KRUGER TO CANYONS RANGELAND RESTORATION PROJECT

Document Prepared by Conservation South Africa in collaboration with unique land use GmbH

Project Title	Kruger to Canyons Rangeland Restoration Project
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Project Location	South Africa
Project Proponent(s)	Conservation South Africa Forrest House, Ground Floor, Belmont Office Park, Belmont Road, Rondebosch, 7700, South Africa +2721 100 3950 ltheron@conservation.org
Prepared By	Project proponent
Validation Body	SCS Global Services 2000 Powell Street, Ste. 600 Emeryville CA 94608 USA www.SCSglobalServices.com
Project Lifetime	08 August 2018 – 07 August 2048; 30-year lifetime
GHG Accounting Period	08 August 2018 – 07 August 2048; 30-year lifetime
History of CCB Status	N/A

Gold Level Criteria	The K2C project seeks to achieve all climate, community, and biodiversity Gold Level criteria. **Exceptional climate benefits** The project contributes to the climate resilience / adaptation of rural households by restoring nature's capacity to retain soil, provide fodder for livestock, replenish aquifers, store water, and reduce impacts of droughts, and fires. **Biodiversity benefits** This project zone falls within the Kruger 2 Canyons area which is recognized by UNESCO as a Biosphere reserve. The project zone also contains 350 number of African Wild dog which is classified by IUCN as an endangered species. **Exceptional community benefits** The project is community-led. Participating communities have management rights to land in the project area and rights to claim that their activities will cause the project's benefits. The role of project proponent will also be handed over to community structures once these are fully put in place. The project creates jobs for unemployed youth who are one of most vulnerable community groups.
Expected Verification Schedule	August 2023

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1 SUMMARY OF PROJECT BENEFITS

This section highlights some of this project's important benefits. Section 1.1 (Unique Project Benefits) should be aligned with a project's causal model and is specific to this project. Section 1.2 (Standardized Benefit Metrics) is the same quantifiable information for all CCB projects. This section does not replace the development of a project-specific causal model or the monitoring and reporting of all associated project-specific impacts (positive and negative) that are described in Sections 2-5 of this document.

1.1 Unique Project Benefits

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Restoration and rehabilitation of degraded rangelands to buffer against drought & soil erosion	3.4.3
2) Improved livestock & human health	3.4.3
3) Reduced threats to protected tree species	5.2.1
4) Reduced human-wildlife conflict.	5.2.2

1.2 Standardized Benefit Metrics

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions or removals	Net estimated emission removals in the project area, measured against the without-project scenario	2.88 $tCO_2e\ ha^{-1}\ yr^{-1}$	3.2.4
	Net estimated emission reductions in the project area, measured against the without-project scenario	-0.04 $tCO_2e\ ha^{-1}\ yr^{-1}$ (emissions)	3.2.4
Forest[1] cover	For REDD[2] projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario	N/A	N/A
	For ARR[3] projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	N/A	N/A
Improved land management	Number of hectares of existing production forest land in which IFM[4] practices are expected to occur as a result of project activities, measured against the without-project scenario	N/A	N/A
	Number of hectares of non-forest land in which improved land management practices are expected to occur as a result of project activities, measured against the without-project scenario	82,300ha	2.1.21 (2)
Training	Total number of community members who are expected to have improved skills and/or knowledge resulting from training provided as part of project activities.	1,518	4.5.9
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	760	4.5.9

[1] Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (*VCS Program Definitions*)
[2] Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)
[3] Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)
[4] Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuelwood (*VCS Program Definitions*)

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
Employment	Total number of people expected to be employed in project activities,[5] expressed as number of full-time employees[6]	785	4.2
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	393	4.2
Livelihoods	Total number of people expected to have improved livelihoods[7] or income generated as a result of project activities	18,000	4.2
	Number of women expected to have improved livelihoods or income generated as a result of project activities	9,000	4.2
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	N/A	N/A
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	N/A	N/A
Education	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	4,500 learners at schools have access to high-speed internet	4.2.1
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	2,200 female learners at schools have access to high-speed internet	4.2.1
Water	Total number of people who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	18,000	

[5] Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.
[6] Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])
[7] Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	Number of women who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	9,000	
Well-being	Total number of community members whose well-being[8] is expected to improve as a result of project activities	18,000	4.2.3
	Number of women whose well-being is expected to improve as a result of project activities	9,000	4.2.3
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation,[9] measured against the without-project scenario	82,300 ha	5.2
	Expected number of globally Critically Endangered or Endangered species[10] benefiting from reduced threats as a result of project activities,[11] measured against the without-project scenario	350 individuals' African wild dog (*Lycaon pictus*)	5.1.2

[8] Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g. Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.
[9] Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g. enhancing the status of endangered species
[10] Per IUCN's Red List of Threatened Species
[11] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2 GENERAL

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Summary Description of the Project (G1.2)

Conservation South Africa (CSA) supports livestock farmers to adopt and expand rangeland practices that foster restoration and maintenance of healthy savannah ecosystems. The principal project action is to shift livestock management from continuous grazing to planned rotational-rest grazing for cattle. This is done as a collective by the livestock farmers through adopting strategic herding and kraaling (practice of keeping cattle or other livestock in an enclosure overnight for protection) practices that align with the grazing plan as determined and implemented by the livestock farmers. Planned rotational-rest grazing, also called season-long grazing, is known to improve grazing lands through increasing the recovery rate and ground cover of sub-perennial and perennial grass species, which are more desirable forage. Usually, one camp will be rested from grazing during the growing season while an adjacent area is open to grazing. Camps may be rotated as agreed with communities through the Grazing Associations (Farmers Cooperatives); these associations are the drivers of the grazing systems within the landscape and are composed of locally elected community members who own livestock.

The project is located on the communal rangelands of the Kruger to Canyons (K2C) Biosphere Reserve in the Mpumalanga and Limpopo provinces of South Africa. The K2C biosphere reserve is a landscape of significant global biodiversity stretching from the Kruger National Park in the east to the Blyde River Canyon in the west and includes a remarkably diverse suite of land uses ranging from formal conservation to peri-urban, urban, intensive commercial agriculture, subsistence agriculture, and livestock farming land uses. The first project instance includes communal rangelands of the Mnisi and Amashangana tribal authority totaling 6432 ha. The project started in 2018 with the signing of the first conservation agreement between the Ahitiriheleni and Nhlanganani grazing associations and Conservation South Africa (CSA). In addition, foundational steps were made towards enhancing internal governance of the grazing associations through capacity building, mentoring grazing associations on good governance and formalizing a cooperative. The conservation agreements are the guiding framework for the grazing plans and are negotiated with each grazing association to ensure each agreement is best suited for the particular grazing association. The conservation agreements proposes a suite of benefits to each grazing association to promote compliance of the grazing plans; these benefits may differ slightly between each association. In partnership with Meat Naturally, the benefits are focused on supporting improved livestock management in the form of market access for livestock, provision of fodder and/or nutritional support, provision of eco-trainers and provision of animal production.

The baseline scenario (without project) in the communal rangelands is ongoing loss of soil organic carbon (SOC) due to low productivity and bare soil relative to reference sites, such as the Kruger National Park. Unrestricted animal movements and high grazing intensities disrupt recovery time for grasses during the growing season, thereby reducing vegetation and seed production of perennial and palatable grass species. This in turn results in relatively higher proportions of annuals vs. perennials and, eventually, bare soil. Unrestricted grazing is occurring due to a 'tragedy of the commons' where communal areas are over-utilized for livestock grazing and knowledge of sustainable grazing practices has lapsed, largely due to the legacy of Apartheid and the segregation of indigenous people into previous homelands and inequality of land ownership. The lack of vegetation and high occurrence of bare soil leads to high run-off and massive loss of topsoil during the rainy season. This causes localized flooding events instead of infiltration into the soils and creates siltation which reduces river flows and affects fauna and flora downstream in protected and other areas. At the same time, unfavourable herd structures with lots of unproductive, old cattle cause high emissions for little to no extra beef produce.

Project activities will restore the ecosystem functioning of the rangelands thus enhancing the resilience of communities that depend on the rangelands to the impacts of climate change. The project will also contribute positively towards the livelihoods and long-term wellbeing of communities in the project area by creating alternative sources of employment, building capacity in different skills as well as raising awareness about conservation. This will also impact the project's biodiversity objectives to conserve endangered flora and fauna in the project zone while restoring vegetation biodiversity in the rangelands. The project will sequester soil carbon by reducing bare soil and producing a natural shift from annual to perennial grass species as enabled by rotational grazing. Furthermore, greenhouse gas emissions from enteric fermentation will be reduced by changing the herd structure from older to younger animals.

The project will net sequester approximately 115,281 tCO_2e/yr and 3,458,420 tCO_2e total over 30 years according to current estimates of project extent.

2.1.2 Project Scale

Project Scale	
Project	X
Large project	

2.1.3 Project Proponent (G1.1)

Organization name	Conservation South Africa
Contact person	Julia Levin
Title	Vice President, Africa, South Africa
Address	Forrest House, Ground Floor, Belmont Office Park, Belmont Road, Rondebosch, 7700, South Africa
Telephone	+2721 100 3950
Email	jlevin@conservation.org

2.1.4 Other Entities Involved in the Project

Organization name	Meat Naturally Pty Partner
Contact person	Nomusa Mashile
Title	K2C Meat Naturally Incentives Manager
Address	K2C Nodal Office, Zandspruit Bush and Aero Estate, R527 road, Hoedspruit
Telephone	+2772 470 0650
Email	nmmashile@conservation.org

Organization name	Kruger to Canyons Biosphere Reserve Partner
Contact person	Marie-Tinka Uys

Title	Executive Coordinator & Chief Operating Officer
Address	K2C Biosphere Nodal Centre, Zandspruit Bush & Aero Estate, R527, Hoedspruit, Limpopo, South Africa
Telephone	+2715 817 1838
Email	info@kruger2canyons.org

Organization name	Ahititirheleni Farmers' Cooperative (Dixie Community)
Contact person	Farmers Organization Chairperson
Title	Justice Ntimane
Address	Chairperson
Telephone	Dixie Trust, Stand Number 20067, Hluvukani, 1363
Email	+27714380147
	Justicentimane26@gmail.com

Organization name	Mokgapeng Farmers' Cooperative (Welverdiend A)
Contact person	Lion Thete
Title	Chairperson of the Cooperative
Address	P.O.Box 39; Hluvukani; 1363
Telephone	+27723342867
Email	N/A

Organization name	Welverdiend B Farmers' Cooperative
Contact person	Johnson Mlambo
Title	Farmers Organization Chairperson
Address	Welverdiend B, Stand Number 27, Hluvukani, 1363
Telephone	+27762327049
Email	N/A

Organization name	Nhlanganani Farmers' Cooperative (Utah)
Contact person	Lucas Ubisi
Title	Farmers Organization chairperson
Address	Utah Stand number 10133; Hluvukani, 1363
Telephone	+27728762821
Email	Lucasubisi67@gmail.com

Organization name	Mnisi Traditional Authority
Contact person	Lawrence Ndubane
Title	Secretary
Address	Thulamahashe Rd, Khokhovela, 1367
Telephone	+27 829657949
Email	ndubane10@gmail.com

Organization name	Amashangana Traditional Authority
Contact person	Masocha Khoza
Title	Senior Admin
Address	Newforest Bushbuckridge
Telephone	+27 022736996
Email	amashanganatraditionalcoucil@gmail.com

Organization name	Unique land use GmbH (PD writing and technical support)
Contact person	Benjamin Schwarz
Title	Senior consultant
Address	Schnewlinstr. 10, 79098 Freiburg, Germany
Telephone	+49 761 208534-29
Email	benjamin.schwarz@unique-landuse.de

Organization name	Conservation International
Contact person	Chris Zink
Title	Vice President Carbon Finance
Address	2011 Crystal Drive, Suite 600 Arlington, VA 22202
Telephone	+1 703 341 2400
Email	czink@conservation.org

2.1.5 Physical Parameters (G1.3)

Vegetation

The project area is broadly within the Savanna Biome of South Africa and comprises savanna and grassland vegetation types (Figure 1) Granite Lowveld in the west (80% of survey points), Northern Escarpment Dolomite Grassland (8%), Poung Dolomite Mountain Bushveld (3.3%), Legogote Sour Bushveld (1.6% of survey points), Northern Escarpment Quartzite Sourveld (1.6%) and Origstad Mountain Bushveld (1.6%) as per SA's vegetation map (Mucina and Rutherford 2006). Tree canopy cover varies between 0 and 30% at most sites, reaching up to 45% in a few sites (2019 European Space Agency (ESA) tree cover) with all trees in survey sites being below 5 m tall. Project activities will not alter the land classification as they are not aimed at tree cover and will not involve conversion of grassland or savannah to another land cover.

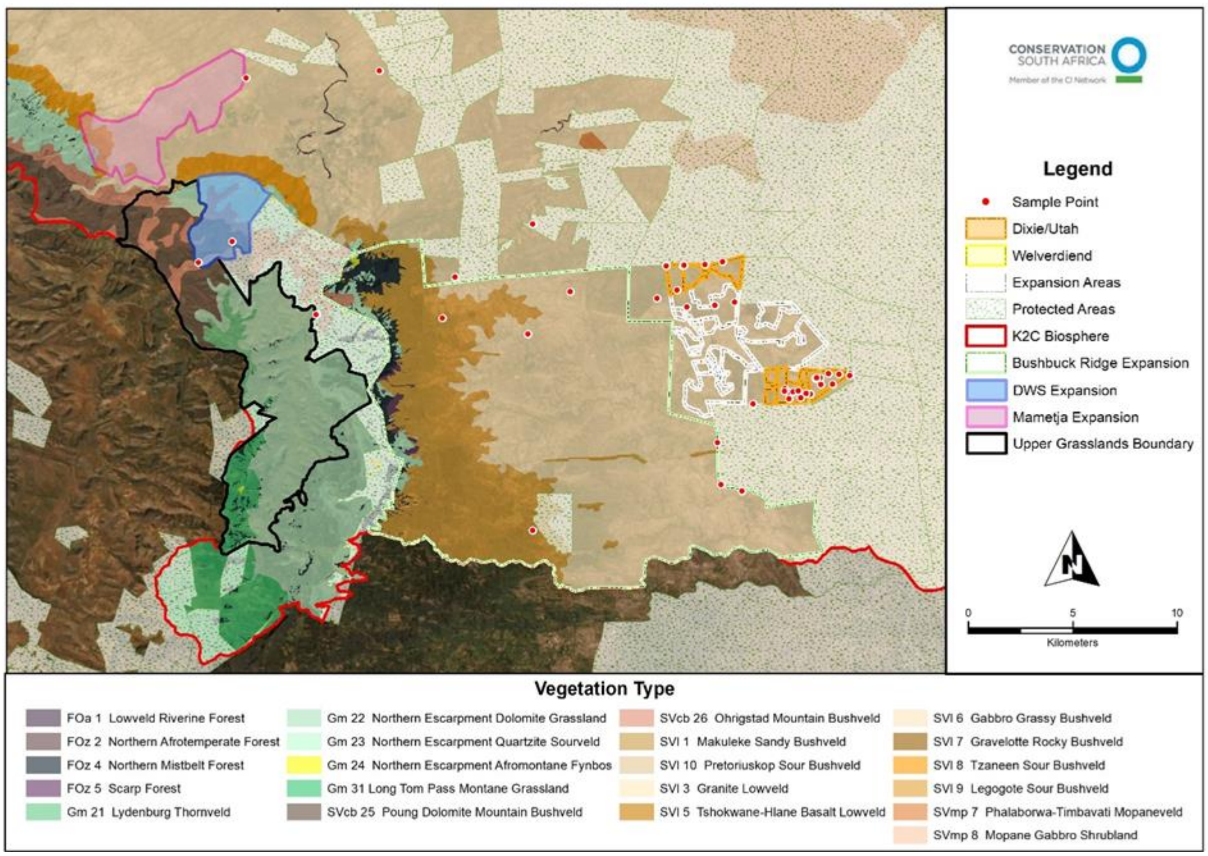

Figure 1: Vegetation types within the Kruger to Canyons (K2C) Biosphere where baseline sampling of vegetation and soil occurred.

