B., Rees, R. M., & Smith, P. (2018). Critical review of the impacts of grazing intensity on soil organic carbon storage and other soil quality indicators in extensively managed grasslands. *Agriculture, Ecosystems & Environment*, 253, 62–81.

5.3.16 Verification Frequency

In the project scenario, the change in SOC is measured using remote sensing as discussed in ATBD document. As we know, to observe considerable changes in SOC takes time. Hence, PP has decided to take the verification for every 3-year period (this also meets methodology requirement to verify once in every 5 years).

5.3.17 Adaptive Management Plan

The Adaptive Long-Term Management Plan offers ranchers a proactive approach to managing grazing lands while addressing key challenges like fire hazards, pests, extreme weather, and land-use changes. This plan is designed to help ranchers maintain healthy pasturelands, ensuring long-term productivity and the well-being of their livestock.

An adaptive management plan for this project in Kenya will incorporate strategies to address and mitigate internal, external, and natural risks. Given the ecological, economic, and climatic challenges in the region, a flexible and evidence-based approach is essential to ensure the long-term sustainability of the grasslands while supporting local livelihoods.

1. **Internal Risks:** To mitigate internal risks, it is crucial to enhance capacity building among project stakeholders, including ranchers, local communities, and conservation groups. This can be achieved through regular training sessions on sustainable and improved grazing techniques, soil conservation, and ecosystem monitoring. Furthermore, the project has established clear governance structures with defined roles and responsibilities to improve decision-making and accountability. Financial viability has been strengthened by ensuring adequate resource allocation and maintaining transparent financial records. Additionally, participatory decision-making should be promoted, where local stakeholders are actively involved in planning and implementation. This helps to build trust, minimize conflicts, and ensure that the management approach aligns with the needs of the people directly dependent on the grasslands.

2. **External Risks:** External risks, such as land tenure and resource access/impacts, community engagement, political risk, changes in government policies, can significantly impact the viability of the project. Addressing land tenure security through legal frameworks and advocacy will help protect local communities and ensure long-term project success. Conducting regular consultations and interactions with ranchers will help to understand the concerns and solve the issues. Sustainable resource access should be managed through collaborative agreements that balance conservation goals with community needs. Political risks, including shifts in leadership or policy priorities, necessitate ongoing engagement with policymakers and government agencies to advocate for policies that support sustainable land management and conservation incentives. Strengthening community engagement strategies, such as participatory governance models and benefit-sharing mechanisms, can improve local support and reduce conflicts over resource use. Additionally, forming strategic partnerships with stakeholders can help buffer against external shocks by ensuring continued investment, knowledge sharing, and policy alignment.

3. **Natural Risks:** The grasslands are highly vulnerable to climatic variability, including droughts, floods, and wildfires. To mitigate these risks, the project should promote rotational grazing systems, which

improve soil health, maintain vegetation cover, and reduce overgrazing. Establishing contingency plans, such as firebreaks, and water conservation strategies, will further reduce the impact of natural disasters.. A comprehensive Adaptive Management Plan has been developed as a standalone document and will be submitted for review during the Verification Audit. A summary of this plan is provided in Appendix 4 of this current PD.

By continuously monitoring ecological and socio-economic indicators and adjusting strategies based on new data and stakeholder feedback, the project can remain adaptable and resilient. Boomitra has also developed a comprehensive grievance redressal platform to support all stakeholders, ensuring transparency and responsiveness. This platform allows stakeholders to raise concerns through a dedicated email ID, access emergency support via phone calls, and seek assistance from consulting partners for resolution. By addressing grievances efficiently, Boomitra fosters trust and collaboration among stakeholders. This initiative also serves as a form of an adaptive management plan, enabling continuous improvement by incorporating feedback and resolving challenges in a timely manner. This adaptive management approach ensures that the grasslands of Kenya remain productive, ecologically intact, and beneficial for local communities in the long term.

APPENDIX 01: COMMERCIALLY SENSITIVE INFORMATION

Use the table below to describe the commercially sensitive information included in the project description to be excluded in the public version.

Section	Information	Justification
Not applicable	Not applicable	All information contained in this grouped description document is not confidential and is available for stakeholders. However, information about commercials involved in project development, implementation and some of the procedures (financial audit reports, businesses forecasting model, etc.) may include commercially sensitive information because of the company’s business activity.

APPENDIX 02: LOCAL STAKEHOLDER CONSULTATION MEETING

Initial studies regarding the importance of implementing rotational grazing in the project area, as conventional grazing practices had degraded the grasslands, were conducted by the origination partner with the help of intervention coordinator in the region. For instance, the intervention coordinator, AKWCA, developed many training manuals on good practices for sustainable grassland ranching and conservation of biodiversity in pastoral systems in 2018 & 2019 to train the ranchers/pastoralists. This work helped the partner to frame grazing and conservation practices along with the inputs of the local ranchers and communities in the region. The practices suggested by the intervention coordinators and origination partner happen to coincide with each other. Hence, the outcomes of this project emphasized the practice of rotational grazing in the region which has been implemented by the 1st instance ranchers from the start date of the project.

Our origination partner along with intervention coordinator have been conducting capacity-building and training programs on sustainable ranching practices for the ranchers, for many years. Several ranchers in the region have attended the training workshops such as “ATHI-KAPITI WILDLIFE CONSERVANCIES ASSOCIATION (AKWCA) CAPACITY BUILDING FOR RANCHERS 2018”, “ATHI-KAPITI Wildlife Conservancies Association (AKWCA) Training Report: Capacity Building for Ranchers, November 2018” etc. Interested and motivated ranchers who are part of our project have been implementing the practice of rotational grazing, one of the project's promoted activities, since 2019. After consulting with Intervention Coordinator and Origination Partner who are the secondary stakeholders, about the improved grassland management activities, Boomitra developed a scientifically rigorous implementation plan for the project. Rotational grazing is a core component of this plan. This was then presented to the ranchers for any additional input and feedback and to check if the practices deviated from their practices implemented after the start date. All input from the ranchers was received and duly acknowledged. All of them agreed upon the list of project activities as it resonated with the improved practices, they were willing to implement. Hence, we did not receive any deviation inputs from the project ranchers regarding the project design and project promoted activities, it did not necessitate any changes to the project design or activities.

FPIC Process

FPIC process was conducted which intended to ensure that the ranchers and the communities involved have the right to make informed decisions about projects affecting their lands and resources without coercion. Our Origination partner and Intervention coordinators have conducted many capacity building session and training at preliminary levels for ranchers at different sub-county level as described above and conducted assessments where ranchers have attended with their willingness. In these trainings, ranchers were educated about the improved grazing practices, the impact associated with implementation of these activities, etc. In June 2023, after many consultations with our origination

partner where we agreed upon the project design and implementation, an agreement was signed with our Origination Partner. In continuation to this in July 2023 a stakeholder consultation was conducted to bring together all the stakeholder impacted from the project on a single forum to discuss and implement the carbon project. Although the actual implementation of the project activities of the rancher was initiation from the project start date i.e., 10th January 2019, who have informally provided consent from the time they started implementing the improved grazing practices, but the formal consent was standardized and provided to signed in the form of Carbon Agreement after partnering with Boomitra in June 2023. All participating ranchers have consented to the proposed activities and have been implementing them since the project start date. The consultation process with the ranchers is continuous and ongoing throughout the project's lifetime, and their interests are considered in project decision-making and management. As outlined in section 2.1.2, the plan for sustained communication and consultation between Boomitra and the rancher regarding the project includes: regularly reviewing the communication and consultation plan to ensure effectiveness and address the needs of all stakeholders, implementing a feedback mechanism, and developing a communication plan that utilizes various channels such as regular physical and virtual meetings, phone calls, and emails. Project's activities were conducted in a manner that respects the rights and voices of the landowners and stakeholders throughout its duration.

Initially, when all the stakeholders of the project were consulted in person to discuss the project details, information was also collected regarding their preferred communication channels. As the Zoom platform was accessible to all the consulted stakeholders, the initial large meeting was conducted via Zoom. A total of 500+ stakeholders were invited to the meeting, with 160+ in attendance. These stakeholders included project-participating ranchers, employees from the implementation partner organization, research scholars, government officials from the Ministry of Environment and Sustainable Development, and the Boomitra team. (The invitee list is shared with VVB.) The below paragraphs summaries the meeting proceedings.

As discussed in section 2.1 of the PDD, a virtual stakeholder meeting was conducted on 13th July 2023 on Zoom platform, for pastoralists/ranchers, prospective partners and other stakeholders in the Kenya region of the project. A virtual platform was selected to facilitate maximum participation of the stakeholders for the consultation. The pastoralists/ranchers not accessible with the virtual platform were gathered at a specific location and with the help of intervention coordinator were able to attend the meeting. It was organized to create awareness about the grassland project in Kenya and its potential environmental benefits while seeking input from relevant stakeholders. The date and time of the meeting was conveyed to the stakeholders through invitation letters, emails, and other appropriate means. Pastoralists/ranchers and other local stakeholders were invited over verbal and phone communication as this was the most effective means to ensure participation of the stakeholders, specifically the targeted beneficiaries of the project.

The agenda of the meeting was as follows:

1. Opening remarks by Boomitra COO, Subramaniam Satyamoorthy

2. EarthAcre Introduction and Overview of Ecosystem Regeneration Practices by EarthAcre CEO, Viraj Sikand
3. The Wildlife Foundation: An Intervention Coordinator Case Study
4. Explanation of the initiative and the project
5. Explanation of third-party certification process
6. Explanation of carbon credits and grievance mechanism
7. Question-and-answer session
8. Feedback collection from the participants

The below paragraphs summaries the meeting proceedings.

All the meeting participants were cordially welcomed to the stakeholder consultation session. The meeting commenced by welcoming all the stakeholders, followed by the welcome speech by Mr. Viraj Sikand who acted as the moderator of the event. The opening remarks were delivered by Boomitra COO, Subramaniam Satyamoorthy who addressed the gathering in both English and the local language (Swahili). He emphasized on the importance of soil, the foundation on which all life forms on Earth thrive. He explained about the objective of the project and how pastoralists will be benefit from this project. He stressed the significance of enhancing soil organic carbon and how this project actively promotes the sustainable development of rancher communities. During the session, our implementation partner, EarthAcre, delivered a PowerPoint presentation (PPT) to the participants, outlining the project's activities, which include rotational grazing and water conservation measures. The presentation also provided information about Boomitra's involvement and their roles in the project.

Nickson Parmisa, Director of the Wildlife Foundation (TWF) shared his views on the objective to create a conducive relationship between pastoralist communities and parks through conservation. He mentioned about the results after implementation of the project, for example after TWF intervention they saw increase in lion population started to increase. TWF aims to reconnect all the pastoralist and open ecosystems and sustain indigenous culture and pastoralism.

A detailed explanation was provided on the overall process (PD development, third party audit, documents required, etc.) and the mechanism for on-going communication with local stakeholders. The grievance mechanism established for this project was also explained as part of the on-going communication process.

A digital feedback form was shared with all participants to seek their feedback on this project. There was a question-and-answer session at the end of the virtual meeting and a few of the participants requested clarification on various aspects of the program:

Questions and Answer Summary:

SI No.	Questions from participant	Conclusion
1	How large the land owner groups be to be able to do the carbon project?	The key to this carbon project is implementing those regenerative practices. In our project, we

	Is the size based on geographical size or number of landowners?	are working with conservancies that range from 5 to 10,000 acres and beyond.
2	What are the company measuring for carbon?	We are measuring mainly 30 cms below the ground carbon present in the soil using remote sensing.
3	Will my land be sold or affect in any way by the project?	No, this project is not to do with selling of any land. As covered in the presentation, this project is service-based and its main agenda is to implement regenerative practices and provide benefits to the land owners through carbon sequestration.
4	Does Boomitra and EarthAcre require individual land consent from the land owners?	Yes, individual land owner consent is required. A consent in the form of agreement between the implementation partner and pastoralist will be required to move forward with the project.
5	Who will meet the costs for validation and verification process?	One of the re-distinguishing factor of this project is that Boomitra and implementation partner, EarthAcre absorbs their own costs respectively. Hence, the pastoralists will not be entitled to pay anything for onboarding, validation and verification process, third party audit, issuance of credit process, etc.
6	What steps does Boomitra have in place for due diligence?	Boomitra's tech is pre-validated and has higher accuracy than mandated by the standards body. Our tech has helped us scale projects across 5M+ acres.
7	Are there any monetary benefits?	There are monetary benefits involved, since we are aiming to diversify your revenue stream. In the process, we also support pastoralists by reinforcing pastoralist cultures that are regenerative.

A majority of the queries raised by the attendees related to project's impact, the implementation of project activities at the field level, technology, partners' role and so on. The queries were addressed by the Boomitra team during the course of the meeting. Boomitra has considering all feedback received during stakeholder consultations and through ongoing communications. The platform was also open for all the stakeholders to discuss and provide inputs that necessitates changes to the project design. Further, there were no inputs received during this stakeholder consultation regarding amendments or updates to the project design. Hence, there were no updated to the project design. During ongoing consultations, any comments received will be duly addressed as per the grievance mechanism and if required amendments will be updated to the project design as per the prevailing VCS standard requirements.

At the end of the meeting, a feedback form was shared with all participants to seek their feedback on the project. Around 160+ participants attended the meeting and provided their valuable comments and feedback. The invitation about the consultation meeting was communicated to all the profiles of stakeholders (primary, secondary and tertiary) as described in section 2.1 (please refer the email screenshots for more details). The participant profile who attended the meeting is represented in the table below and a detailed attendance sheet of all the participants is being shared with VVB for more information. The consultation was conducted in culturally appropriate manner where the consultation was mediated in English and Swahili, there was no gender discrimination and having equal representation.

Participant Profile		Number of Participants
Primary Stakeholder	Pastoralists/Ranchers (This includes community members and conservancies)	68
Secondary Stakeholder	Local authorities	13
	DNA of the country	6
	NGOs	12
	Research Institute Representatives	12
	Local Experts	18
Tertiary Stakeholder	Policymakers	8
	Government institutions	13
	Media	8

Table 20: Participants of the LSC meeting

Feedback received from the attendees:

We received 100% positive feedback towards the project, who expressed their enthusiasm for witnessing the collaborative efforts of all stakeholders in promoting climate mitigation and adaptation for our local communities. The concept of a collective approach to ecosystem restoration, enhancing soil health, and generating income opportunities through carbon credits resonated with stakeholders as it not only addresses climate change but also empowers local communities and aligns with sustainable development goals (SDGs). The consultation was highly regarded for being interactive, educational, and inclusive. Participants expressed a desire for the project to continue in the long term to ensure it fulfills its intended goals and objectives.

Email Invitation Screenshots:

Invitation To the Kenya Local Stakeholder Consultation Meeting for the project: Grassland Restoration in East Africa Through Soil Enrichment External



Viraj Sikand <vsikand@earthacre.com>

Jul 5, 2023, 4:26 AM

Dear Sir/ Madam,

I am delighted to invite you to the stakeholder consultation meeting for our carbon initiative - **Grassland Restoration in East Africa Through Soil Enrichment**. The meeting will focus on our grasslands project in Kenya, and we would be honoured to have your presence at this event.

As a significant and valuable stakeholder, we believe that your participation in this meeting will be instrumental in shaping the future of our initiative. We are working to accelerate carbon removal on a planetary scale through our international soil carbon marketplace. Our goal is to enable farmers and landowners to regenerate landscapes and increase soil organic carbon while providing a new source of income for the farmers and landowners.