Climate

The landscape has a temperate climate. Rain occurs in the summer months, and the winter months are dry and generally free of frost, though sporadic frost may occur in bottomlands (Gertenbach 1983, Mucina and Rutherford 2006). The mean monthly temperature and rainfall for the period 1979-2020 is displayed in Figure 2. The mean annual rainfall (MAP) of the area is 604mm (1979-2020 values from ERA-5 reanalysis data[12], varying between ca. 750 mm in the west and 600 mm in the east.

[12] Copernicus Climate Change Service (C3S) (2017): ERA5: Fifth generation of ECMWF atmospheric reanalyses of the global climate. Copernicus Climate Change Service Climate Data Store (CDS), 11.04.2023. https://cds.climate.copernicus.eu/cdsapp#!/home

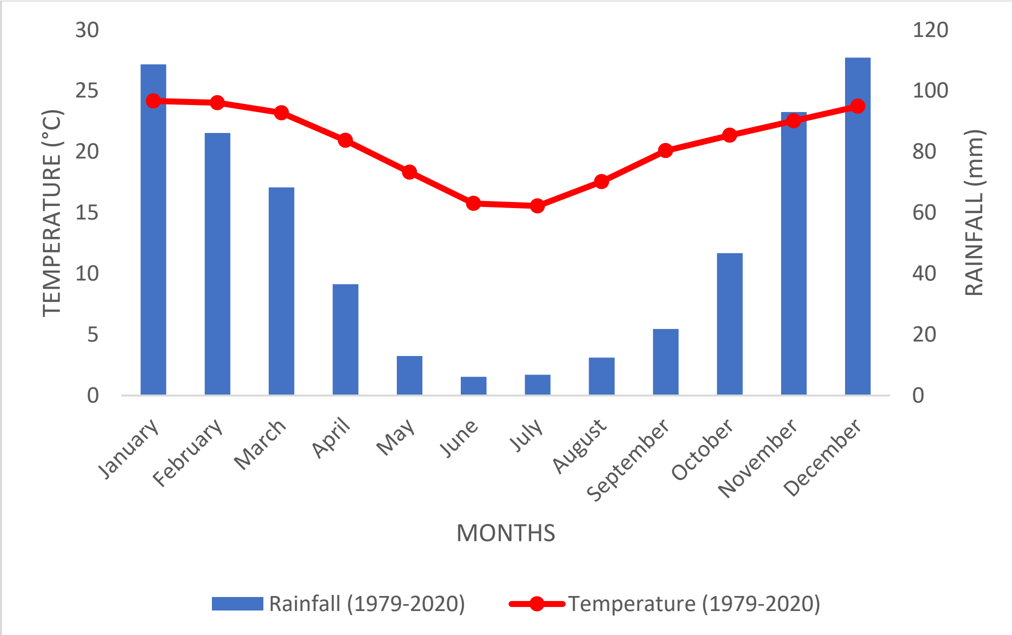

Figure 2: Climate diagram showing the mean monthly temperature and rainfall in the project area from 1979-2020.

Landscape, geology & soils

The landscape is undulating with distinct uplands, ecotones and bottomlands and the altitude varies between 350 and 500 meters above sea level (Gertenbach 1983). The geology of the area includes granite and gneiss, parent material for soils. The soils vary in relation to position in the topography and along the catenal gradient (Gertenbach 1983). The uplands are characterized by sandy soils (6-15% clay) and the dominant soil formations are Hutton and Clovelly with Portsmouth/Swartfontein and Denhere/Makuya respectively as the dominant series (Gertenbach 1983). Glenrosa soils can be expected where slopes become steeper. Where convex topography changes to concave, conditions of temporary water saturation occur and gleyed sandy soils are present (Cartref and Fernwood) (Gertenbach 1983). The soils of bottomlands have become clay-rich because of the accumulation of clay in these areas over time and are often sodium saturated (Gertenbach 1983). Dominant soil formations are Estcourt, Sterkspruit, Swartland and Valsrivier (Gertenbach 1983). The frequent occurrence of dolerite intrusions in the granite of this landscape sometimes obscures the catenary sequence described above. The soils on the dolerite intrusions are usually much darker with higher clay content (Gertenbach 1983).

2.1.6 Social Parameters (G1.3)

A summary description of the main settlements, land ownership, population and ethnicity of the project area are summarized in Table 1.

Table 1: Description of Social Parameters in the project area

Villages	Longitude	Latitude	Population	Total Area (Ha)	Land ownership	Dominant Ethnic Group
Dixie (Phungwe)	24.6943 S	31.4741 E	405	1394	Mnisi Tribal Authority	Shangaan Sepedi
Utah	24.7037 S	31.4421 E	1530	2669	Amashangaan Tribal Authority	Shangaan Sepedi
Welverdiend	24.58 S	31.3394 E	7601	5917	Mnisi Traditional Authority	Shangaan Sepedi

Table 2: Percentage of ethnic groups in project area.

Ethnic groups in Bushbuckridge Local Municipality	*Percentage*
Black African	*99.5 %*
Coloured	*0.1%*
Indian/Asian	*0.1 %*
White	*0.2 %*
Other	*0.1%*

The total project expansion will extend across the Bushbuckridge Local Municipality, which has a total population of 541,248 of which 99.5 % are black Africans. Of those aged 20 years and older, 4.0% have completed primary school, 32.3% have secondary education, 25.7% have completed high school (grade 12) 7.4% have some form of higher education and 18.7% of have had no form of schooling[13].

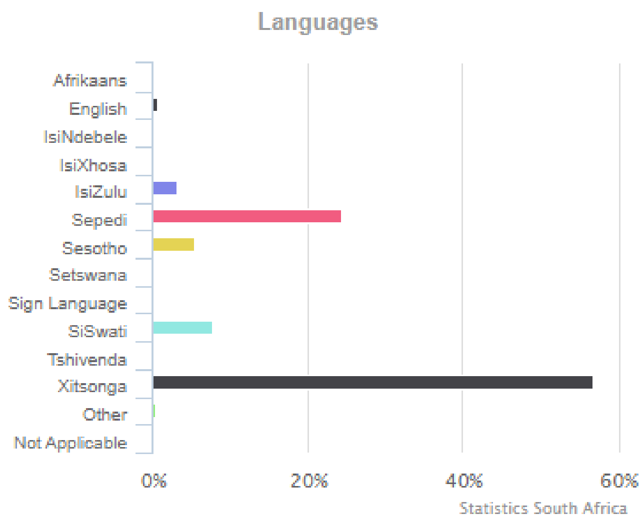

Figure 3: Most prominent languages in the Bushbuckridge community is Xitsonga and Sepedi.

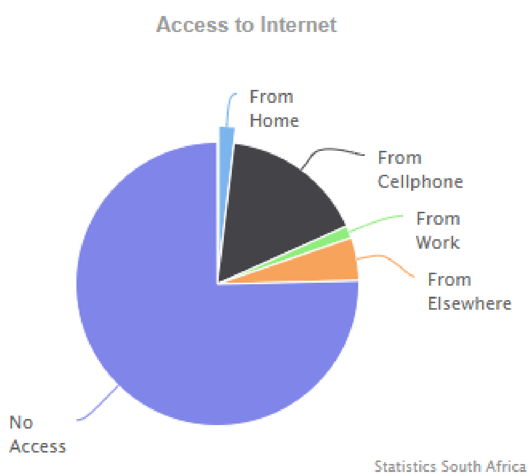

Figure 4: More than 75.3% of community members do not have access to internet in the project area.

[13] StatsSA Census 2011: https://www.statssa.gov.za/?page_id=993&id=bushbuckridge-municipality

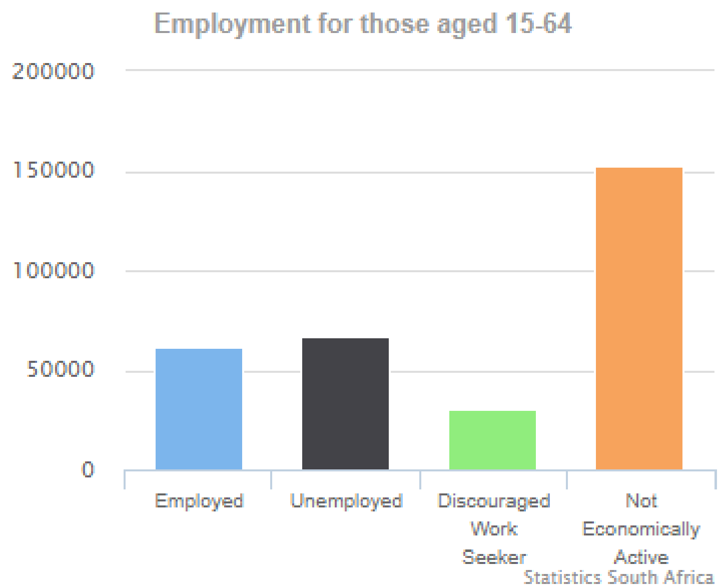

Figure 5: Employment for those aged 15-64.

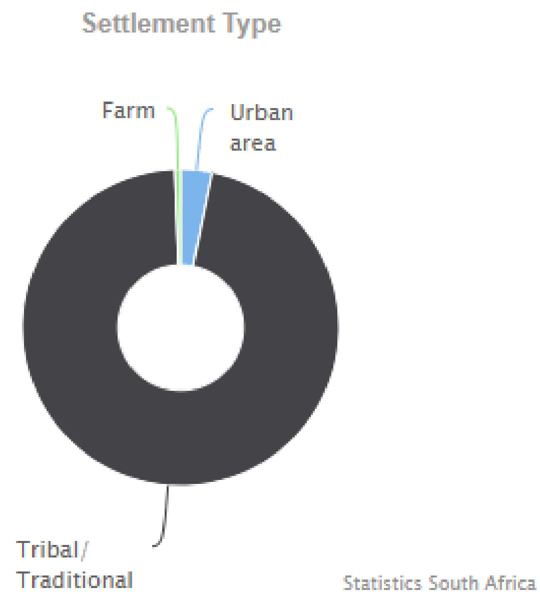

Figure 6: Settlement type, indicating that 96.2% is categorized as "Tribal/Traditional".

2.1.7 Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2)

The grouped project is located within the Kruger to Canyons (K2C) Biosphere within the Limpopo and Mpumalanga provinces of South Africa (*Figure 7*). This is the larger **project zone** and includes all potential project areas, including areas where community development activities are implemented. The entire K2C biosphere is regarded as an area with High Conservation Value and is a UNESCO Biosphere Reserve. The **project area** for the first activity instance comprises Dixie (Phungwe), Utah and Welverdiend communal grazing camps (orange and yellow polygons) totaling 6,432 ha. Areas proposed for immediate expansion are outlined in white, and subsequent expansion areas to the west are outlined in green, blue, and pink. Sites that will be included into the project by 2030 stretch over Mpumalanga and Limpopo

Province in the Ehlanzeni, Thaba Chewu and Maruleng District Municipalities and Bushbuckridge Local Municipality. Geodetic coordinates are provided below and are available separately as a KML file.

Coordinates	Welverdiend:	24°35'7.33"S 31°19'22.39"E
	Dixie:	24°42'13.07"S 31°28'31.40"E
	Utah:	24°42'56.82"S 31°26'10.73"E

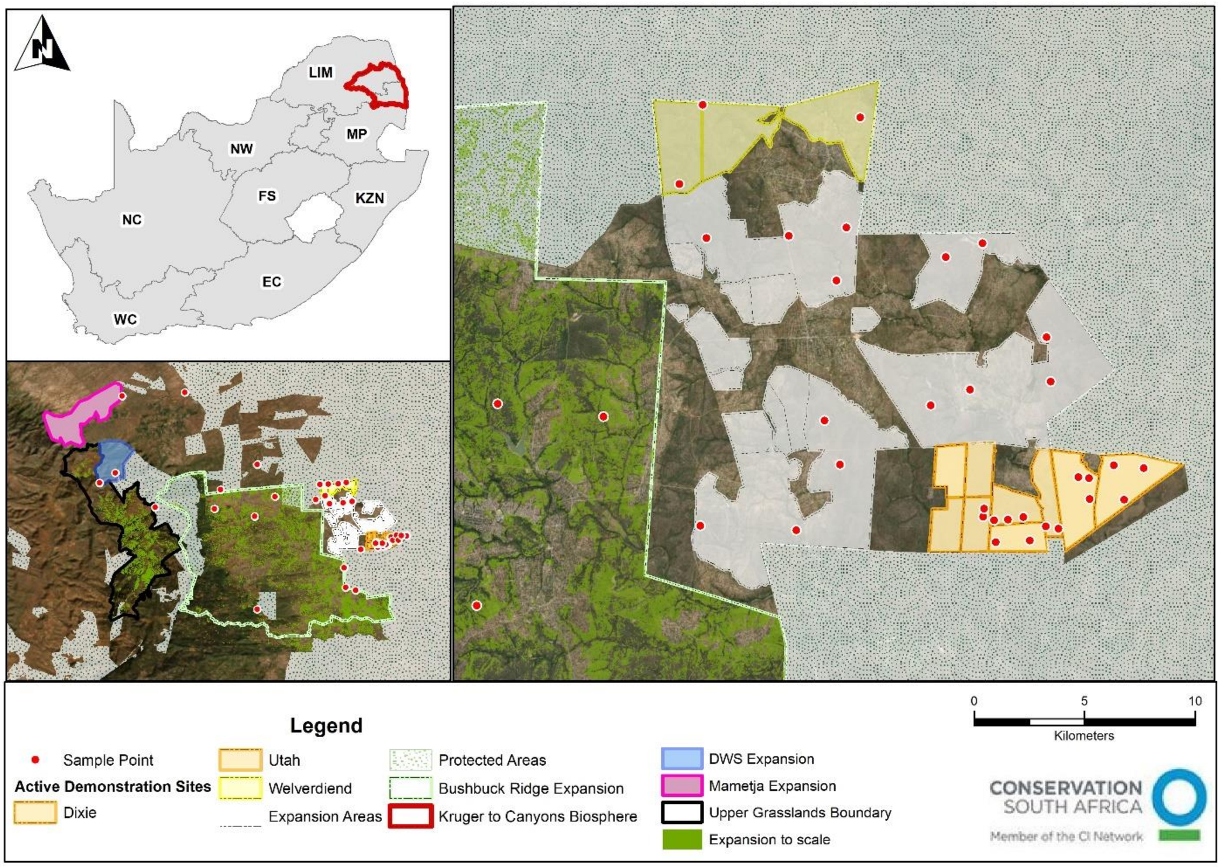

Figure 7: Project location in the Kruger to Canyons (K2C) Biosphere within the Limpopo (LIM) and Mpumalanga (MP) provinces of South Africa. The base maps are satellite imagery.

2.1.8 Stakeholder Identification (G1.5)

CSA uses CI's stakeholder mapping guide to identify and systematically analyze all actors who directly or indirectly may affect or be affected by the project. The stakeholder mapping follows a six-step process briefly described as follows:

1. Planning: This is started as early as possible in the project cycle. The most critical part of this step is defining the purpose of the stakeholder analysis – which goals are to be accomplished, which stakeholders will need to be consulted, who will use the information, and in which ways the resulting information will benefit the project.
2. Identifying stakeholders: The project implementation team lists all groups known to influence or be impacted by the project at hand. Stakeholders are identified based on given categories in the

Stakeholder Analysis worksheet. This step provides an important basis from which to expand the number of known stakeholders as well as begin to analyse those listed.

3. Gathering information: In this step, data for the subsequent steps are collected from the identified stakeholders in three main ways, (1) electronic communication – such as email or online surveys, (2) interviews – by phone or in person, and (3) focus groups with multiple stakeholders. This step also proves useful in collecting and adding groups to the list of stakeholders by asking each group to identify others who may have interest in or be impacted by the project.
4. Filling in stakeholder mapping worksheet: The questions in the worksheet are answered by the project implementation team using input from prior steps. These include questions of stakeholder rights, interests, conflicts, alliances, and overall relevance to the project.
5. Analysing the worksheet: Once information has been compiled on as many stakeholders as possible, we again answer each question on the worksheet to re-evaluate the answers and reach a better understanding of the interests, positions, relevance, partnerships, and conflicts of stakeholder groups.
6. Applying the results: The stakeholder analysis shapes the project design, reflecting the feedback provided by stakeholders impacted by it. This step is ongoing and is revisited consistently as the project progresses.