In Kenya, we are working with EarthAcre, landowners and a range of Intervention Coordinators across thousands of hectares. Our aim is to incentivize and reward the adoption of improved grassland management practices, including rotational grazing, livestock management, conservation of grassland biodiversity and water management, to name a few. We then measure the increase in soil carbon achieved by the landowner and convert this into 3rd-party certified carbon credits, which will help increase landowner income.

The agenda items, will be taken up as per below:

- Opening remarks by Mr. Aadith Moorthy (CEO, Boomitra)
- Project details presentation by Mr Viraj Sikand (CEO, EarthAcre), Mrs Elizabeth Gitari (Legal Counsel, EarthAcre), and Mr Nickson Parmisa (Director, The Wildlife Foundation)
- 3rd party Certification Process (Validation and Verification Body – Auditor)
- Carbon credits and complaint mechanism
- Q&A and Discussion

We look forward to your active participation. Feel free to email us with any questions, comments or feedback on the initiative and meeting, at info@boomitra.com

Thank you for your time.

We look forward to your active participation. Feel free to email us with any questions, comments or feedback on the initiative and meeting, at info@boomitra.com

Thank you for your time.

Sincerely,
Aadith Moorthy
CEO

Meeting Details

Date: 13th July 2023
Time: 3pm- 5pm
Zoom Meeting Link: <http://tiny.cc/x4nuz>

See attachments:

1. Non-Technical Summary of the project
2. Feedback form: <https://forms.office.com/r/X1WDuWs20t>

Viraj Sikand
CEO, EarthAcre

Website: <https://www.earthacre.com>

LinkedIn: <https://www.linkedin.com/company/earthacre>

One attachment • Scanned by Gmail



Invitation sent to DNA of Kenya:

Invitation To the Kenya Local Stakeholder Consultation Meeting for the project: Grassland Restoration in East Africa Through Soil Enrichment

2 v q v

You forwarded this message on Mon 7/3/2023 10:35 AM

AM

Ann Maina

To: annomambia@nema.go.ke; anomambia@nema.go.ke; anomambia2002@yahoo.co.uk
Bcc: Viraj Sikand <sikandviraj90@gmail.com>; Chethan T.R.

Mon 7/3/2023 10:08 AM

Stakeholder Meeting Invitation ...
52 KB

Grasslands LSC Non-Technical ...
93 KB

2 attachments (145 KB) Save all to OneDrive - Boomitra Inc. Download all

Dear Madam **Omambia**,

I am delighted to invite you to the stakeholder consultation meeting for our carbon initiative - **Grassland Restoration in East Africa Through Soil Enrichment**. The meeting will focus on our grasslands project in Kenya, and we would be honored to have your presence at this event.

As a significant and valuable stakeholder, we believe that your participation in this meeting will be instrumental in shaping the future of our initiative. We are working to accelerate carbon removal on a planetary scale through our international soil carbon marketplace. Our goal is to enable farmers and landowners to regenerate landscapes and increase soil organic carbon while providing a new source of income for the farmers and landowners.

In Kenya, we are working with EarthAcre, landowners, and a range of Intervention Coordinators across thousands of hectares. Our aim is to incentivize and reward the adoption of improved grassland management practices, including rotational grazing, livestock management, conservation of grassland biodiversity and water management, to name a few. We then measure the increase in soil carbon achieved by the landowner and convert this into 3rd-party certified carbon credits, which will help increase landowner income.

The agenda items will be taken up as per below:

- Opening remarks by Mr. Aadith Moorthy, CEO Boomitra
- Project details presentation by Mr Viraj Sikand, Mrs Elizabeth Gitari, and Mr Nickson Parmisa
- 3rd party Certification Process (Validation and Verification Body – Auditor)
- Carbon credits and complaint mechanism
- Q&A and Discussion

We look forward to your active participation. Feel free to email us with any questions, comments or feedback on the initiative and meeting, at info@boomitra.com

Thank you for your time.

Sincerely,
Aadith Moorthy
CEO

[Meeting Details](#)

Date: 13th July 2023
Time: 3pm- 5pm

2

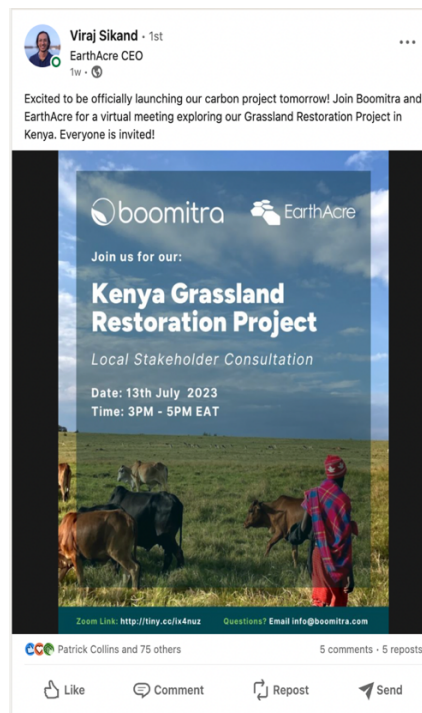
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 Stakeholder Meeting Invitation ... 52 KB

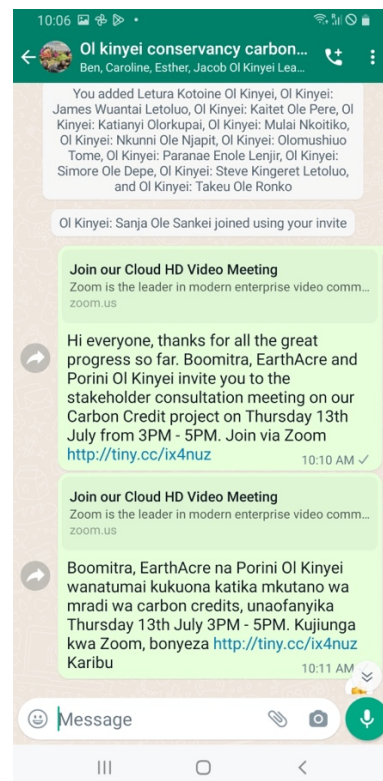
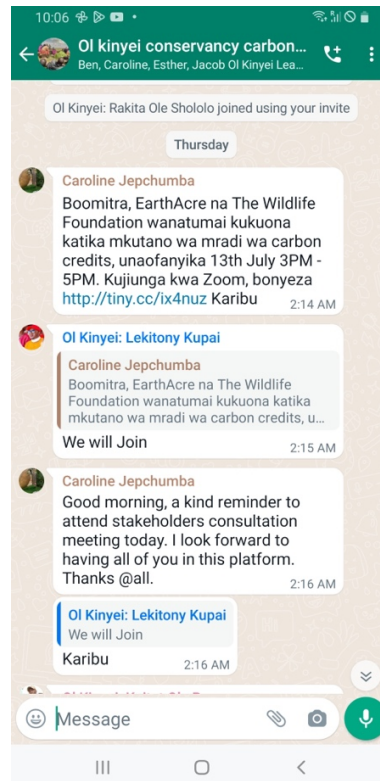
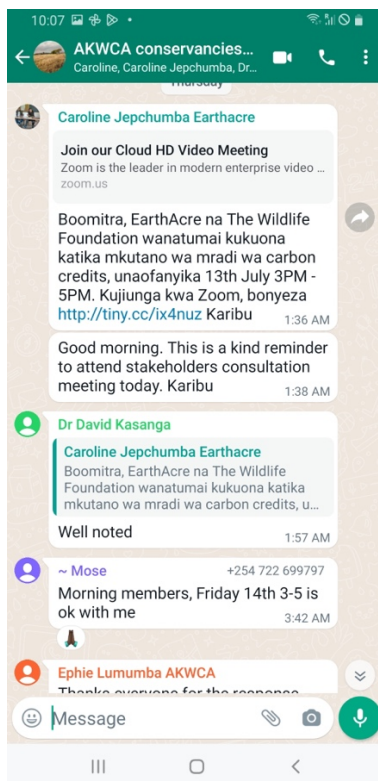
 Grasslands LSC Non-Technical ... 93 KB

Meeting Details

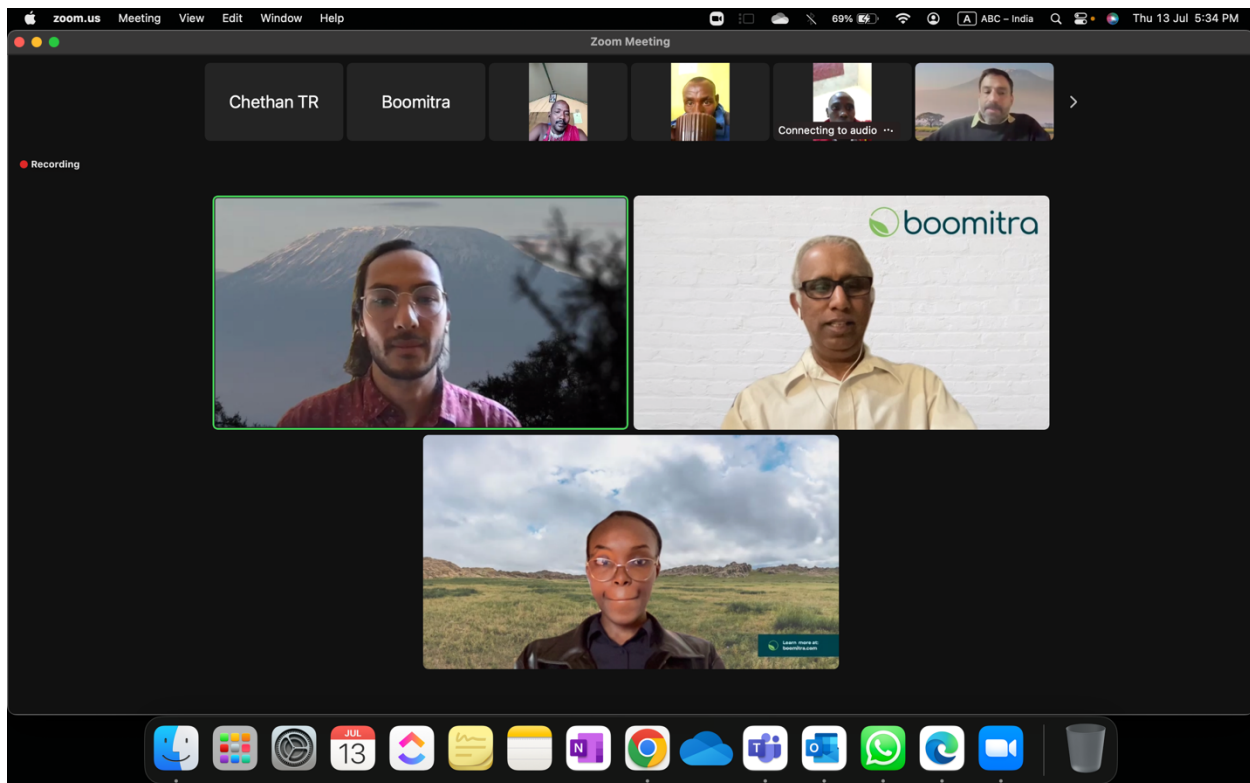
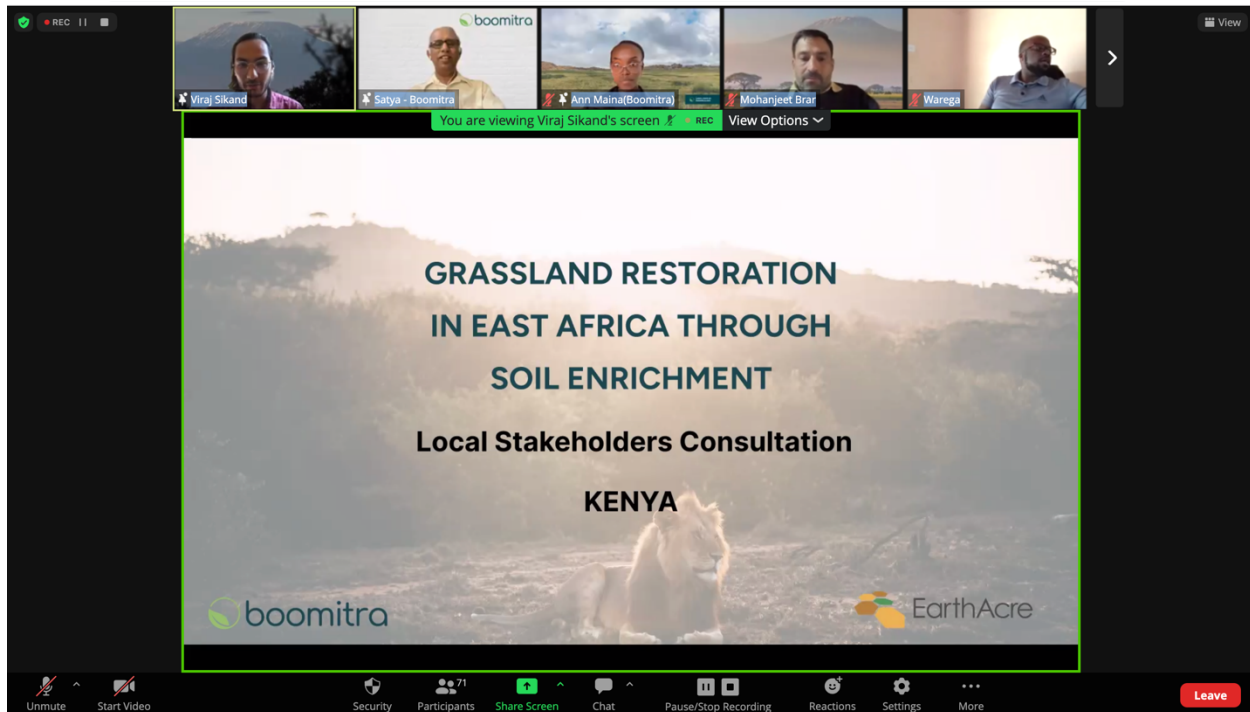
LinkedIn Post



WhatsApp Reminder Message Screenshots:



Screenshots of the Virtual Zoom Meeting



Stop Recording

You are viewing Viraj Sikand's screen

What is climate change?

- Shifts in weather and temperature patterns due to carbon dioxide emissions from human activities
- Affects all of us: increased droughts, floods, pests etc
- Companies are willing to pay people who remove carbon dioxide from the atmosphere (carbon credit)



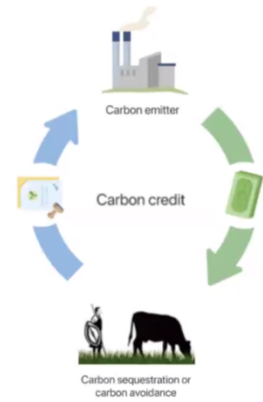
Participants in the video call include: Viraj Sikand, Patita Nkamunu, Ann Maina(Boomitra), Mohanjeet Brar, Satya - Boomitra, Warega, Wilson Kasaine, Kakuro, Simon Nkoloti, Philemon Koltamo, Martin Mulama, Alfred Rono - PIK, Everlyne prech, Jacob Nkananai, and Benson Mutunkel.

Unmute Start Video Security Participants 95 Share Screen Chat Pause/Stop Recording Reactions Settings More Leave

You are viewing Viraj Sikand's screen

What is a carbon credit?