2.1.9 Stakeholder Descriptions (G1.6, G1.13)

The project proponent has identified the following stakeholders who need to be engaged at various levels:

Table 3: Stakeholders of the K2C Rangeland Restoration Project

Stakeholder	Rights, Interest and Overall Relevance to the Project
Conservation South Africa	Conservation South Africa (CSA) is the project proponent and leads the development of the project. CSA has been working in three landscapes in South Africa namely, Namakwa, Kruger to Canyons and Umzimvubu Catchment since 2010. CSA's priorities are driven through four pillars: Conservation, Climate Positive Planning and Finance, Jobs for Nature, and Healthy African Rangelands. Through the rangeland restoration model, CSA engages with local communities to promote rotational grazing and train local farmers and eco-rangers in rangeland restoration. This model is guided by conservation agreements and Herding for Health principles. CSA has built a relationship with local farmers and traditional authorities through the Herding for Health program since 2017. CSA works within the Mnisi, Amanshangaan and Jongilanga Traditional Authorities through a range of projects, including: • Promoting environmental education through the Scouts project, securing reliable internet connections at schools and youth centres; • Empowering local green businesses; • Providing work experience to youth through the Yes 4 Youth Jobs for Nature programme;

	• Improving livestock health and market access in partnership with Meat Naturally; • Rangeland Restoration, which is the anchor project for CSA in the K2C landscape.
Meat Naturally Pty.	Provision of market access, training, and market readiness services to farmers cooperatives in project sites, project partner as part of an incentive package that is self-financed through the market.
Kruger to Canyons Biosphere Reserve*	Kruger to Canyons Biosphere Region Non-Profit Company (K2C) is the implementing agency managing the 2,474,700 ha (UNESCO) Kruger to Canyons biosphere reserve since 2001. K2C is currently running 12 projects with partners in the biosphere linking sustainable development and biodiversity conservation including expansion of protected areas and sustainable land management. The Kruger 2 Canyons Biosphere undertake the bulk of the landscape restoration efforts through their various Invasive Alien Plants control projects in the areas. They also employ Environmental Monitors and herd monitors in the villages who work alongside the CSA eco-trainers.
Conservation International	Parent organization. Through CI technical support and funding is made available to support the project VCS validate and verification process.
Traditional Authorities: - *Mnisi* - *AmaShangaan* - *Jongilanga* - *Ba pedi Dinkwanyane*	Tribal authorities are the “custodians of the land”. They are the first stakeholders to be approached before an organization can start a project with communities and communal lands. Land Use Planning/management, prevailing leadership structure in project sites, project partners and endorsement of CSA projects in the communities. Local communities in these traditional authorities will participate in the project through conservation agreements.
Community Farmers Cooperatives (Mogapeng Cooperative, Welverdiend B Cooperative, Nhlanganani Cooperative, Ahititirheleni Cooperative)	Land users, Project beneficiaries, livestock farmers, and implementers of conservation agreements. Information trickles down from cooperative committee to all farmers in the cooperative.
Bushbuckridge Local Municipality	Mandated to implement Integrated Development Plan (land use planning, Spatial Development Plan), Support of farmers cooperatives in project sites
Ehlanzeni District Municipality	Drafting of Integrated Development Plan (no direct implementer of project)
SANParks BSP	Project Partner, invasive alien plants (IAP)/Bush Clearing in project sites (no direct implementer of project)
Parastatals (Mpumalanga Tourism and Parks Agency*, SANParks, LEDET)	Management of state-owned protected areas adjacent to project sites, Human-Wildlife Conflict management
DARDLEA	Project partner, support livestock farmers in project sites (Infrastructure maintenance, provision of livestock management services, funding, disease control, market access)

University of Pretoria, Wits Rural, University of Mpumalanga, Southern African Wildlife College	Project partners, research, and disease control, implement Herding for Health programme.
Department of Agriculture through the Mpumalanga State Veterinary Department	Animal husbandry and weekly diptank visits.
Thaba Chewu and Maruleng Municipalities	Passive stakeholder (no direct implementer of project)
Department of Forestry, Fish and Environment	Passive stakeholder (no direct implementer of project)
French Development Agency (AFD)	AFD is a co-funder to CSA for the Pro-Nature Enterprises Project.

2.1.10 Sectoral Scope and Project Type

The project falls under sectoral scope 14: Agriculture, Forestry and Other Land Use (AFOLU) of the VERRA's VCS Program.
It is an Improved Grassland Management (IGM) project under VM0032, which includes practices that manipulate number and type of domestic livestock grazing animals and/or grouping, timing and season of grazing in ways that sequester soil carbon and/or reduce methane emissions. Altering fire frequency and/or intensity in ways that increase carbon inputs to soil is also an included activity.
This is a grouped project as per the VCS Standard version 4.4, i.e., "projects structured to allow the expansion of a project activity subsequent to project validation".

2.1.11 Project Activities and Theory of Change (G1.8)

Summary: The project consists of implementing planned rotational-rest grazing for cattle, sheep, and goats by collective herding and kraaling. This is achieved with community grazing cooperatives by means of conservation agreements across project sites. Sustainability of project activities is enabled and incentivized through market-access opportunities for compliant producers, provided by our commercial partner Meat Naturally Pty (MNP). Project activities are aimed at improving livelihoods, biodiversity, and climate change adaptation and mitigation. The project takes place within the context of CSA's rangeland restoration programme which targets benefits for people and the natural environment (Figure 8). A detailed theory of change can be made available to the validator on request. No native ecosystem has been cleared to implement the project in the last 10 years. The area has been used as grazing land for as long as living memory. See description in section 2.1.5. The project area does not fall within a jurisdiction covered by a Jurisdictional REDD+ program.

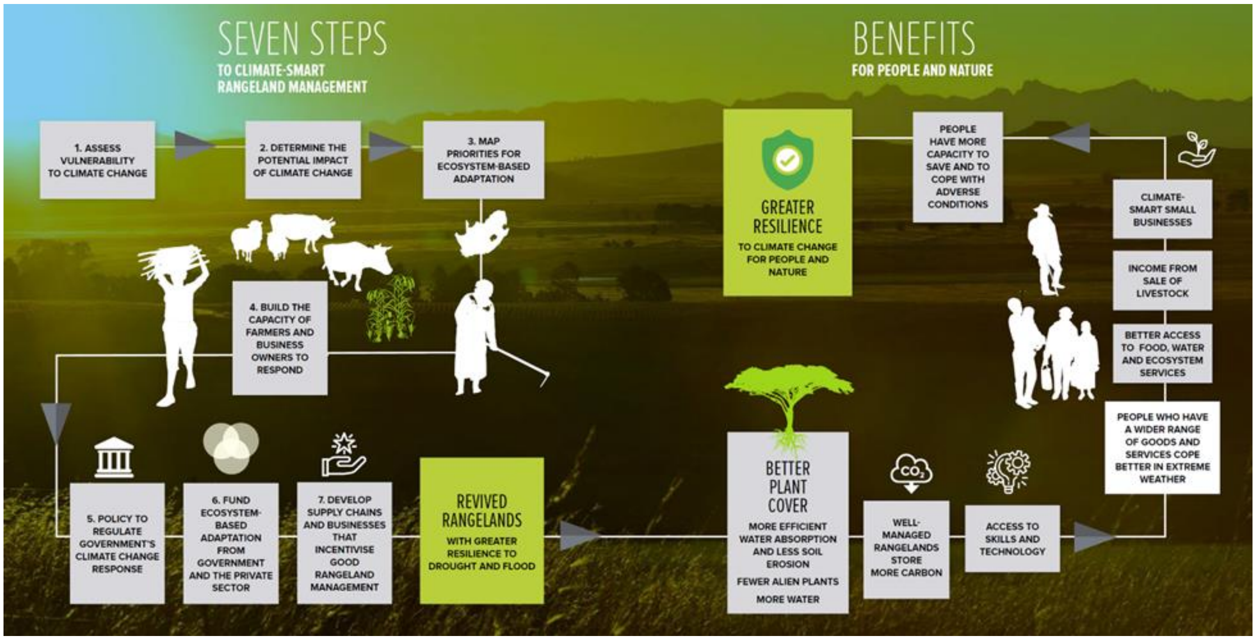

Figure 8: Conservation South Africa's overall rangeland restoration approach for increased climate resilience on rangelands enables and provides context for the present project.

Grazing management

The project focuses on a shift in livestock management from continuous grazing to planned rotational-rest grazing by collective herding and kraaling of cattle, sheep, and goats according to a grazing plan. Grazing plans are developed with the support of Eco-trainers who have received training in regenerative land management. Grazing plans ensure that selected camps are rested from grazing during the growing season (November to April). During the rested period, disturbances are minimized, allowing the ecosystem to recover. A schematic representation of the change in livestock management can be seen in Figure 9 below. This is done within a framework provided by CI's Herding for Health (H4H) Programme, which promotes value-chain development with local communities, government partners, enterprise, and conservation agencies.

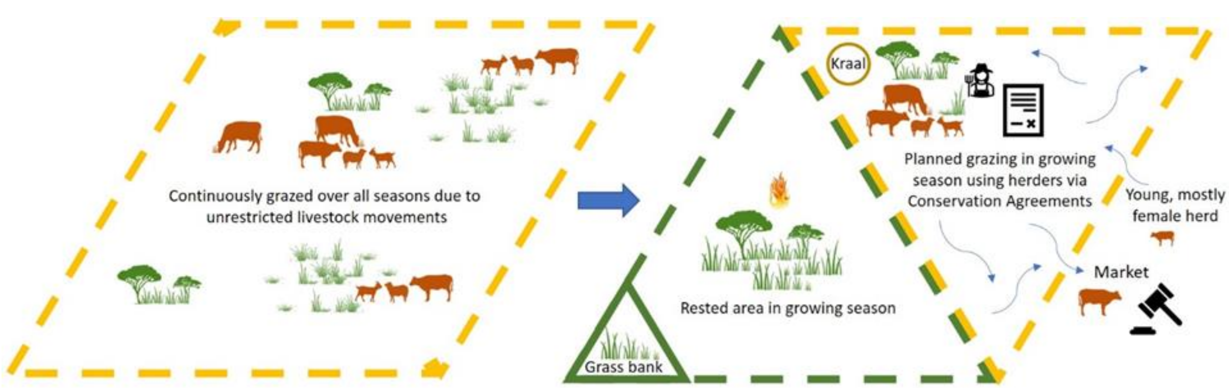

Figure 9: Change from continuous unrestricted grazing (left) to planned rotational-rest grazing (right). The large blue arrow indicates the direction of change. Small blue arrows indicate animal movement. The yellow and green dashed lines demarcate grazed and un-grazed (seasonally rested) areas, respectively. The solid green triangle indicates a 'grass bank' that may be rested for an entire year as drought forage at the discretion of the grazing association. Short-term kraals used to protect animals will not result in more than 50% dung cover as per VCS VM0032 criteria.

Planned grazing management is expected to reduce grazing intensity on communal lands via management of animal movement, restricting animals concentrating around water points and settlements as well as the maintenance of a rotational-rest area and grass bank. This will lead to productivity and diversity of perennial plant cover as well as increased carbon sequestration in the soil from plant litter and dung.

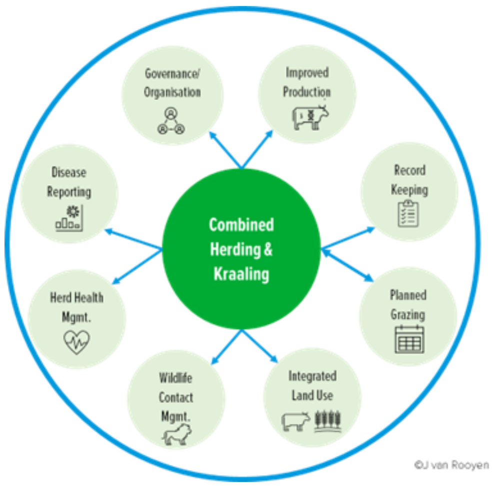

Figure 10: Herding for Health linkages of combined Kraaling and Herding

Implementation of the planned grazing is governed by the conservation agreement model. Using this approach, conservation agreements are signed by the community's livestock farmers, who are part of the Farmers Cooperatives (grazing associations), and by the project proponent (CSA).

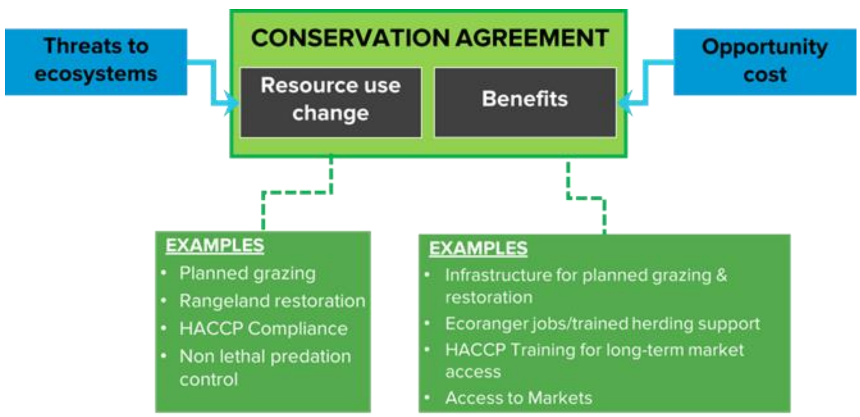

Figure 11: Conservation agreement model demonstrating how the change in resource use produces benefits, with a focus on mitigating threats to the ecosystem.

The agreement is discussed and drafted with the input of the farmers to ensure that the project also draws from indigenous knowledge. Under the conservation agreements, livestock farmers agree to implement sustainable grazing management while the project proponent undertakes to provide a suite of agreed benefits. Benefits include a livestock-to-market mechanism provided by our commercial partner Meat Naturally Pty (MNP). The MNP organizes mobile auctions that bring rural farmers and commercial buyers together; provides livestock management training for herders, NGOs, and farmers; and organizes mobile abattoirs, enabling increased market opportunities for farmers and providing NGOs and farming communities with bulk purchasing power and access to critical farming equipment and vaccinations. Fodder, ear-tagging for traceability, and ultimately favorable livestock prices are major incentives. Improved forage quality (crude protein) and younger herd structures are also expected to reduce overall livestock emissions via methane. Additionally, management of livestock via herding will also reduce livestock-wildlife conflict, while the tracking of livestock movements (herding and livestock tagging) should ameliorate restrictive disease control policies. Changes in fire management (frequency and seasonality) are expected to become more important as fuel loads (grass cover and biomass) increase due to project activities, and will be incorporated into grazing plans and agreements.

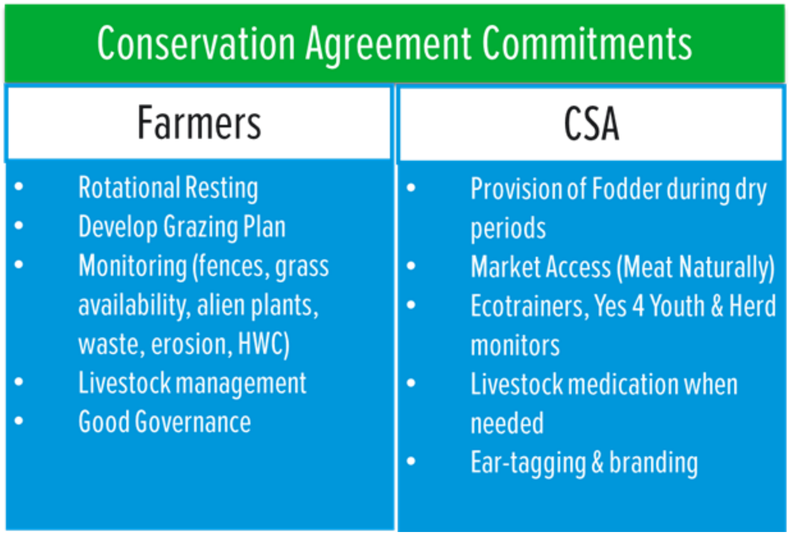

Figure 12: Example of the commitments under conservation agreements.