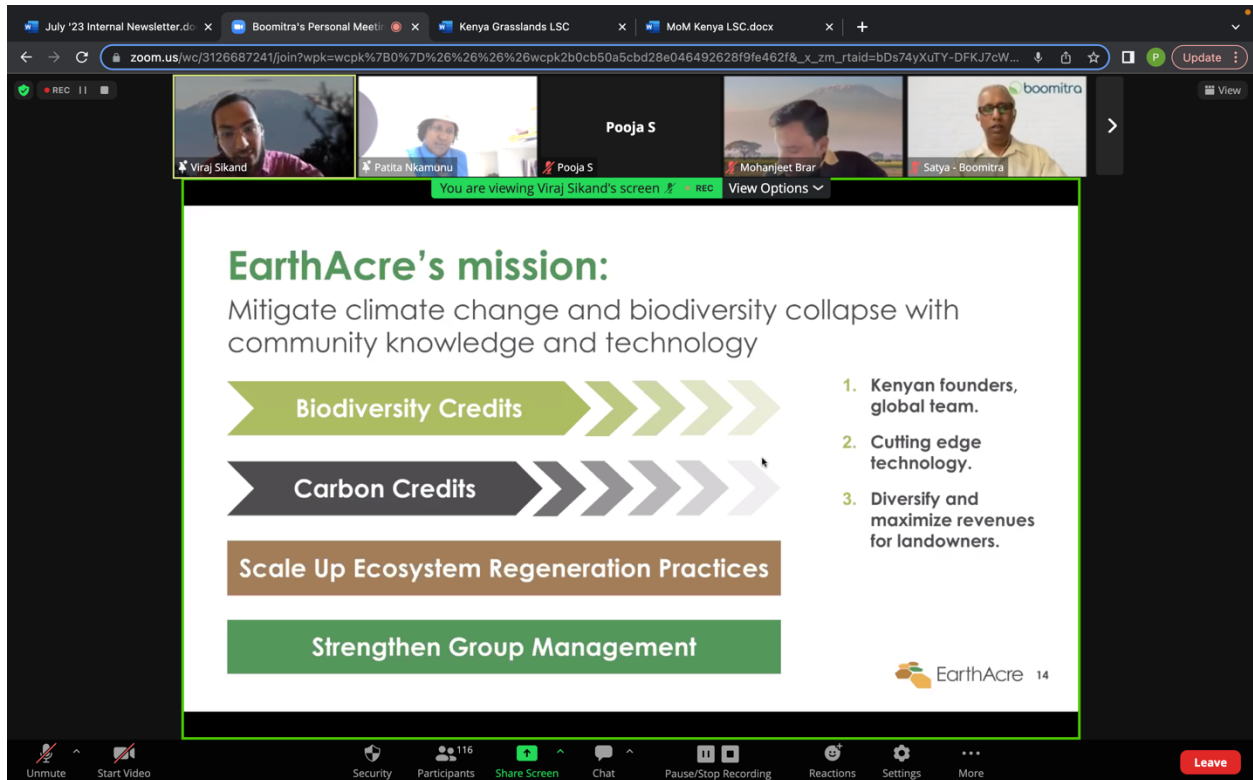
- Carbon dioxide is removed from the atmosphere naturally as plants grow and wildlife comes back: **ecosystem regeneration**
- Regeneration practices require **capital investment** to implement
- Buyers of carbon credits are paying for **regenerative activities** that result in carbon removal



EarthAcre 7

Participants in the video call include: Viraj Sikand and Patita Nkamunu.

Unmute Start Video Security Participants 104 Share Screen Chat Pause/Stop Recording Reactions Settings More Leave



July '23 Internal Newsletter.docx | Boomitra's Personal Meeting | Kenya Grasslands LSC | MoM Kenya LSC.docx

zoom.us/jc/3126687241/join?wpk=wcpk%7B0%7D%26%26%26wcpk2b0cb50a5cbd28e046492628f9e462f&x_zm_rtaid=bDs74yXuTY-DFKJ7cW... | Update

REC | II

Viraj Sikand | Patita Nkamunu | Pooja S | Mohanji Brar | Satya - Boomitra

You are viewing Viraj Sikand's screen | REC | View Options

EarthAcre's mission:

Mitigate climate change and biodiversity collapse with community knowledge and technology

Biodiversity Credits

Carbon Credits

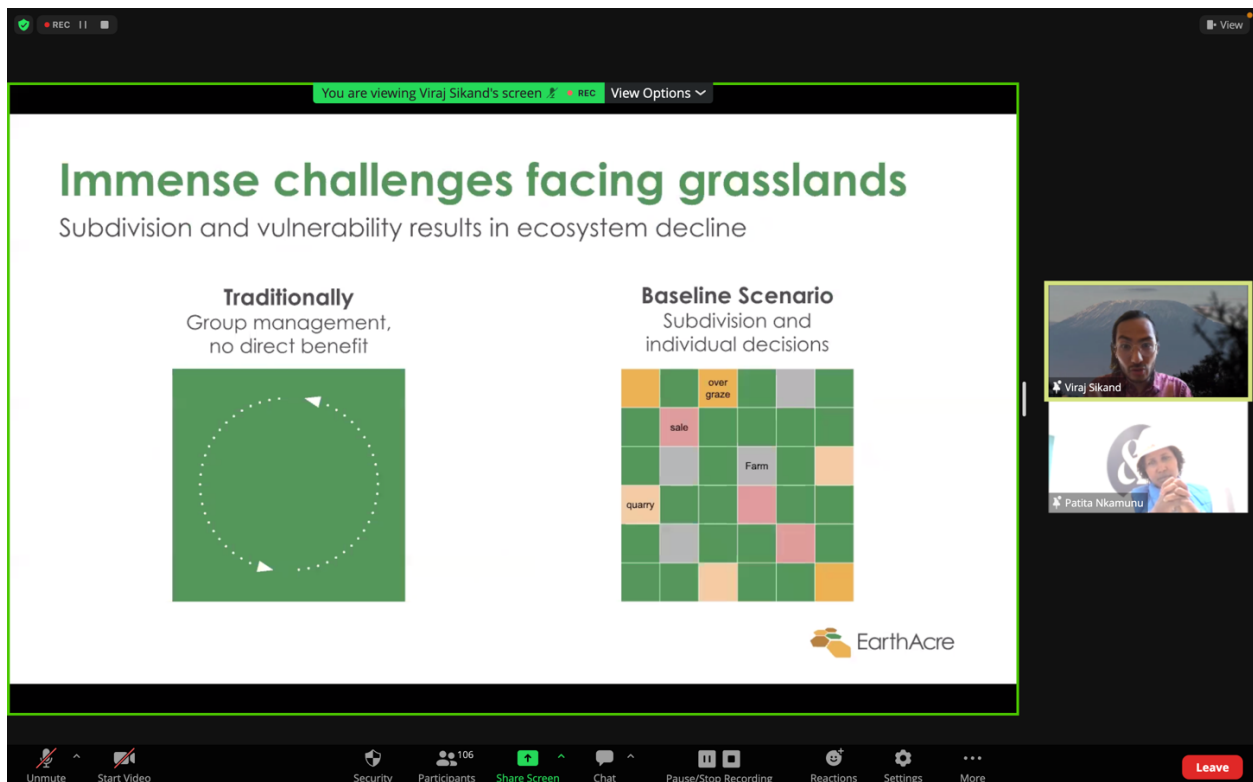
Scale Up Ecosystem Regeneration Practices

Strengthen Group Management

1. Kenyan founders, global team.
2. Cutting edge technology.
3. Diversify and maximize revenues for landowners.

EarthAcre 14

Unmute | Start Video | Security | Participants 116 | Share Screen | Chat | Pause/Stop Recording | Reactions | Settings | More | Leave