Yes 4 Youth

The facilitation of strategic herding and kraaling as per grazing management plans is done by skilled herders that are recruited from communities, trained in critical skills, and redeployed to communities to facilitate the implementation of best practices for rangeland and livestock management. Thus, the Yes 4 Youth program forms the basis of local job creation through the project. Yes 4 Youth is a government-led program to offer job experience to one of the most vulnerable groups in South Africa society: unskilled, low-educated, unemployed youth. The project offers 10 vacancies each year per available supervisor per community. The community and livestock herders decide who will get these vacancies depending on who they find trustworthy and fit for the job. The best of these Yes 4 Youth are offered the possibility to become Eco-rangers after their contract ends (1 year). Eco-rangers are the mentors of the Yes 4 Youth. Individual Eco-rangers qualify for further training to become Eco-trainers. Eco-trainers eventually move up to fill other positions as advertised in the organization.

Bush thinning, brush packing, and alien species clearing

In collaboration with SANParks and K2C Biosphere, alien plant clearing teams were formed to engage in bush clearing and removal of invasive alien plants in the parts of the rangelands which are affected by the species *Lantana camara*, *Psidium guajava*, and *Agave sisalana*. Brush packing involves pruning branches in areas that are bush encroached and packing the branches over bare patches. The bush thinning allows for better sun penetration and reduces competition from encroaching woody species on the herbaceous stratum. The branches that have been pruned from the tree is use on bare patches of soil to create a micro-climate which enables regrowth of grass and mitigates soil run off that may lead to erosion. In many respects, brush packing mimics elephant and other large herbivore behavior and impact on ecosystem functioning. These species outcompete and inhibit the establishment of indigenous species, leading to a reduction in biodiversity, loss of vigor in grass layer, and potentially modification of soil pH. Removal of invasive plant species is exclusively mechanical and is done by humans using hand tools. The project targets the clearing of alien (exotic) vegetation infestation and bush encroachment to a defined maintenance level to promote palatable grass growth and keep the flora and fauna diversity intact.

Awareness on wildlife conservation

The project also aims to reduce incidence of conflicts between herders and endangered wildlife species by engaging Eco-rangers in community sensitization activities. Eco-rangers engage continuously with the communities, raising awareness on the importance of wildlife, threats they face, and solutions to reduce conflict between wildlife and people. This is expected to increase tolerance of herders towards predators such as Wild Dogs (*Lycaon pictus*) and improve the prospects for conserving wildlife in general outside of protected areas. Eco-rangers are also responsible for patrolling communal rangelands and have received training in identifying wildlife tracks, specifically predators, to support neighboring nature reserves with tracking wildlife to have crossed over the fence. This supports rapid reporting of wildlife outside protected areas to the relevant authorities and aims to prevent human-wildlife conflict.

Boy and girl scouts
The project establishes scout centers within local communities where boy and girl scout activities are conducted once a week as an after-school activity for two hours. Here, children in the project communities learn the value of wildlife, recycling, and conservation. This is used as a vector to raise environmental awareness also at home. The scouts programme also educates youth on Water, Sanitation and Hygiene (WASH) through the CSA Veld Sanitation Guide.

ICT centers & skill development
Information, Communication and Technology (ICT) centers have been established by the project at schools and youth centers in communities who form part of conservation agreements. These centers are focused on providing reliable and fast internet connections and support youth with computer skills, e.g., assisting youth with drafting their curricula vitae in an electronic format. Where funding is available, the project plans to include bursaries/scholarships to youth in project communities.

Promotion of various gender-development and income-generating activities for women
The project also comprises an enterprise development component, where women-only workshops are held, and community women are provided training in financial literacy and business skills. The focus is placed on green retail businesses which are pro-nature. The women are also given support on regulatory compliance issues for their small businesses.

Through a combination of the above activities, the project uses a sustainable, community- and enterprise-driven model to address the complexity associated with rangeland degradation, climate-change vulnerability and greenhouse gas emissions, poverty alleviation and rural development in communities within and adjacent to protected areas. Due to the CSA track record in the area, scaling up can be fast-tracked. It will be possible to complete community consultation and include the remainder of the proposed areas by 2030 if sufficient funding is available.

2.1.12 Sustainable Development

The project will contribute to underprivileged farming communities' resilience to climate change by restoring nature's capacity to retain soil, provide fodder for livestock, replenish aquifers, store water, and reduce impacts of floods and fires. From South Africa's National Development Plan 2030[14], the project specifically addresses 2 of 13 stated action areas:

- Economy and Employment
- Environmental sustainability and resilience

The project also aligns with the objectives of the South African National Adaptation Plan[15] which are:

- Build climate resilience and adaptive capacity to respond to climate change risk and vulnerability.
- Promote the integration of climate change adaptation response into development objectives, policy, planning and implementation.
- Improve understanding of climate change impacts and capacity to respond to these impacts.

[14] https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf
[15] https://unfccc.int/sites/default/files/resource/South-Africa_NAP.pdf

- Ensure resources and Systems are in place to enable implementation of climate change responses.

The project will measure its contribution to Sustainable Development through indicators of the SDGs, particularly in outcomes 6 (Clean Water and Sanitation), 13 (Climate Action) and 15 (Life on land).

Table 4: Sustainable Development Goals of the K2C Rangeland Restoration Project

SUSTAINABLE DEVELOPMENT GOAL	SUB-TARGET	INDICATORS	RELATED PROJECT ACTIVITIES
6 CLEAN WATER AND SANITATION	**SDG 6.3 Improve water quality (6.3.2 - ambient water quality)**	Rangeland rehabilitation: spring repair Ecosystem health: critical habitat condition	WASH education project through the CSA Veld Sanitation Guide.
	SDG 6.4 Increase water-use efficiency and ensure sustainable withdrawals and supply to reduce water scarcity	Rangeland rehabilitation: spring repair Ecosystem health: critical habitat condition	WASH education project through the CSA Veld Sanitation Guide.
	SDG 6.6 Protect and restore water-related ecosystems	Rangeland rehabilitation: spring repair Ecosystem health: critical habitat condition	Rangeland rehabilitation: planned grazing WASH education project through the CSA Veld Sanitation Guide.
13 CLIMATE ACTION	**SDG 13 Combat climate change**	Soil carbon stocks	Rangeland rehabilitation: Planned grazing
		Net ecosystem exchange. Net CO_2	Rangeland rehabilitation: Planned grazing SNAPGRAZE (modelled)
	SDG 13b Combat climate change via education of the youth, women, and marginalized communities	Number of youth (16-24 yrs) trained formally (accredited), and informally (mentored, workplace learning, internship, primary health care session).	All activities

SUSTAINABLE DEVELOPMENT GOAL	SUB-TARGET	INDICATORS	RELATED PROJECT ACTIVITIES
		Number of people (>24yrs) trained formally (accredited), informally (mentored, workplace learning, internship, primary health care session).	All activities
		Number of influential actors (officials, traditional leaders, etc.) trained	All activities
		Number of organisations trained	All activities
15 LIFE ON LAND	**SDG15A. Increase financial resources to conserve & sustainably use biodiversity and ecosystems**	Number of direct beneficiaries in landscape	All activities
		Number of jobs created	All Activities
		Value of stock sales at auctions.	Rangeland rehabilitation: Meat Naturally
		Number of households supported from stock sales and GED	Rangeland rehabilitation: Meat Naturally
		Meat Naturally Pty turnover (Rands)	Rangeland rehabilitation: Meat Naturally
	SDG15.1 Conservation, restoration & sustainable use of terrestrial and inland freshwater systems	Number of Conservation Agreements - individuals and entities	Rangeland rehabilitation: Planned grazing
		Area covered by Conservation Agreements (hectares)	Rangeland rehabilitation: Planned grazing
		Compliant Conservation Agreements	Rangeland rehabilitation: Planned grazing
		Area of indigenous woody plant encroachment reduced (hectares)	Rangeland rehabilitation: Planned grazing
		Grazing plans in place	Rangeland rehabilitation: Planned grazing
		Number of rest days in grazing plan	Rangeland rehabilitation: Planned grazing
		Total camps area (hectares)	Rangeland rehabilitation: Planned grazing

SUSTAINABLE DEVELOPMENT GOAL	SUB-TARGET	INDICATORS	RELATED PROJECT ACTIVITIES
		Productivity/greenness of rangelands (NDVI)	Rangeland rehabilitation: Planned grazing
		Change in % basal cover of herbaceous layer	Rangeland rehabilitation: Planned grazing
		Plant biodiversity and composition. Shannon Wiener index / species list	Rangeland rehabilitation: Planned grazing
		Area of wetlands protected by planned exclusion of livestock (hectares)	Rangeland rehabilitation: Planned grazing
	SDG15.3 Combat desertification, restore degraded land and soil	Number of gabions, micro-catchments	Rangeland rehabilitation: Erosion control activity
	SDG15.8 Prevent and reduce invasive alien species	Hectares of Alien vegetation infestation	Rangeland rehabilitation
		Hectares of Alien vegetation cleared to maintenance level	Rangeland rehabilitation

2.1.13 Implementation Schedule (G1.9)

The start of the landscape intervention was a facilitated meeting by Conservation South Africa to bring together all stakeholders involved in rangelands and livestock in Utah, Dixie, and Welverdiend to develop a concept note. The skill audit and visioning process described in 2.3.3 below was followed with the villages. The concept was then developed into a Conservation Stewardship Program project. Following the CSP conservation agreement process described in 2.4.4 leading to the signing of conservation agreements with three cooperatives in their villages in August 2018 marked the project kick-off. Planned grazing was implemented in the initial Mnisi implementation sites covering 6432 ha of rangelands and engaging with 348 livestock farmers. The key conservation action, switching from unplanned, continuous grazing to ecologically informed rotational grazing, was successfully implemented across the target grazing areas. In addition, foundational steps were made towards enhancing internal governance of the Farmers Cooperatives (grazing associations), including democratic nomination and implementation of new leadership, underpinned by the conservation agreement framework. Initial implementation was funded by the Conservation Stewardship Program. These Mnisi sites will continue to be implemented and expanded until 2024 by CSA with French Development Agency (AFD) funding as part of the Pro Nature Enterprise.

After successful validation/verification, the subsequent verifications are planned at five-year intervals to allow sufficient time for the accumulation of carbon removals, especially SOC. Community engagement will be an ongoing part of the project as new areas will be continuously added.

Table 5: Milestones of the K2C Rangeland Restoration Project

Date	Milestone(s) in the project's development and implementation
April 2015	Baseline vegetation surveys undertaken
March 2017	Socio-Economic Survey baseline done in pilot sites
April 2017	Feasibility study assessing states of rangelands: • Veld Condition Assessment (G Wolfaard); • Conservation Stewards Programme Feasibility Assessment (Conservation South Africa) and • Vulnerability Assessment (S Holness)
October 2017	Stakeholder mapping & skills audit done. Inception meetings held & engagement on CSP commenced.
February 2018	Design & negotiation workshops started.
May 2018	Capacity building for CSA project staff, CSA Eco-rangers & Eco-trainers, K2C Env monitors, herd monitors to assist with the implementation of Rangeland Management Plans, monitoring. Community trainings to strengthen capacities for improved rangeland management
	Meat Naturally trial slaughters successfully conducted to demonstrate benefits to farmers.
August 2018	CAs successfully negotiated & signed with farmer organisations
	Grazing calendars collaboratively developed & implementation introduced in the rangelands.
October 2018	Infrastructure for monitoring gully erosion and water infiltration installed in grazing areas, baseline recorded
August 2019	First annual review of benefit packages provided to Farmers Organisations upon verified compliance to Farmers Organisations.
March 2021	Baseline soil sampling survey done in pilot sites as well as 10-year expansion sites.
2022-2023	SNAP graze model calibrated / validated for project area
2023-24	Project validation, First verification and credit issuance
Yearly	Monitoring of Climate, Community and Biodiversity indicators
2024	Mnisi 3-year expansion areas of 12,500 ha
2025	Bapedi Dinkwanyane (DWS) expansion of 11,800 ha
2028	Bushbuck Ridge Expansion of 51,000 ha
Every 5 years from 2023 onwards	Verification of Monitoring Report by external auditors

2.1.14 Project Start Date

The project start date was 8 August 2018 with the signing of conservation agreements between Conservation South Africa and implementation of grazing plans with the initial grazing associations (Ahitiriheleni and Nhlanganani cooperatives).

2.1.15 Benefits Assessment and Crediting Period (G1.9)

The project crediting period is 30 years from the start date: from 8 August 2018 to 7 August 2048. This is the project lifetime.

2.1.16 Differences in Assessment/Project Crediting Periods (G1.9)

There are no differences between the GHG emissions accounting, climate adaptive capacity and resilience, community, and/or biodiversity assessment and periods.

2.1.17 Estimated GHG Emission Reductions or Removals

The following table shows the estimated emission reductions or removals. Note that numbers are negative to imply a GHG emission reduction or removal. Further explanations on the ex-ante calculation can be found in chapter 3.2.4.

Table 6: Estimated GHG Reductions or Removals

Year	Estimated GHG emission reductions or removals (tCO_2e)
2019	-15508
2020	-15508
2021	-15508
2022	-15508
2023	-25554
2024	-35601
2025	-45647
2026	-55913
2027	-67390
2028	-79084
2029	-91019
2030	-102954
2031	-114889
2032	-126824
2033	-138759
2034	-150694
2035	-162628
2036	-174563
2037	-186498
2038	-198433
2039	-181073
2040	-181073
2041	-181073
2042	-181073
2043	-181073
2044	-169826
2045	-158580
2046	-147334
2047	-135841
2048	-122993
Total estimated ERs	**-3,458,420**
Total number of crediting years	**30**
Average annual ERs	**-115,281**

2.1.18 Risks to the Project (G1.10)

The risks as well as their mitigation strategy is presented in the table below. The main risk is a lack of changed grazing intensity or herd structure, which may arise due to e.g., unfavorable climate, inadequate stakeholder engagement, or traditional tendencies to keep older male animals.

Table 7: Project Risks

RISK EVENT / ISSUE	DESCRIPTION	POTENTIAL MITIGATION STRATEGY
Non-compliance of communal farmers with agreed restoration activities (planned grazing, management of herd characteristics)	Compliance of farmers depends on short-term (2-yr) conservation agreements (CAs), which in turn depend on incentives (auctions, fodder, training, etc) and farmer willingness	Non-compliance means no benefits (auctions, etc). The well-established social enterprise (Meat Naturally Pty, MNP) provides a sustainable market mechanism that has proved to encourage good compliance with CAs. Extend conservation agreement renewable period to 5 years.
Land ownership and Land rights	Land ownership is a complex issue in communal systems, meaning the land is state owned and without an individual ownership title deed but is rather under the custodianship of the Tribal Authorities and recognised under the Communal Land Rights Act 11 (2004) and the Interim Protection of Informal Land Rights Act (IPILRA) of 1996. The use of the land is decided through the Tribal Authority and local municipal government through consultation with communities and community structures. Therefore, change in land use from communal rangeland to any other land use is possible but unlikely.	Livestock ownership is part of cultural practices. Therefore, the need for communal land to graze livestock is entrenched and not easily lost. Small portions of the areas may change in land use but not in totality.
Climate change impacts are evident in the area and predicted to increase through longer dry seasons and increased temperatures.	Longer dry seasons and increased temperatures are stressors for livestock production in communal rangelands. Here, people rely heavily on rainfall and surface water for livestock as well as good grass production. Over-utilization during growing seasons can result in increased risk during the dry periods.	Planned grazing should account for extreme climatic predictions to ensure that risk is mitigated. An incentive for better quality animals ahead of higher quantity of animals should be incorporated from the beginning to reduce over utilization
Foot and Mouth Disease	The areas adjacent to the Greater Kruger fall within the Foot and Mouth Vaccination zone. This is monitored by state vet services, and, if foot and mouth disease is detected in the area, it can slow the progress of certain activities	Work by CSA in FMD areas to find alternative market options and policy work with the OIE around FMD regulations are already underway and are well supported.

RISK EVENT / ISSUE	DESCRIPTION	POTENTIAL MITIGATION STRATEGY
Discrimination	Women and youth experience discrimination in the distribution of benefits because they do not own large herds of cattle.	All CSA employees are familiarised with CSA's non-discrimination policies and follow the principles of these policies during all stakeholder engagements. In addition, CSA employees promote gender equality according to the gender plan.
Land Use Change	There is pressure from urban areas, and some areas might be needed for urbanisation and expansion.	Support and work with local authorities such as Traditional Councils and Municipalities to mitigate land use change impacts on important ecosystems, such as the rangelands.

2.1.19 Benefit Permanence (G1.11)

The project forms part of CSA's efforts to implement community-led sustainable rangeland management including local job-creation and value-chain improvements. Over the project lifetime, CSA intends to hand over as much of the project ownership as possible to Farmers Cooperatives that demonstrate good governance. This will be achieved by setting up a community-led governance and organizational structure (Figure 15) that can distribute the profits transparently and continue the function of delivering the benefits derived from conservation activities long beyond the lifespan of this project.

Project activities implemented over the project lifetime (e.g., planned grazing periods as decided by the livestock farmers, tagging and branding of cattle, market access through Meat Naturally offering fair prices) should form communal habits and be adopted as prevailing practice over the next decade. Witnessing higher income through better prices, improved cattle production and increased palatable grass cover as a result of sustainable rangeland management, farmers should continue this beneficial way of managing rangelands. This way, the benefits of the project for climate, community and biodiversity permeate after the project. An example of success from the project is made by communities directly benefitting from increased grass growth in rested camps, which reduced the number of additional fodders purchased during the dry season. Livestock farmers have also seen additional benefits from improved prices for their cattle per kg through the Meat Naturally interventions.

2.1.20 Financial Sustainability (G1.12)

The project costs follow four main categories: establishment costs, implementation costs, program management costs and carbon accounting costs. These are summarized as:
Establishment Costs: The overall project establishment costs are approximately $369,000, the majority of which will be incurred in 2022 and 2023. These costs include technical analysis, consultation processes and costs associated with developing the PDD and project validation. The PDD is expected to be submitted in the first half of 2023, with first expected validation and credit issuance in late 2023.
Implementation Costs: Implementation costs for the project average around $1,269,000 per year throughout the life of the project, for a total cost outlay of approximately $38 million. Implementation costs involve costs for Eco-rangers (i.e., community jobs), equipment, dedicated staff implementation functions, and the management of the community-owned entity that will distribute the community profits over the life of the project for project related activities.

Program Management Costs: Program management costs cover personnel costs for managing the project, including technical advisory during project implementation and engagement with service providers. These costs average $131,000 per year and aggregate to just over $4M over the life of project; some of these costs are embedded in the implementation costs.
Carbon Accounting Costs: This includes standard costs associated with issuance and registration of carbon credits and verification costs. While the project proponents have the option to choose the frequency of verification, the financial model assumes verification is conducted every three years, with the first verification planned for 2023. Carbon accounting costs an average of $33,000 per year throughout the life of the project, for a total of $1,000,000 over 30 years.

Commercial Model
The primary source of revenue in the financial model is through the sale of verified carbon credits generated from the project. Over the 30-year lifespan of the project, the project is estimated to generate around 3 million tons of verified carbon credits, net of carbon held in the buffer (15%). On an annual basis, the project is expected to generate 115,281 tCO_2e/year. The financial model assumes that the first issuance of credits occurs in FY23. The first issuance of credits includes tonnage from year 2018-2022, amounting to 54,914 tCO_2e (including deductions of non-permanence risk and buffer for uncertainty). Subsequent verification and issuance occur every three years. With regard to expected sales of generated credits, this analysis does not account for an estimate variation in future demand for carbon credits. The analysis assumes that an average quantity of credits generated is sold each year, with the excess credits banked for subsequent years. This helps smooth project financial flows and ensures there is sufficient cash flow over the course of the project's life.

The start-up financing of the project including any gap-financing after the first issuance of credits is funded by CI and AFD.

Table 8: Summary of financial model.

Description	12 Years Aggregates	30-Year Estimates	Annual Estimates
Carbon (Tons) net	564,938	3,456,832	115,228
Carbon Value ($) @ $9.00, 6% increment	$9,974,990	$109,819,056	$3,660,635
Establishment Costs	$369,945	$369,945	$184,973
Implementation and Management Costs	$6,725,530	$38,086,567	$1,269,552
Carbon Accounting Costs	$418,002	$1,011,386	$33,713
Total Costs	$7,513,477	$39,467,899	$1,488,238
Breakeven price	13.30	11.42	
Breakeven Year	Year 1		
Project has secured 80% or more of funding needed to cover the total cash out before the project reaches breakeven	Grant by CI		

Note: The 12-year figures represent 12 years from the project start date of FY19, which would include 12 years of credits but only 8 years of actual costs incurred, due to backend credits.

2.1.21 Grouped Projects

1) Eligibility Criteria for Grouped Projects (G1.14)

New instances to this project are part of CSA's scale-up plan and thus apply the same criteria and theory of change as described in G1.8. Namely these criteria include:

- Project activities include establishing conservation agreements with local communities with the conditions as shown in Figure 12.
- The area consists of grasslands (savanna).
- Lands are grazed and/or subject to fires in the baseline and/or project scenarios. Lands may be used for different purposes, such as livestock production, conservation, hunting or tourism.
- Livestock is kept within the project area, and the boundaries of the project area are enforced (mostly via herding and fencing).
- There is no net increase in the density of, or time spent by, animals in confined corrals where dung can pile up and begin to decompose anaerobically and result in CH_4 and N_2O emissions, such as an increase in the number of livestock aggregated (e.g., kept in corrals or pens) that would result in more than 50 percent of the ground area covered by dung.
- Baseline emissions derived from livelihood-driven human impacts on aboveground woody biomass (e.g., cutting for fuel wood, charcoal, or timber sales) must be deemed *de minimis* (i.e., not included in the cumulative 95 percent of total baseline emissions) and project activities cannot significantly alter such livelihood-driven activities. This applicability condition was modified in an issued Errata and Clarifications to VM0032 and restated as "…must be deemed de minimis (not greater than 5% of the total greenhouse gas benefit of the project)…".
- The baseline scenario in terms of climate, community, and biodiversity is the same as described in chapter 2.2.
- Being in line with the additionality situation as provided in G 2.2 or chapter 3.1.5.
- Being subject to the same processes for stakeholder engagement described in G3 and respect for rights to lands, territories and resources including free, prior, and informed consent described in G5.
- Being monitored with the same methods and parameters as shown in this document.

2) Scalability Limits for the Grouped Projects (G1.15)

The project is planned to be scaled to around 83,200 ha. This is according to CSA's ten-year plan and corresponds to the area achievable within the traditional authority areas in which CSA is currently working. The project needs to scale up similarly its capacities (management, staff) as its spatial scale increases. However, this is no hard limit to scalability within the K2C biosphere reserve. Yes 4 Youth has a constant stream of candidates for future Eco trainers, and existing staff can take over director roles. Negative impacts on biodiversity with increased scale are unlikely because of the project's largely positive biodiversity impacts. Rangelands are defined by the Republic of South Africa. Thus, project activities can only happen on rangelands, and land use conversion is not expected.

3) Risk Mitigation Approach for Grouped Projects (G1.15)

Not applicable because no scalability limits in the sense of the methodology apply.

2.2 Without-project Land Use Scenario and Additionality

2.2.1 Land Use Scenarios without the Project (G2.1)

The baseline scenario is the same as the conditions existing prior to the project initiation. The rangelands in the project area have been degraded over time due to anthropogenic causes and continue to degrade. This degradation is a result of population growth, political marginalization connected with the history of

South Africa, and unchanged livestock grazing and herding behavior. Such degradation is not a result of any incentive to subsequently produce carbon credits. Section 3.1.4 provides more detailed information on this baseline scenario.

2.2.2 Most-Likely Scenario Justification (G2.1)

Without the proposed carbon project, the most-likely scenario is the continuation of the baseline scenario. This is due to a widespread lack of access to services, training, and infrastructure to support a change in grazing practices. Since communities lack training in tourism/other sectors and keep livestock for cultural reasons, it is not expected that they favor the conversion of rangelands from grazing purposes. Moreover, the resident communities in the project area are highly dependent on water, natural- and grazing resources (Figure 13) of the rangelands for their livelihoods. The increasing population and the effects of climate change in the project area are thus likely to worsen the degrading conditions in the absence of incentives offered by the project. In addition, there is a cultural tendency to maintain a herd structure that is unfavorable for climate change mitigation, i.e., less efficient forage to energy production with relatively high methane emissions from older, larger (male) and less climate-adapted animals. The tendency to keep older animals, including large bulls, arises because livestock represent personal wealth and status and are integral to the ethnic groups in the project area. Section 3.1.5 shows further evidence on the justification of this most-likely scenario.

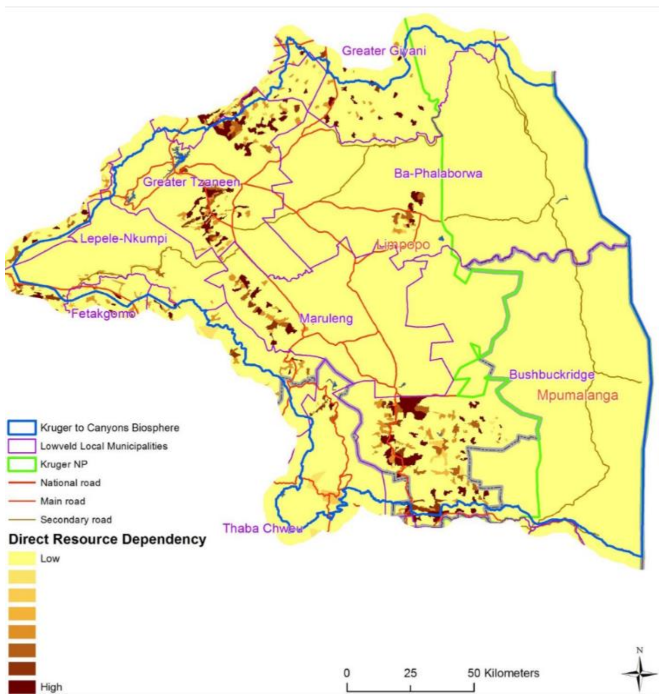

Figure 13: Climate Vulnerability Assessment showing areas where farming communities have direct dependence on natural resources including water, grazing, wood, and building materials. Source: Holness 2017[16]

2.2.3 Community and Biodiversity Additionality (G2.2)

The additionality of the project is discussed in detail in section 3.1.5. The arguments provided there also apply to community and biodiversity benefits since the project activities depend on the finance provided by carbon credits. Extension services, Eco-rangers, vocational training for women, and other community benefits are all provisions that are simply not available in the project area from other sources. The financing through the carbon project would provide the necessary continuous and long-term financing source to pay for these activities.

[16] Stephen Holness 2017. Priority Areas for Ecosystem-based Adaptation to Climate Change in the Kruger to Canyons Biosphere.

In addition, biodiversity benefits are hampered by barriers due to social conditions and land-use practices. Predator conflicts have also been reported within the project area, such as when wildlife leaves the protected areas and enters the rangelands through damaged fences. This often results in retaliatory killing of wildlife following an attack on livestock. Poaching is also a common problem, with occasional conflict between law enforcement and poachers that are embedded in the communities. Without project interventions, such conflicts are expected to continue as worsening rangeland conditions deplete the resources on which communities within the area rely for their livelihoods.
The current population growth rate is high, and urbanization and development, especially to meet essential needs such as housing, can generate conflict if not correctly addressed. The regulation of building is the responsibility of the municipality via town planning, however, a lack of resources often limits the enforcement of the legislation and unplanned development is taking place in the rangeland.

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

There are no plans to use any community or biodiversity benefits as offsets.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

The different stakeholders of interest will be able to access the complete documents and monitoring reports of the project freely and within a means to which they have access. Hard copies will be left with the traditional authorities, in the communities and in schools/youth centers where CSA provides internet access. The project monitoring report will also be published on the Verra website and made available to the wider public for a public commenting period. CI and CSA will share this link as well with other project stakeholders for their information and input.

2.3.2 Dissemination of Summary Project Documents (G3.1)

As mentioned above, project description documentation and monitoring reports will be shared as hard copies with the traditional authorities, in the communities and in schools/youth centers where CSA provides internet access. A translated summary is planned to be provided with this documentation. In addition, Eco-rangers and/or CSA staff will present and discuss summaries of the documents in the livestock committees as well as in the events of the Scouts. These presentations will take the form of focused feedback sessions on specific issues of particular interest to stakeholder groups such as soil, grazing quality etc.

2.3.3 Informational Meetings with Stakeholders (G3.1)

Traditional Authorities were consulted first before approaching the communities since they are the statutory custodians of the land. At the project inception phase, CSA Environmental Monitors working on a particular village approach the village Induna (local chief) to introduce the project and seek approval to work in the Village. Once approval is obtained from the Induna, CSA then facilitates community meetings to explain the intended project and engage members of the community, partners, CDF, businesspeople, land users, government employees, youth, women, and all influencers. After this is done, the venue and all other necessary resources are then organized to facilitate the Skills Audits and visioning workshops. During visioning workshops, the communities voice their challenges and needs, their skills and resources, as well as their connections with other organizations. CSA then presents itself, checks for which challenges they can provide help and then explains how they will deliver this help through conservation agreements. This process is described in CSA's field guide[17] serving as the SOP on outreach. After the engagement team presents the conservation agreement idea (including costs, benefits, and risks, if any) and verifies that the stewards understand the intent, the representatives are given as much time as they need to communicate with their constituency and discuss the desirability of designing an agreement with CSA. CSA confirms that the decision made reflects the sentiment of the wider resource user group, for example through randomly selected focus groups or informal individual interviews (with representatives from a variety of social groups). The objective of this step is to ensure that the resource users understand

[17] Supporting documents “CI_CSP-Field-Guide”

and consent to the proposition of proceeding to the next step, namely designing a conservation agreement. So far, design and negotiation workshops were successfully facilitated with four Farmers Cooperatives in Mnisi area, two in Welverdiend and one each in Utah and Dixie.

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

During the engagement phase, CSA presents the conservation agreement concept to the resource users (stewards) to introduce the idea and explore whether they are interested in working together toward an agreement. During the process, it is ensured to involve all relevant groups within a community (women and men, youth as well as the elderly, different resource-user groups, marginalized sub-groups, etc.) This phase also sets the stage for design and negotiation of the agreement, by presenting what an agreement is and how it works, verifying understanding of the concept, and seeking a mutual decision to proceed with design of specific agreement terms. Since conservation agreements are voluntary, CSA emphasizes that this is a choice and ensures that stewards understand the concept. Once communities show interest in working towards a conservation agreement, negotiation workshops ensue whereby the conservation actions and benefits are designed together with the communities. During negotiation workshops the costs and benefits are explained to farmers by experienced facilitators following the CSP Field Guide SOP. All exchanges take place in the local languages of potential stewards', while observing cultural norms and expectations to ensure transparency and a shared understanding.

2.3.5 Information to Stakeholders on Validation and Verification Process (G3.3)

When the project was initiated, it did not envision to be developed into a carbon project according to the Verified Carbon Standards (VCS). However, since the inception of these standards in the project scope, livestock farmers that are part of the conservation agreements, have been made aware of what it means to align the grazing project with a VCS methodology. CSA took a tiered approach in disseminating communications regarding this process.

The first step was to draft communication materials describing what carbon is, how the methodology speaks to the grazing activities, and how carbon markets work. This training material will be made available to the validator. Once the material was created it was important that the CSA team understood what this entailed and undertook a train-the-trainer approach. This approach rolled out a series of training sessions that were facilitated to the Eco-trainers, Eco-rangers, Yes 4 Youth supervisors and Yes 4 Youth participants. These sessions included a practical session in-field that spoke to how herbaceous cover supports soil organic sequestration. The train-the-trainer approach enables large scale knowledge sharing within local communities.

The second stage of communication and information dissemination was focused on the Farmers Cooperatives (grazing associations). This was done through two communication methods. The first method focused on presentations that were presented at the weekly Farmers' Cooperative meetings, where a presentation was given on the prepared materials. Discussions were also held with printed materials (some farmers do not have good vision, and the printed material made it possible for them to see the presentation). Throughout these engagements, the communications were translated and facilitated in Tsonga, a local language.

The second approach was done through video screening sessions. A video was played that explained the carbon project and was translated on-site to facilitate discussion and understanding. Key questions were captured during these engagement sessions to provide feedback to communities if there were any uncertainties. These screening sessions were also open to all community members to attend.