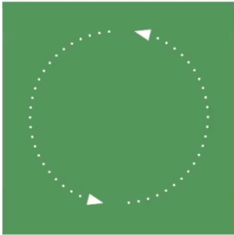
REC | II

You are viewing Viraj Sikand's screen | REC | View Options

Immense challenges facing grasslands

Subdivision and vulnerability results in ecosystem decline

Traditionally
Group management,
no direct benefit



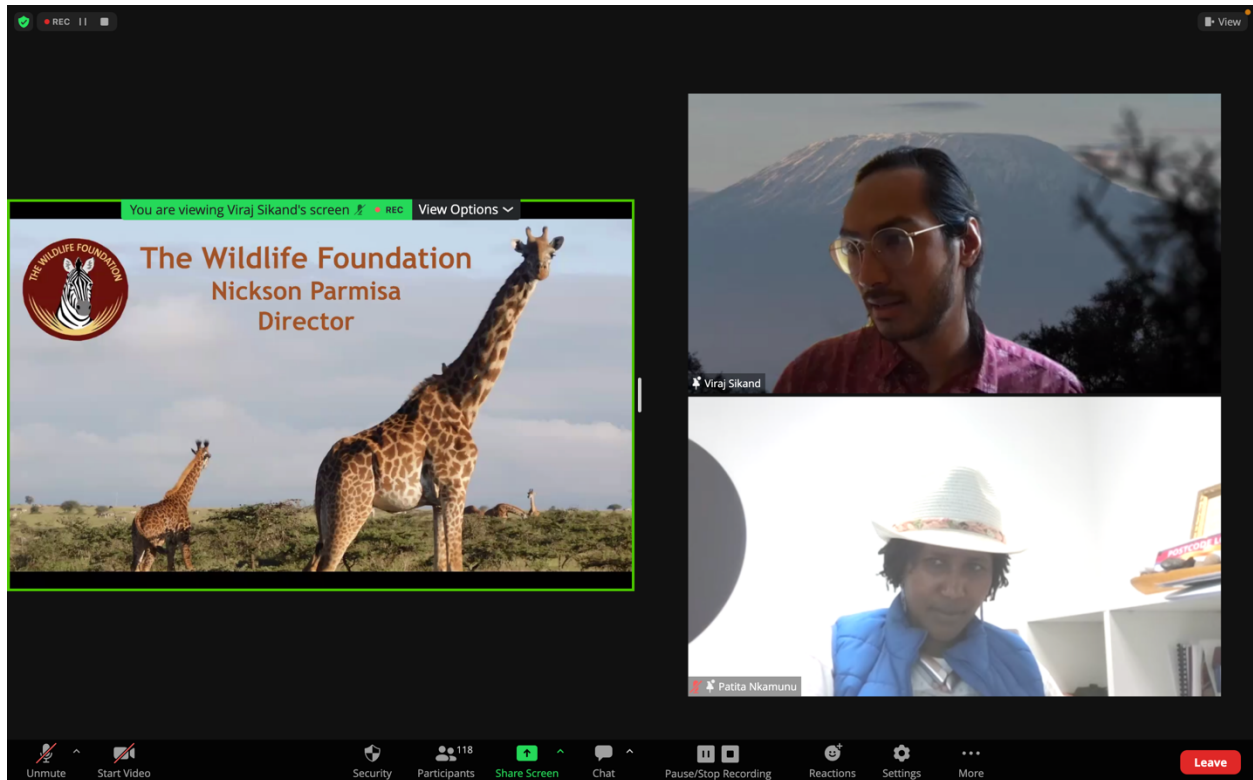
Baseline Scenario
Subdivision and
individual decisions



EarthAcre

Viraj Sikand | Patita Nkamunu

Unmute | Start Video | Security | Participants 106 | Share Screen | Chat | Pause/Stop Recording | Reactions | Settings | More | Leave



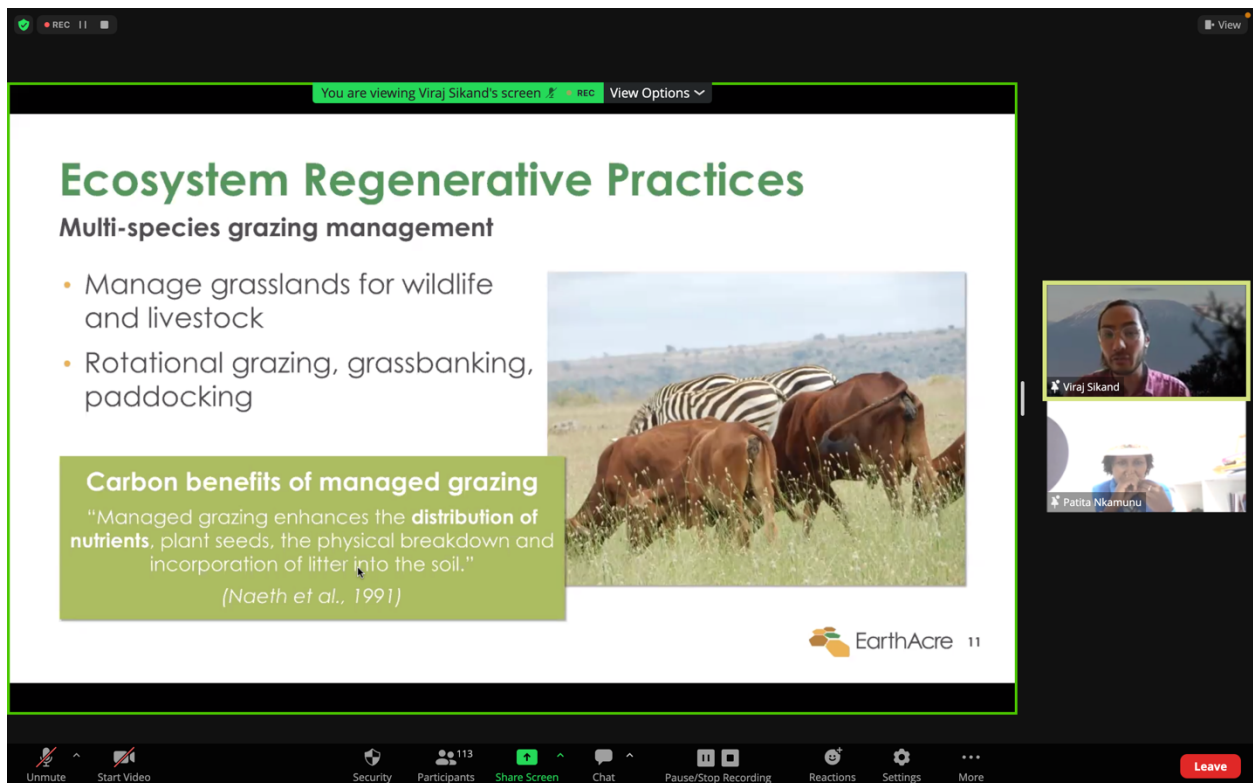
You are viewing Viraj Sikand's screen  View Options ▾

 **The Wildlife Foundation**
Nickson Parmisa
Director

Viraj Sikand

Patita Nkamunu

Unmute Start Video Security Participants 118 Share Screen Chat Pause/Stop Recording Reactions Settings More **Leave**



You are viewing Viraj Sikand's screen  View Options ▾

Ecosystem Regenerative Practices

Multi-species grazing management

- Manage grasslands for wildlife and livestock
- Rotational grazing, grassbanking, paddocking