CSA promotes open and informed communication between all its stakeholders. It is extremely important that conversations regarding the carbon project are continuous and that Eco-trainers continue to facilitate carbon-related discussions with grazing organizations in a way that they can understand. All engagement materials can be made available upon request.

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

As soon as auditing events are scheduled, stakeholders are informed via communication by the Eco-rangers in the weekly meetings of farmers on the date and planned timing of the site visit. CSA will organize the meetings between the auditor and stakeholders and moderate introductions. At the discretion of the auditor, CSA staff shall leave the meeting for enough time so that stakeholders are not influenced by the presence of the project proponent. For a closing of the discussion, CSA staff stays on site and can be called back to the meeting as necessary.

2.3.7 Stakeholder Consultations (G3.4)

As described in sections 2.3.1, 2.3.2, the first step in the conservation agreement approach involved visioning workshops where the communities voice their challenges and needs. Afterwards, CSA presents the concept of conservation agreements, and resource users consent to further processes. Negotiation workshops commence, where conservation agreements are designed. In conservation agreements, farmer associations agree to certain conservation actions in exchange for incentives/benefits. These conservation actions make up the inputs for grazing plans, which are drafted together with Eco-trainers in a subsequent step. All farmers are present when grazing plans are made, and they jointly take the decision to participate during the planning session. Throughout the whole approach, stakeholders are directly involved in the project activity design and in selecting benefits which are most suited to their needs. (See Supporting Documents “Stakeholder Consultations” and “Conservation Agreements”). Furthermore, it is planned that stakeholders will become the owners of this project over time. CSA is acting as the initial Project Proponent and leading project development until such time as the cooperatives register a community-owned entity.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

The management and steering of the project are influenced by the continuous feedback obtained by the Eco-rangers who work directly with the farmers as well as by other CSA staff involved, e.g., in pro-nature business development supporting other community members (oftentimes women) with compliance and business-related questions. Feedback is also collected through project monitoring structures, e.g., weekly farmer meetings and bi-annual household surveys. For future upscaling of the project in terms of area or quality, feedback from stakeholders is encouraged and considered in the management plan as much as possible. Continued stakeholder consultation according to the processes described in sections 2.3.3, 2.3.5, and 2.3.7 is expected as project expansion continues.

2.3.9 Stakeholder Consultation Channels (G3.5)

Stakeholder engagement and participatory processes through which the project organizes information sharing and consultations are described at length in sections 2.3.3, 2.3.4, 2.3.5, and 2.3.7. In addition, a strong focus throughout this project has been placed on strengthening institutional capacity and decision making of the participating farmer communities. This takes the form of formal training, as well as informal interactions through attendance at weekly grazing association meetings. Meetings are organized and chaired independently of CSA, minutes taken by a nominated member, and CSA is requested to report back on issues where necessary.

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

Respecting customary decision-making mechanisms within communities ensures that CAs are adapted to local realities. However, it is important to also remember that some customary decision-making mechanisms do not allow for disadvantaged or marginalized groups to be heard. It is necessary to find culturally appropriate ways to ensure those voices are part of decision-making. Various socioeconomic and cultural dimensions shape social groups, such as ethnicity or race, poverty level, gender, age, field of work or religion, among others. This is considered by the engagement team. As an example, when CSA commenced with the engagement of Farmers Organizations to introduce and discuss CSP and conservation agreements, there was limited inclusion, especially of youth and women. This was largely on account of prevailing cultural norms and taboos in the area. These norms and taboos often meant that women and young people did not speak during workshops or meetings and therefore their inputs on the process were not included. Through introduction of FPIC the team highlighted the importance of

everyone's participation in the process and this prompted the leadership to start encouraging everyone to speak in meetings, although this was a slow process overtime participation of women and youth improved as the chairperson (in Utah village) would use the techniques such as saying "for the next 10 minutes we only want inputs from the women", this allowed some of the more outspoken men to give others a chance to speak, until it became a norm over time. Creation of informal communication platforms also played a useful role. For example, during breaks women or silent participants in the meeting are asked bilaterally for their inputs and if they are happy with where the discussion is going. Also, house visits by female environmental monitors allowed the team to capture the inputs of women and youth members.
Throughout the implementation stage participation of these two groups, especially in Utah and Dixie villages has improved to the point where women lead key processes such as facilitation of learning exchanges and being representatives at meetings with the department of agriculture and recently were they successfully engaged the MTPA on compensation packages for farmers who lost livestock due to lions breaking out of the Manyeleti Nature Reserve which is next to the communities.
Since participation in conservation agreements is voluntary, CSA works to ensure that community members who are not willing to participate in project activities are not stigmatized or forced to participate via the imposition of other community members. Communal livestock farmers are sensitized about the voluntary nature of the agreement and educated on conflict management within the project.

2.3.11 Anti-Discrimination Assurance (G3.7)

The project is committed to the fair treatment and equal opportunity for all stakeholders, community members and employees. Neither the project, nor any agent of the project, will discriminate against any person for any reason, including – but not limited to – gender, religion, nationality, tribe, or sexual identity. CSA is committed to providing a workplace and programmes that are safe and free from all kinds of harassment. CSA's Code of Ethics as well as policies towards Harassment and Workplace violence and Gender Policies are available under the supporting documents 'CSA internal policies and processes' folder.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

The project implements CI's 6-step Accountability and Grievance mechanism as outlined below (Figure 14).

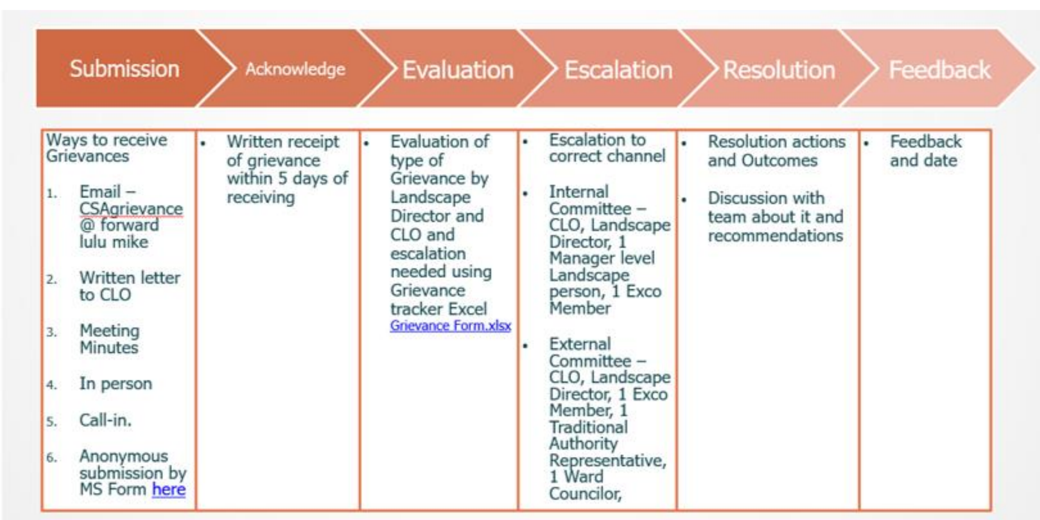

Figure 14: Overview of the Grievance redress mechanism for the K2C Carbon project

Submission
Stakeholders are encouraged to channel their grievances to the project proponents through formal meetings (face to face or online) where possible. The minutes of such meetings are to be noted and archived, and attendance registers taken. Alternatively, grievance redress is handled via a dedicated email account, phone calls, in writing or anonymously via an online Microsoft form.

Acknowledge
Receipt of the grievance is acknowledged and communicated in writing within 5 days after the grievance is lodged through any of the above-mentioned channels.

Evaluation
Each grievance is then reviewed to understand whether a potential breach of CI's environmental and social safeguards, principles, standards, or procedures has occurred. The mechanism then looks to identify the root causes of the subject of the grievance and ensures that issues of non-compliance with CI's environmental and social safeguards are corrected.

Escalation
Where necessary the grievance is escalated to appropriate internal or external channels for resolution. This process also considers traditional conflict resolution procedures by including relevant local authorities where necessary.

Resolution
The resolution of grievances includes identifying recommendations and actions to reach a desirable outcome from the situation. This could involve follow-up meetings or calls to ensure satisfaction and equity in addressing the grievance(s).

Feedback
After a resolution has been reached, the grievance is closed, and feedback is given to all parties involved on the outcome.

The project team records and track grievances on live form on SharePoint. Records of grievances are available in supporting documents folder 'Grievance Tracker_Form'. For additional information on the project's Grievance Mechanism, refer to Grievance Overview.ppt provided in the supporting socuments.

2.3.13 Accessibility of the Feedback and Grievance Redress Procedure (G3.8)

The Eco-rangers promote awareness of the feedback and grievance process during weekly farmer meetings and other interactions. This way, direct stakeholders are made aware of the various channels through which they can raise issues. The proponents will also promote external awareness of the feedback and grievance process to larger audience of stakeholders via processes outlined in section 2.3.1.

2.3.14 Worker Training (G3.9)

The following training is provided to field staff implementing project activities:

- Workplace Ethics Training
- Conservation Stewardship Program field guide training
- Project team trained on carbon, carbon credits and financing.
- Veld and Sanitation Training (for Environmental Monitors, Eco trainers and project staff)
- Training in facilitation skills, difficult conversation & conflict resolution.
- Financial Literacy (Yes4Youth, Eco trainers, Environmental Monitors & project staff).
- Gender Based Violence Training (Yes4Youth, Eco trainers, Environmental Monitors & project staff).
- Alien Invasive Plants Removal Training
- Waste Management Training through Operation Basis
- Rangeland management and restoration learning exchanges.

Almost all staff in the project area are either directly or indirectly connected to livestock herding, grazing management, and livestock marketing as either they or their families own or have owned cattle. So, the skills learnt in these trainings cater to locally useful skills and knowledge. So far, the project shows little staff turnover, partly also since local job opportunities are rare. Potential gaps in the staff of e.g., Eco-rangers can be filled through learning exchanges hosted by senior team members.

2.3.15 Community Employment Opportunities (G3.10)

The Yes 4 Youth program forms the basis of local job creation through the project. Yes 4 Youth is a government-led program to offer job experience to one of the most vulnerable groups in South Africa society: unskilled, lowly educated, unemployed youth. The project offers 10 vacancies per supervisor each year per community. The community and livestock herders decide who will get these vacancies depending on who they find trustworthy and fit for the job. The best of these Yes 4 Youth are offered the possibility to become Eco-rangers after their contract ends (1 year). Eco-rangers are the mentors of the Yes 4 Youth. Individual Eco-rangers qualify for further training to become Eco trainers. Current Eco trainers eventually move up to fill Monitoring and Evaluation positions. Eco-rangers are also selected from local communities and are employed on an annual basis, the selection of Eco-rangers is done through community consultation. As the project expands throughout the landscape it envisions having an Eco-ranger present in each community.

Livestock herding is culturally male dominated. Recognizing this and to also provide opportunities for women in the project, vacancies in other parts of the project, such as finances/operations, livestock marketing, pro-nature business development, and more are specifically reserved for women.

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

The following laws and regulations contain provisions with regards to labour rights in South Africa:

1. Basic Conditions of Employment Act (BCEA): This act sets out the minimum standards for working conditions, including working hours, leave, payment, and termination of employment.
2. Labour Relations Act (LRA): This act regulates the relationship between employers and employees and provides for collective bargaining, dispute resolution, and protection of employees' rights.
3. Employment Equity Act (EEA): This act promotes equal opportunities and fair treatment in employment, prohibits unfair discrimination, and requires affirmative action measures to redress imbalances in the workplace.
4. Compensation for Occupational Injuries and Diseases Act (COIDA): This act provides for compensation for employees who suffer injuries or contract diseases arising from their work.
5. Occupational Health and Safety Act (OHSA): This act sets out the health and safety standards for workplaces and imposes duties on employers to provide safe working conditions.
6. Skills Development Act (SDA): This act promotes skills development and training for employees and provides for the establishment of Sector Education and Training Authorities (SETAs).
7. National Minimum Wage Act (NMWA): This act provides for a national minimum wage that employers must pay their employees, as well as for exemptions and enforcement measures.
8. Unemployment Insurance Act (UIA): This act provides for the payment of unemployment insurance benefits to employees who become unemployed or are unable to work due to illness or maternity leave.
9. Skills Development Levies Act (SDLA): This act requires employers to contribute a percentage of their payroll to the National Skills Fund, which is used to fund training and development initiatives.
10. Employment Services Act (ESA): This act provides for the establishment of public employment services and the registration of private employment agencies.

Key elements of these labour laws are embodied in the employment contracts of workers, according to National and Provincial legislation, governed by The Department of Employment and Labour. These Departments ensure the implementation of the country's and province's labour laws, regulations and

policies and protect labour rights. The core mandate of the Department of Employment and Labour is to regulate the South African Labour Market for sustainable economic development through appropriate legislation and regulations, inspection, compliance monitoring and enforcement, protection of human rights, provision of employment services, promotion of equity, social and income protection, and social dialogue.
South Africa joined the ILO (International Labour Organisation) in 1994. The country has ratified 28 ILO Conventions. Of these, 25 are already in force in the country. The project proponents being a socially responsible organization will ensure that any relevant international conventions or government laws and regulations (provincial and national) are fully followed.

2.3.17 Occupational Safety Assessment (G3.12)

CSA as an affiliate to Conservation International (CI) is working in increasingly complex environments that pose a range of safety and security risks to our people, assets, operations, and reputation. Conservation International believes that managing these safety and security risks is essential in not only ensuring that our critical assets are protected, but also to guarantee we can continue to empower societies to care for nature, our global biodiversity, and for the well-being of humanity. Conservation International will take every reasonable measure to ensure that safety and security risks are minimized.

The following risks to the health and safety of workers were identified through the project's CI safety and security analysis process. The CI Safety Screening risk assessment provides further details on the security plan for CSA (Conservational International South Africa Safety Security Plan V2). All workers are fully informed about workplace risks and safe practices to mitigate those risks. These include training in conflict resolution, safe working practices, as well as the enforcement of requirements for safe handling of equipment and other materials. All CSA employees are contracted under a medical aid scheme that prescribes the minimum requirements for medical cover to ensure that each employee has access to an accepted standard of medical treatment.

Table 9: Identified health and safety risks.

Project activity	Risk	Mitigation
Office Security	Office fire Break-in / Theft Injury while at office	• Each office has their keys held by the respective focal point, with spare keys held by landscape director. • An annual fire drill should be held. A fire drill is effective if it results in the rapid evacuation of all people from the office and to the pre-arranged rendezvous point outside of the building. • Fire-fighting equipment is available (this needs to be purchased) • The office first aid kit is stored in the kitchen cupboard in the boardroom and contains basic supplies to treat a patient during an emergency. • If you are in the office at the time of the break in, attempt to leave the office and contact the police when safe to do so, do not confront intruder
Travel Security	Vehicle Accident	• Conservation South Africa relies currently relies on CI owned vehicles and utilizes CI staff who have a valid driver's license for driving. • All CI staff who are authorized to drive for work duties must have their local driving license on file. • Cars must only carry the number of passengers as legally authorized by the vehicle and insurance. No passengers should ride in the back of pickups.

Project activity	Risk	Mitigation
		• Conservation South Africa hired vehicles must have the following equipment (depending on whether or not the travel is rural or urban); o Safety belts (Urban and Rural) o Spare tire and tools (U/R) o First aid kit (often provided by CI) (R) o Adequate fuel for the journey (U/R) o Hazard signs to mark the vehicle in the event of a break down (U/R0 o Communications equipment – if travel is beyond mobile network for extended periods then consider satellite communications devices. (R) o Water and basic emergency food supplies (R) o Emergency blankets and mosquito nets (R) • No road travel between towns will occur during the hours of darkness, except in exceptional circumstances (such as medical emergency) authorized by the CEO of Conservation South Africa or Operations Director.
Ranger Patrolling and Confrontations	- Injury on duty resulting from restoration activities. - Conflict from livestock theft - Increase illegal poaching and rangelands become unsafe for herders	• Eco-rangers, must be deployed in locations with mobile coverage and have contact numbers for the relevant local police and local community leaders. • Prior to deployment, Eco Rangers/ Restoration workers are given level 1 and 2 first aid training as well as Health and Safety training. • Evacuation plans for each field site are required and monthly health and safety meetings with teams will help to highlight concerns and complications. Typically, the type of issues being reported include people not wearing PPE, drunken workers, community conflicts, etc. • Ensure all restoration workers are fully equipment with the correct PPE prior to any restoration work may commence. • Whenever rangers observe livestock thieves or people suspected of planning these activities they must alert the police and local community livestock committee, which will mobilize members of the community to confront the thieves. The Eco Rangers should not directly engage with the thieves who should be considered as being armed and dangerous. • Collaboration with SANParks and authorities. • Introduction of alternative, sustainable livelihoods to discourage poaching activities. • Do not engage directly with any suspected illegal poachers.
Wildlife Attacks	- Domestic or rabid dog - Lions - Elephants - Hippos - Buffalos - Crocodiles - Snakes	• When budgeting for Eco rangers working in high-risk areas the programs should budget to have the individuals vaccinated against rabies. • Don't make direct eye contact but shout at the animal look threatening and confident. • Keep a safe distance form the wildlife and do not engage it and walk away from it and report sighting to team members • Stay in the vehicle if you suspect wildlife in close proximity.

Project activity	Risk	Mitigation
		• Should you be bitten follow the emergency response guidelines and contact emergency services..
Health	- Malaria - Typhoid	• Take malaria precautions such as wearing long sleeves, insect repellent, use mosquito nets. • Avoid Typhoid using the following precautions; o Drink bottled water (preferably carbonated) o If bottled water cannot be sourced, ensure water is heated on a rolling boil for at least one minute before consuming or is form a clean source. o Ensure fresh fruit and vegetables are cleaned in clean water.

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

Livestock farmers establish a Cooperative that forms the foundation for the governance of livestock management and activities that contribute rangeland restoration through the support of Conservation South Africa. Livestock Farmers Cooperatives ensure good governances through ensuring that the Cooperative's membership list is updated, registration certificate is obtained and properly archived, that a bank account in the Cooperative's name is opened and that each farmer in the Cooperative has made payment to the Cooperative of an agreed membership fee. The Cooperative members also attend monthly farmers meetings to ensure proper implementation of the grazing plan and compliance with conservation agreements.

CSA is an independent affiliate of Conservation International, as an affiliate, CSA subscribes to the aspirational vision and mission, strategic framework, and operational requirements of Conservation International, but is enabled to adapt language and specific policies and goals to the unique context of South Africa. CSA is a registered Non-Profit Organization working across South Africa and works with government, communities, and the private sector to implement sustainable landscape management strategies and restore degraded ecosystems, while supporting the creation of green enterprises, green jobs, and green skills. Focusing on vulnerable households with an emphasis on rural women, youth and small-scale farmers. In the Kruger to Canyons landscape there is a strong focus on working with livestock farmers to promote rangeland restoration in communal rangelands.

The governance and organizational model (Figure 15) below is the result of discussions both internally and externally with livestock farmers and/or Farmers Cooperatives (grazing associations), traditional authorities, and any project implementation partners, such as Meat Naturally.

1. Livestock farmers who are part of a Farmers Cooperative, sign a conservation agreement with CSA (or other legal entity as determined during the next stage of this project) as a conservation action of planned grazing/resting in accordance with the Benefit Sharing Agreement and conditions outlined in the conservation agreement.

2. Conservation South Africa will provide transparent governance and oversight of conservation agreements and financial transparency through the carbon project with all Farmers Cooperatives and Traditional Authorities.
3. Conservation South Africa provides the technical expertise for initiation and operating project activities, including initial project development (e.g., stakeholder consultations, engagement, workshops, site visits, and co-planning; feasibility studies; technical analyses; capacity building; strategic planning; communications), ongoing project maintenance and implementation activities (e.g., sustainable livelihood support; protection and enforcement related activities; project infrastructure and equipment; community engagement, training, and capacity building; biodiversity / social impact monitoring; management plans; restoration; planting; and communications).
   Conservation International provide funding for project implementation costs and services, including but not limited to marketing, communications, public relations, due diligence on potential carbon credit offtakers, negotiations with carbon credit offtakers, legal services (including project related advice and drafting / negotiations of Verified Emission Reduction Purchase Agreements), carbon registry management, reporting to project stakeholders and carbon offtakers, related project and financial management, monitoring, and oversight (including site visits, as necessary), and technical Project support (including Verra compliance, future Project verification matters, and carbon baseline calculation).

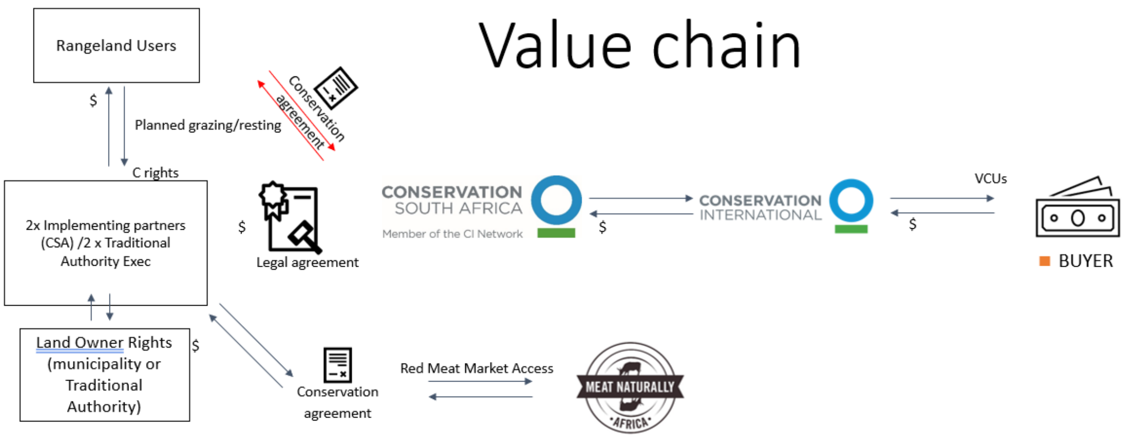

Figure 15: Governance and organizational model for the Kruger to Canyons carbon project.

The benefit sharing agreement depicts the responsibilities and benefit sharing structure of any carbon revenue generated through project activities that resulted in the generation of carbon credits. The benefit agreement ensures transparency is maintained with Farmers Co-operations and Traditional Authorities throughout the project lifespan.

2.4.2 Required Technical Skills (G4.2)

CSA, being the project proponent, will lead the implementation of proposed project activities in collaboration with the local communities and other partner organizations when deemed appropriate and useful. This includes those partners listed in Section 2.1.4 but also includes a range of other collaborators. CSA has the required human resources with expertise in ecosystem restoration, stakeholder engagement, training facilitation, wildlife conservation as well as the management capacity to implement large-scale conservation and carbon projects.

Through the herding for health program, CSA's Eco trainers who are trained in regenerative land management will support the communities of livestock farmers with the development of grazing plans and in building up sufficient local capacities for sustainable rangeland management via selected herders and Eco-rangers. Eco-trainers also receive accredited training at the SA college for Tourism Herding Academy.

The social enterprise Meat Naturally Pty Ltd brings experience and expertise in livestock management and livestock markets. They will be responsible for providing a suite of livestock management benefits (vaccination, planned grazing equipment, and herder training) to the participating farmers as part of the conservation agreement approach.

Consulting organization Unique land use GmbH guides in preparation of this document and the application of the methodology to the project area. Unique land use GmbH brings 20 years of experience in developing nature-based climate solutions around the world. Capabilities for carbon monitoring will be built up among CSA Eco trainers as well as setting up project monitoring and reporting systems.

Monitoring of biodiversity benefits is being conducted by Sustineri Ecological Consulting (Pty) Ltd with technical expertise in Ecological Science. The specialist team is led by Graeme Wolfaard who is a Professional Natural Scientist in Ecological Science (SACNASP No. 117179), and an active partner of International Conservation Services CC. Graeme has experience undertaking veld condition assessments, terrestrial ecological assessments for EIAs and developing management plans for game reserves and communal rangelands.

2.4.3 Management Team Experience (G4.2)

The project management team comprises individuals who have significant experiences in AFOLU projects development. Additionally, Conservation International has been involved in numerous carbon projects from inception, design, implementation to validation and several verification rounds. Hence, they have developed the capacity to design this AFOLU project, account for climate mitigation impacts, and report and participate in validation and verification under the VCS program.

Key Staff in the Kruger to Canyons Landscape:

Michael Grover
Michael Grover holds an BSc Honor in GIS and Spatial Mapping and as the landscape director has been the driving force of the Kruger to Canyons Landscape since its implementation in 2016. He works closely with the field teams in all aspects of operations, from financial management to conservation agreement facilitations. Michael has extensive experience in ecology with a strong focus on landscape and business management.

Hardie van Tonder
Hardie is the Rangeland Restoration Manager, he holds a BS Honours in Wildlife Management and has also attended the land management course for executives at the Herding Academy, South Africa. He has 9 years' experience working as a wildlife manager and a facilitator.

Lerato Mogane
Lerato holds a BSc. Geography and Environmental Sciences. She started her career working under a Learnership program run by the South African Wildlife College and Thaba-Chweu Municipality from 2013 to 2015 focusing on environmental education and waste management. From there she joined the Association of Water and Rural Development (AWARD) as a project officer under the RESILIM-O program. In 2018 Lerato joined CSA as a Stewardship Coordinator in the K2C landscape and has been the key facilitator for conservation agreements.

Natasha Reynolds
Natasha Reynolds has been working in the Kruger to Canyons project since 2020 as a Monitoring and Evaluation Co-ordinator. She holds a BA Honours degree in in Environmental Management and has

been working in the environmental field for the past 8 years, some of her key roles include project management, Environmental Impact Assessment and Environmental compliance.

Moses Mathabela
Moses has a number of certificates to support his role as community liaison officer namely Diploma in Youth Development University of South Africa; Senior Teachers Diploma; Conflict management in community. He has been working as the community liaison officer for CSA since prior to that he has worked for Sabi Sands on the Pfunanani Enterprise Development as Community Liaison Officer, other experience includes working with women and youth on medical awareness programmes.

Agnes Rapau
Agnes holds numerous certificates including: Advanced Diploma in computer literacy; Assessor Moderator (Oxbridge Academy); Small Business enrichment Programme (UJ); Mentoring programme as a Mentor (Reach Africa); Project Management (IQ Academy); Tourism and Hospitality Management(IQ Academy). She worked at Small Enterprise Foundation (SEF) as a branch Manager from 1996-2008, thereafter she worked as the regional manager at Women Development Business until 2013. She gained business development experience working with Hand in hand as Enterprise Development Manager until 2014. In 2015 she joined Pfunanani Enterprise Development Project (Buffelshoek Trust) as an Enterprise Development Manager and then Joined CSA in March 2017 as Enterprise Development Coordinator and is currently coordinating the development of Green Businesses for the Kruger to Canyons landscape. She is also a lead facilitator for establishing governance structures and formal business registration with communities.

Nomusa Mashile
Nomusa holds a BSc Agric (Animal Science) and MSc Agric (Animal Production &Ecology). She did her internship at Agricultural Research Council under Animal Production (2011-2012). Worked at Red Farms AgriPark (2014-2017) as the deputy director for Specialized Animal Production. Thereafter she worked for Meat Naturally Pty (2017-2023) as the Farmer Outreach and Mobile Abattoir Project Coordinator. Currently she is working for Conservation South Africa as the Stewardship Incentive Manager.

Stanley Mathebula
Stanley is one of the senior Eco-trainers working on the Kruger to Canyons project. He initially started working in the landscape under the Herding for Health programme, which dates to 2016. Since then, he has been promoted to the monitoring officer and has received formal training on Herd Management form the Herding Academy South Africa. He has extensive experience with indigenous knowledge of pastoralism and working with communities on grazing plans as well as monitoring rangelands.

National supporting staff:

Leon Jacques Theron
Leon is the Carbon Project Development Director for Conservation International, he holds a MSc in Zoology, and his work focuses on carbon accounting in the land use sector and ensuring that projects comply with ISO standards and pass third party verification. He has led the verification of VCS and CCB projects.

Heidi-Jane Hawkins
Heidi is a research fellow at Conservation International (CI), a research associate at the University of Cape Town, and led the action research portfolio at CI in South Africa between 2015 and 2022. Her doctoral and postdoctoral work explored nutrient and water relations including in specialized roots and root symbioses.

Perushan Rajah
Perushan Rajah has been with CSA for over 4 years, he holds a PhD in Environmental Sciences (Remote sensing) and leads the Conservation Impact Portfolio for the country program. He has a strong

background in spatial science and earth observation which is critical to the way CSA measures, tracks, and reports on conservation Impact.

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

The project proponent CSA is a member of the Conservation International network, a non-profit environmental organization with a presence in 29 countries. CI and CSA receive revenue from a diversified, well-balanced portfolio of donors, including individuals, corporations, foundations, government, and multi-lateral agencies. In general, this support is evenly distributed between contribution and grant and contract revenue. The broad diversification of funding sources affords CSA the flexibility to support annual operating needs, meet unforeseen short-term needs, and the resources to implement complex, longer-term programs at scale. In addition, CI is fortunate to receive consistent, ongoing support from a highly engaged Board of Directors as does CSA.
CSA's audited financial statements are published in an annual report on their official website[18] . Further details if needed can be made available to the validator.

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

CSA's anti-corruption policy does not tolerate bribery, kickbacks, or corrupt acts of any kind or in any circumstances from CSA staff, or its agents, consultants, grantees, vendors, or representatives of any kind. Our policy ensures that CSA complies with all applicable anti bribery and anti-corruption laws and ensures that any CSA gifts or payments given to government officials are proper, transparent, and appropriately documented. Members of CSA staff, and other persons acting on behalf of CSA or for its benefit are required to comply with additional anti-corruption policies and procedures. In addition, as an affiliate of CI, CSA subscribes to CI policies. These include robust controls to prevent, detect and respond to corruption, suspicions of corruption and poor financial management. Staff must abide by all applicable anti-bribery and anti-corruption laws. All CI staff in all countries are subject to the U.S. Foreign Corrupt Practices Act ("FCPA").

Necessary steps have been taken to avoid corruption and other unethical behavior within the project. These steps among others include:

1. Annual declaration of conflict of interests by the project team per CI's requirements.
2. Mandatory attendance of training on ethics, power dynamics and harassment done annually by project team.
3. Use of FPIC in engagement of project beneficiaries and partners to ensure inclusivity, fairness, and transparency.
4. Safeguards and Gender Mainstreaming Plan completed by project team to explore and address any potential challenges in implementation.
5. CSA project team and project beneficiaries made aware of CI Ethics hotline for reporting of corrupt practices and unethical behaviour.
6. Compliance to Employment Equity Act 55 of 1998
7. Compliance CI Procurement Policy when sourcing services

CSA is committed to the highest standards in integrity ethics from their staff, directors, vendors and grantees and CI provides regular training to staff, including CSA, and partners on these policies, ensures awareness of, understanding of and compliance with these policies. Above-mentioned policy documents are provided as supporting documents to the validator in the folder 'CSA Policies and Processes'.

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

CSA has been using CI's Conservation Stewards Program (CSP) conservation agreements framework to make conservation a viable choice for local resource users since 2009. The CSP operates through an existing governance platform, the K2C Biosphere, a public benefit organization that includes the partners

[18] 2018-19 report here.

CSA, South African National Biodiversity Institute, South African National Parks, National Research Foundation, BirdLife South Africa, government, industry, and others. The K2C employs a network of community based environmental monitors including herd monitors in partnership with CSA, rhino monitors and the world-renowned Black Mamba all ladies anti-poaching team. Other relevant project management partnerships are detailed in Sections 2.4.1 and 2.4.3.

2.4.7 Commercially Sensitive Information (*Rules* 3.5.13 – 3.5.14)

There is no commercially sensitive information that has been excluded.

2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

The Communal Land Rights Act 11 of 2004 and the Interim Protection of Informal Land Rights Act (IPILRA) of 1996 are both laws that govern land rights in South Africa. As with this project, whereby it is primarily on communal land the Interim Protection of Informal Land Rights Act 31 of 1996 (IPILRA) should be applied (noting that the Communal Land Rights Act 11 (2004) was promulgated but subsequently declared unconstitutional). IPILRA was intended to operate as a temporary instrument, however delays in finalizing new customary land statues (currently Communal Land Rights Bill) have resulted in it applying indefinitely. The land of the project site is owned by the Department of Agriculture, Land Reform and Rural Development (DALRRD) but the traditional authorities have a recognized right to use the land under IPILRA, termed an “informal right to land” under IPILRA.