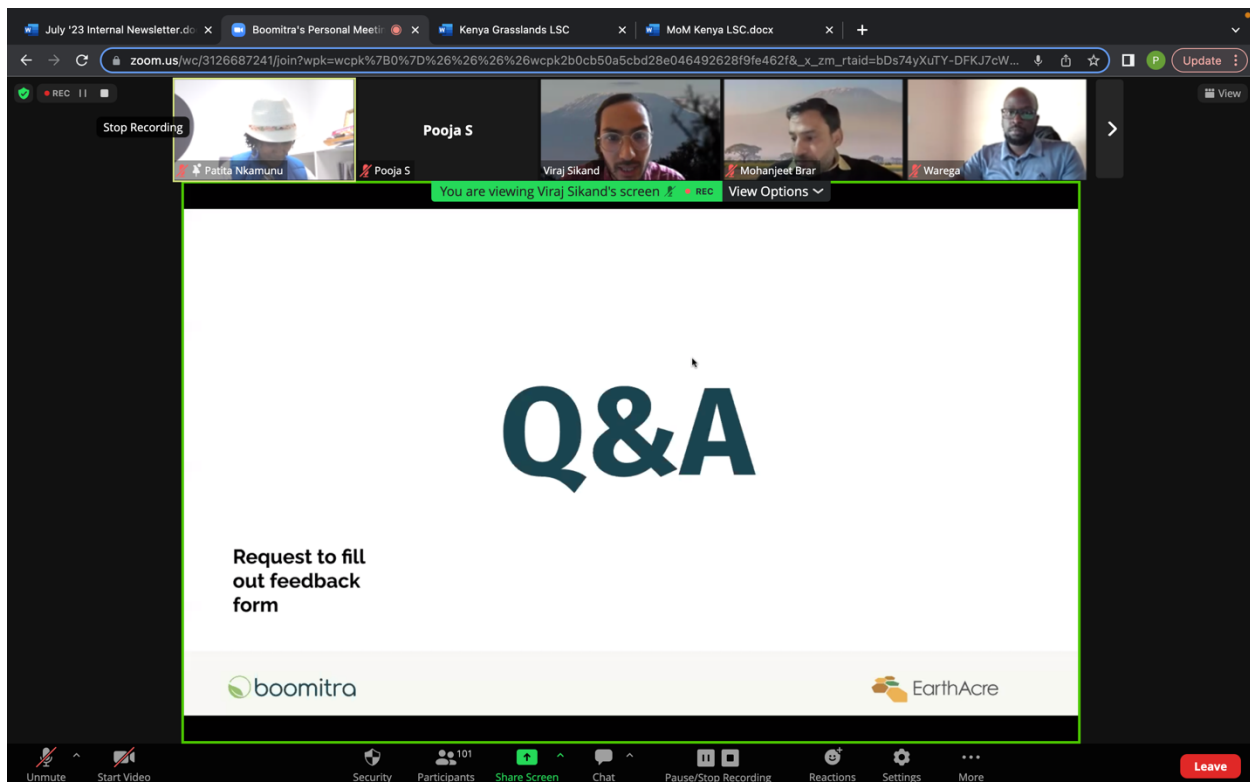
Carbon benefits of managed grazing
"Managed grazing enhances the **distribution of nutrients**, plant seeds, the physical breakdown and incorporation of litter into the soil."
(Naeth et al., 1991)

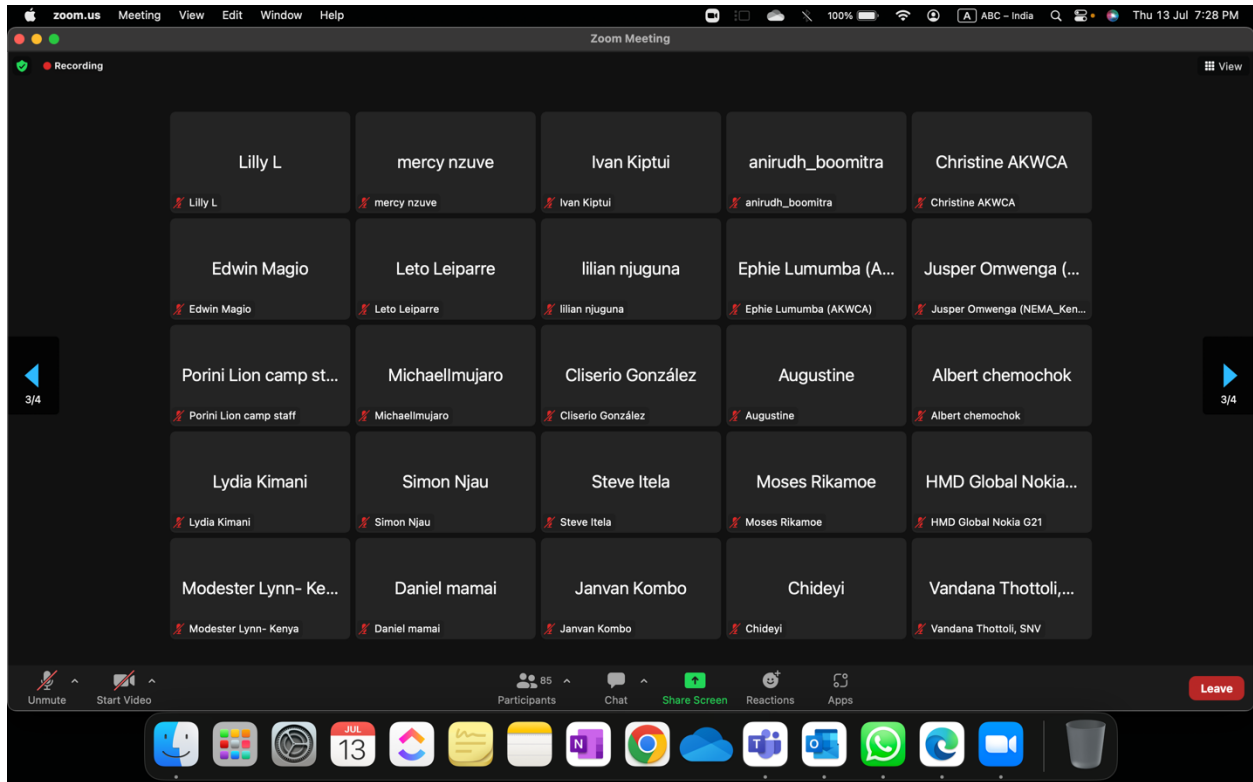
 EarthAcre 11

Viraj Sikand

Patita Nkamunu

Unmute Start Video Security Participants 113 Share Screen Chat Pause/Stop Recording Reactions Settings More **Leave**





APPENDIX 03: BASELINE SURVEY TEMPLATE



Baseline Rancher Information Collection

Date:	
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Name of Respondent	
Role of Respondent	
Phone Number	
Email	
Legal Address of the ranch	

Ranch Name	
Ranch Ownership (Private, Community owned, etc.) provide details of the ownership	
Ranch Coordinates	
Acreage	
Average Yearly Rainfall (in)	
Temperature range (year)	
When did you start the Regenerative grazing Practices	
Types of Regenerative Practices (Eg. Holistic Grazing; Keylines, Improved water manage etc.)	
Has the land remained a grassland for the past 15 years? If no, what was it prior?	

Livestock Type and Count			
	Type	Count	Breed(s)
Cattle	Bulls		
	Cows		
	Heifers		





Livestock Type and Count			
Horses	Steers		
	Type	Count	Breed(s)
	Stallions		
	Mares		
Sheep	Horses		
	Type	Count	Breed(s)
Donkeys	Type	Count	Breed(s)
Goats	Type	Count	Breed(s)
Other	Type	Count	Breed(s)
What is the theoretical livestock carrying capacity of the ranch (if known)			

Livestock Number Changes in the years (total)						
2022	2021	2020	2019	2018	2017	2016

Management Practices				
Number of Herds				
Herd 1 Avg Time Per Paddock	Grazing (Days)		Rest (Days)	
Herd 2 Avg Time Per Paddock				
Herd 3 Avg Time Per Paddock				
Herd 4 Avg Time Per Paddock				
Herd 5 Avg Time Per Paddock				
Herd 6 Avg Time Per Paddock				
Provide details of Animal Welfare Practices adopted				





Management Practices			
Average Body Condition Score ?			
Permanent Non-electric Fence (miles)		Permanent Electric Fence (miles)	
Number of Permanent Paddocks			
Portable Fence Paddocks, Average Number per year			
Changes to Management Practices/Investments since 2019			
If using electric fencing, what is the source of electricity for the electric fence	☐ Diesel ☐ Natural Gas ☐ Gasoline ☐ Solar ☐ Grid ☐ Other (mention below)	Average Electricity consumption per month	
If fossil fuels are used for electricity production, average number of liters of fossil fuel consumed per month			
If using solar electricity, provide the wattage/power output and number of panels			
Do you use fertilizer? If yes, what types of fertilizer and what amount per acre?			

Water Conservation			
Are there any water conservation activity in the ranch? If Yes, Describe.			
What sources of water are available for animals to drink			
Source of energy to pump water	☐ Diesel ☐ Natural Gas ☐ Gasoline	Average Electricity consumption per month	





Water Conservation			
	☐ Solar ☐ Grid ☐ Others (mention below)		
If fossil fuels used for electricity production, number of liters of fossil fuel consumed per month			
If Solar electricity, provide the wattage/power output of a panel & number of panels			

	2022	2021	2020	2019	2018	2017	2016
Do you use any synthetic fertiliser in your grasslands? If yes, provide quantitative details year wise.							
What was the land use scenario in these years?							
If you use this land for any other activity other than grazing, please provide reason for the same							
Did you take up any control burning activity in the ranch?							
How are animals being grazed in these years?							

Are there any barriers, hurdles etc being faced during adoption of sustainable practices? If yes please describe them here	
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Do you practice any control burning practice in your land? If yes please provide details of the same.	
What are typical grass species found in your ranch	
Are these grass species are perennials?	
Does wild life also graze in you land? If yes, what type of wild animals? And provide average count of them.	
Are there any wildlife and human conflicts in your land.	
If wild life graze in your land, does forage is sufficient for your livestock? If no, what are the alternative methods you adopt to meet the forage requirements?	
Has grassland degradation and land use change (conversion to croplands) increased in the last 20 years/timeline in general?	Increased: ☐ Decreased: ☐ No Change: ☐ Don't Know: ☐
If increased what are the reasons?	
According to you, has there been a change in rainfall and temperature patterns over the last 20 years/informal timeline?	

I, _____, certify that the information provided in this document is true and accurate to the best of my knowledge.

Signature



APPENDIX 04: ADAPTIVE MANAGEMENT PLAN

Risk	Mitigation Strategies	Impact on Ranches
Drought	• Rotational grazing to optimize forage availability. • Water conservation techniques (ex: rainwater harvesting, efficient irrigation). • Training on rotational grazing management and workshops on efficient water use • Collaborating with local ranchers through cooperatives can help mitigation plan among each other. Engaging with government programs for subsidies, drought relief, and insurance options ensures financial support during critical periods. Partnering with research institutions can also facilitate the adoption of innovative drought adaptation techniques tailored to local conditions.	Reduced forage shortages, sustained livestock health, improved water security.
Flooding	• Improved drainage systems and water flow management through project promoted water management activities. • Elevation of critical infrastructure (Livestock shelters, storage). • Build ditches, swales, and berms for water diversion; restore riparian buffers; consider floodwater harvesting. • Developing emergency plans for livestock during flood situation. • Work with local authorities and share knowledge with neighboring ranchers.	Minimized damage to pasturelands, preserved infrastructure, and reduced livestock loss.
Wildfires	• Firebreaks and controlled burns. • Community-based fire monitoring and early warning systems. • Paddock management to prevent wide spreading of fire in the ranches. • Participate in climate resilience programs and workshops.	Reduced fire spread, lower livestock mortality, and protected rangelands.

Risk	Mitigation Strategies	Impact on Ranches
	• Advocate for regional policies that support sustainable ranching. • Access government aid, grants, or climate adaptation funds.	
Extreme weather Events	• Develop an extreme weather emergency response plan. • Train staff and ranch hands on emergency protocols. • Provision of shaded areas and cooling structures. • Water point distribution for livestock hydration. • Participate in climate resilience programs and workshops. • Advocate for regional policies that support sustainable ranching. • Adjust feeding strategies during extreme heat or cold by developing and use livestock management techniques.	Minimized heat stress in livestock, improved animal productivity, and reduced mortality.
Pests and Disease Outbreaks	• Regularly inspect livestock, pastures, and facilities for signs of pests and diseases. • Control animal movement, quarantine new or sick animals, and restrict farm visitors. • Rotational Grazing through movement of livestock between pastures to break pest and disease cycles. • Improved Sanitation by keeping water sources, feeding areas, and animal housing clean to prevent disease spread. • Integrated pest management (biological controls, rotational grazing). Use a combination of biological, mechanical, and chemical control methods strategically. • Regular veterinary care and vaccination programs. Ensure livestock are vaccinated and dewormed regularly. • Improved biosecurity measures. • Educate ranch workers on pest and disease identification, handling, and prevention. • - Continuously update strategies based on new disease threats, research, and changing environmental conditions.	Reduced disease outbreaks, healthier livestock, and decreased economic losses.
Invasive species (such	• Manual/mechanical removal, or biocontrol. • Restore cleared areas with native grasses.	Improved pasture quality, reduced

Risk	Mitigation Strategies	Impact on Ranches
as <i>Opuntia</i> , <i>Prosopis</i>)	- Community awareness campaigns on identification and prevention. - Support from local ecological NGOs and rangeland officers.	livestock injuries, restored ecosystem balance.
Community engagement and capacity building	- Establish and train Grazing Committees within group ranches and conservancies to lead rotational grazing planning. - Conduct regular training workshops and refresher courses tailored to literacy and local language levels. - Use Boomitra's mobile app with audio/visual tutorials for accessible learning. - Employ peer-led approaches: train "Lead Ranchers" to support others in implementation. - Create incentive mechanisms (performance-based bonuses, incentives) for active participation. - Promote intergenerational involvement by engaging youth in digital monitoring and livestock care. - Align project activities with cultural values and community decision-making structures. - Partner with trusted local NGOs and elders to increase trust, legitimacy, and participation.	Strengthened community ownership of the project, leading to higher adoption of sustainable grazing practices. Improved continuity across generations, reducing dropout rates. Faster conflict resolution and adaptive learning from within the community. Greater gender and youth inclusion in project benefits.
Implementation failures	- Assign clear roles to local partners and field coordinators. - Continuous training of ranchers on rotational grazing practices. - Use Boomitra app for regular monitoring and feedback. - Identify lagging zones for targeted re-engagement.	Higher compliance, more uniform adoption of grazing plans, timely corrective actions.
Policy or land tenure changes	- Sign MOUs with group ranches and conservancies to formalize land use arrangements, supporting policy implementation and clarifying land tenure rights. - Engage in county-level land use planning meetings. - Conduct annual reviews of land tenure laws and regulations. - Document and map land rights using participatory tools.	Improved land access security, increased project tenure stability, minimized land disputes.

Risk	Mitigation Strategies	Impact on Ranches
	• Involve elders and traditional leaders in grazing committees. • Maintain regular engagement with group ranch committees and conservancy boards. • Organize stakeholder workshops to communicate policy changes and co-develop solutions.	
Conflict/ Insecurity	• Set up peace committees • Conflict resolution training with ward administrators. • Integrate security risk mapping into grazing planning. • Conduct regular risk assessments to identify emerging conflict or insecurity issues.	Safer grazing operations, minimized disruptions, better community cohesion.
Technological failures	• Backup field-level monitoring with manual logbooks. • Use multiple satellite sources to validate carbon and vegetation data. • Offline-enabled apps for remote ranches. • Train local staff in tech troubleshooting.	More reliable data submission, reduced verification delays, continuous project monitoring.
Financial disruption (carbon credit delays)	• Secure carbon pre-financing through forward contracts. • Structure benefit-sharing agreements to allow flexible disbursement schedules. Communicate clearly with ranchers on payment timelines. • Monitor carbon market trends and engage with registries for regular updates. • Prioritize low-cost, high-impact activities during periods of financial delay.	Maintained trust in the program, sustained participation, better risk sharing.