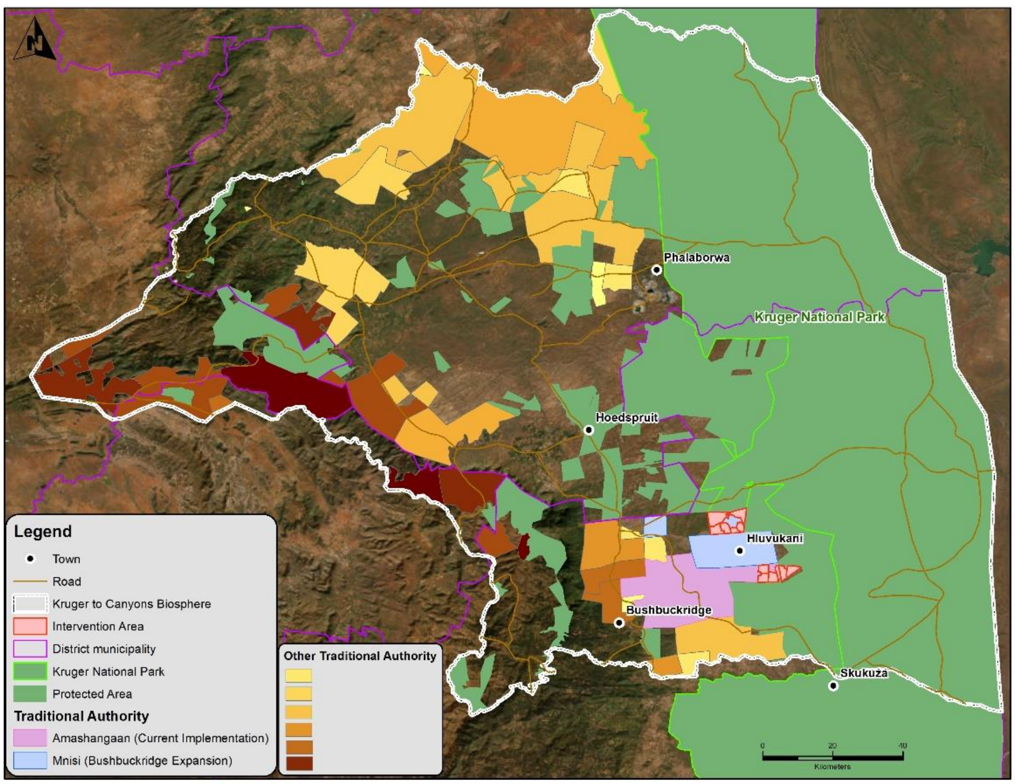

Figure 16: Map showing Traditional Authorities within the K2C Biosphere

Under the current insecure communal land rights system, communal land is generally administered by Traditional Leaders and the land is either registered in the name of the State or it is unregistered and de-facto the state is treated as the legal owner, in addition to a nested set of individual customary law rights which also simultaneously apply to land. Under the Act an “informal right to land” is recognized. An informal right to land includes the right to use, live on or access the land and includes a person's rights to their household plots, fields, and grazing land or other shared resources.

This insecure system is made tenable and weaky functional because IPILRA protects the most basic of rights by preventing unjust dispossession of land. Section 2(1) of IPILRA provides that no one may be deprived of their informal right to the land without their consent, unless in terms of the Expropriation Act 63 of 1975 or any other law that provides for the expropriation of land rights. Section 2(2) provides that "where land is held on a communal basis, a person may, subject to subsection (4), be deprived of such land or right in land in accordance with the custom and usage of that community." Lastly, Section 2(4) provides that:

"the custom and usage of a community shall be deemed to include the principle that a decision to dispose of any such right may only be taken by a majority of the holders of such rights present or represented at a meeting convened for the purpose of considering such disposal and of which they have been given sufficient notice, and in which they have had a reasonable opportunity to participate."

IPILRA regulates the question of whether the activities or arrangement between the parties is either a (i)"disposal" or (ii) a "deprivation" of the community's right "to" or right "in" land. If an activity or arrangements amounts to such disposal or deprivation, then implementation of the activity would require formal consent form the community.

In relation to disposal, IPLRA defines an informal right to land as including "the use of, occupation of, or access to land" and a disposal of the land or a right in the land would, therefore, be a disposal of such rights. In the present instance, the community is not disposing of its rights to use, occupy or access the land but is entering into conservation agreements (effectively, land management agreements) pertaining to rangeland practices on the land.

The Traditional Authority under DALRRD has granted user rights to the Farmers Cooperatives (Grazing Associations) and they are therefore the designated and rightful land users.

2.5.2 Recognition of Property Rights (G5.1)

The project proponent has signed conservation agreements with the Farmers Cooperatives (grazing associations) who have the grazing rights designated by the Traditional Authorities to implement rangeland restoration activities following an FPIC process described in section 2.5.3. All property rights are fully supported and respected, and no property rights are transferred or infringed upon by the implementation of rangeland restoration and associated activities of this project.

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

Any conservation agreement initiative involves a thorough community engagement process and a participatory design and negotiation stage that together must embody the principle of Free, Prior and Informed Consent (FPIC)[19] .

Engagement of Traditional Authorities was first done to introduce CSA and give a detailed overview on the organization and projects as well as to seek permission and endorsement to engage livestock farmers' cooperatives, who are one of several groups using the rangeland. Traditional Authorities provide the organization with a letter to indicate consent. Afterwards, community engagement is commenced by hosting a 'visioning' workshop in which the organization seeks to understand the community's challenges and determine if they can be addressed through any of the proposed projects. FPIC is obtained verbally during the engagement and negotiation stage of conservation agreements. Attendance registers are signed during these engagements to record all parties present. Project activities are only limited to designated grazing areas, and grazing plans are designed and implemented with the input of conservation agreement signatories.

[19] CI's FPIC Guidelines here

The negotiations of the conservation agreements are done throughout continuous engagement with the grazing associations, this process takes form through the initial planning of grazing areas with the support of Eco-Trainers. Once farmers are in agreement of the grazing areas, the stewardship coordinator presents the draft conservation agreement to the grazing associations, this stage of the engagement address the grazing management actions needed for the project and presents the benefits of the conservation agreement. The grazing association is allowed to negotiate the needed actions and the benefits, as these differ between each grazing association. A draft conservation agreement is given to the grazing association for review and input, once CSA and the grazing association agrees on all the clauses in the conservation agreement the conservation agreement is signed. The conservation agreements themselves include declarations that indicate CSA's recognition of project beneficiaries' rights as land users and thus does not implement any activities without their consent (see consolidated conservation agreement). Project activities are only limited to designated grazing areas, and grazing plans are designed and implemented with the input of conservation agreement signatories.

Consent letters, attendance registers and Conservation agreements are provided as supporting documents for this section.

2.5.4 Property Rights Protection (G5.3)

Project activities are limited to designated grazing areas in project sites and do not involve any removal or relocation of property rights holders. The Interim Protection of Informal Land Rights Act (IPILRA) of 1996 regulates the question of whether the activities or arrangement between the parties is either a (i)"disposal" or (ii) a "deprivation" of the community's right "to" or right "in" land. If an activity or arrangement amounts to such disposal or deprivation, then implementation of the activity would require formal consent from the community. In relation to disposal, IPLRA defines an informal right to land as including "the use of, occupation of, or access to land" and a disposal of the land or a right in the land would, therefore, be a disposal of such rights. In the present instance, the community is not disposing of its rights to use, occupy or access the land but is entering into conservation agreements (effectively, land management agreements) pertaining to rangeland practices on the land. The CAs themselves emphasize the voluntary nature of the agreement which in no way infringes on the rights of members regarding the use of land. Moreover, project activities are implemented directly by the land users. Consent to undertake project activities are requested from the tribal authority and Farmers Cooperatives (grazing associations) during conservation agreements negotiation.

2.5.5 Illegal Activity Identification (G5.4)

Illegal activities which may occur in the project area with a direct impact on the project activities that threaten the ecosystem of the rangelands include sand mining, wood harvesting, and illegal dumping of waste. Eco-trainers and environmental monitors which are supported by the project are mandated to capture and report on any of the abovementioned activities. In the instance of these illegal activities, the monitors would highlight areas where these activities have taken place and report the occurrences to the local leader of the community (Induna). The report is then raised through traditional structures. These structures are based on indigenous conflict resolution methods, whereby community members are gathered to discuss the issues, and resolve the matters at hand through confronting identified offenders. In the signed legal Benefit Sharing Agreement between CSA and Traditional Authority, the TA commit in section 6 to supporting CSA to "ensure that the Land is not used in any way which would negatively impact on the operation of the Project and/or the generation of Carbon Credits."
Furthermore, the data that is gathered from the monitors form part of the Kruger to Canyons Monitoring Schema. This provides supporting evidence of illegal activities present in the landscape and enables supporting conditions for enforcement under the National Environmental Management Act 107 of 1998.

Within a larger context the Kruger National Park is faced with widespread corruption linked to criminal syndicates associated with illegal poaching. Unfortunately, corruption at this scale cannot be mitigated through intervention of the project activities and requires a National approach to be addressed. This is thus beyond the sphere of influence of this project.

2.5.6 Ongoing Disputes (G5.5)

An ongoing three – year long court dispute exists in Dixie, where some farmers want to lease 700ha of communal land to a tourism operation. This is currently being appealed and outcomes remain uncertain. However, the risk of disrupting the project is minimal as the area in question constitutes only one percent of the total project area. The Background Information Document to this proposed development can be made available to the validator.

2.5.7 National and Local Laws (G5.6)

The project activity involving livestock grazing in communal lands is a legal activity. Communal rangelands are recognized under the Communal Land Rights Act 11 (2004). The customary land tenure system in South Africa is currently governed by the Interim Protection of Informal Land Rights Act 31 of 1996 (IPILRA). Relevant labour laws are discussed in section 2.3.16. In summary, below is a list of laws that are applicable to the project. All laws are strictly adhered to.

1. National Environmental Management Act (No. 107 of 1998)
2. National Environmental Management: Biodiversity Act (No. 10 of 2004)
3. National Water Act (No. 36 of 1998)
4. National Veld and Forest Fire Act (No. 101 of 1998)
5. Communal Land Rights Act (No. 11 of 2004)
6. Animal Protection Act (No. 71 of 1962)
7. Carbon Tax Act (No. 15 of 2019)
8. Upgrading of Land Tenure Rights Act (No. 112 of 1991)
9. Basic conditions of Employment Act ((No. 75 of 1997)
10. Labour Relations Act (No. 24 of 1956)
11. Employment Equity Act (No. 55 of 1998)
12. Occupational Health and Safety Act (No. 85 of 1993)
13. Local Government Municipal Systems Act (No. 32 of 2000)
14. Interim Protection of Informal Land Rights Act (No. 31 of 1996)
15. Local Government: Municipal Finance Management Act (No. 56 of 2003)

2.5.8 Approvals (G5.7)

Currently, no specific approvals are required from authorities for the implementation of a rangeland management project in South Africa since the project does not involve infrastructure development or land use changes and CSA engages with the land users directly. Nonetheless, the project has engaged municipal and provincial stakeholders including those listed in section 2.1.8. CSA has signed a contract with the Amashangana Tribal Authority and will sign a contract with the Mnisi TA as well, but unfortunately the chief has passed away and there is a period of mourning. The Mnisi TA has, however, provided CSA with a letter of consent.

2.5.9 Project Ownership (G5.8)

In line with VCS Standard v4.4, CSA (the project proponent) is the project owner since they implement the conservation agreement framework which incentivizes GHG emission reductions or removal activities. CSA developed the rangeland restoration project in collaboration with local rangeland users to adapt and mitigate climate change. Conservation agreements were signed with the Farmers Cooperatives (grazing associations - the legal land users) for the first activity instance (6,432 ha), which includes a legal agreement to develop a carbon project with CSA as the project proponent. It is important to note that land tenure and land rights are still complex matters in communal lands in South Africa. The Interim Protection of Informal Land Rights Act 31 of 1996 (IPILRA) that governs the customary land tenure system does not specifically confer ownership or allocate ownership of carbon credits or other environmental commodities on the land nor does it regulate who would own a carbon credit if mitigation activities were to be undertaken on the land. However, Tribal authorities are the designated custodians of communal lands through the Customary Land Rights Act 11 (2004), and rural farmers have land-use rights through the tribal authorities. Conservation Agreements are proof of project ownership, aligned with reducing the non-risk rating and Conservation International's Safeguards, overarching legally binding agreements are in the process of being signed with the Amashangana and Mnisis Tribal Authorities that explicitly transfer carbon rights to CSA insofar as these rights are vested within land rights through inference. (”Conservation Agreements” in supporting documents).

2.5.10 Management of Double Counting Risk (G5.9)

The project currently has and will not seek any other credit from any other greenhouse gas accrediting program. At the project start date, the VCS was the only standard that allowed carbon credits under agricultural land management to adjust grazing.

2.5.11 Emissions Trading Programs and Other Binding Limits

Because the project involves grassland management, project credits are ineligible under existing Emissions Trading programs.

2.5.12 Other Forms of Environmental Credit

The VCS is the only standard that allows carbon credits under agricultural land management to adjust grazing. The project will not pursue other forms of environmental credit.

2.5.13 Participation under Other GHG Programs

The project will only be registered under the VCS 4.4 and CCBA 3.0 Standards.

2.5.14 Projects Rejected by Other GHG Programs

The project has not applied for or been rejected by any other greenhouse gas accrediting program.

2.5.15 Double Counting (G5.9)

Double counting on the voluntary market is avoided by having credits assigned on the VCS Registry, which assigns each credit a unique serial number which is held in retirement when the credit is used to offset greenhouse gas emissions.

3 CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology

Methodology:

- The methodology used in this project is the VCS VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing, v1.0.

Tools:

- CDM A/R methodological tool Calculation of the number of sample plots for measurements within A/R CDM project activities
- VMD0016 Methods for stratification of the project area (X-STR), VMD0016, v1.2
- VT0001 Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities, version v3.0
- VMD0040 Leakage from Displacement of Grazing Activities VMD0040, v1.0
- VCS AFOLU Non-Permanence Risk Tool, v4.0

3.1.2 Applicability of Methodology

This methodology applies to project activities that adjust the number, type and husbandry of grazing animals, adjust the frequency and intensity of planned or unplanned fires, and/or introduce herbaceous grassland species as potential forage for grazing animals or to restore degraded soils.

The project will meet the applicability conditions of VCS methodology VM0032 V1 as follows:

- **The project area must be grasslands in the baseline and project scenarios.** The project area is broadly within the savanna biome of South Africa and comprises savanna and grassland vegetation types such as Granite Lowveld in the west, Northern Escarpment Dolomite Grassland (8%), Poung Dolomite Mountain Bushveld (3.3%), Legogote Sour Bushveld, Northern Escarpment Quartzite Sourveld and Ohrigstad Mountain Bushveld, per South Africa's vegetation map[20]. The mean annual precipitation (MAP) of the area is 584 mm (1901-2020 values from Climate Hazards Group InfraRed Precipitation Station data, CHIRPS), varying between ca. 750 mm in the west and 550 mm in the east. Tree canopy cover varies between zero and 30% at most sites, reaching up to 45% in a few sites (2019 European Space Agency (ESA) tree cover) with all trees in survey sites being below 5 m tall. Project activities will not alter the land cover classification, as they are not aimed at tree cover and will not involve conversion of grassland or savanna to another land use, as would be prohibited by the standard.

- **Lands are grazed and/or subject to fires in the baseline and/or project scenarios. Lands may be used for different purposes, such as livestock production, conservation, hunting or tourism**. All areas in the project are communal grazing lands subject to natural or controlled fire regimes. Communal lands are part of the K2C Biosphere including rural people, ecotourism in private and statutory nature reserves, game farms, plantations, and agriculture for crop production. According to CSA social surveys, the main land use is livestock farming, and there are periodic fires, with fire incidence in the project area ranging between zero and six fires over the last 12 years (2001-2019 Moderate Resolution Imagine Spectroradiometer (MODIS)). The ESA Land Cover CCI v2.1.1 dataset for the period 2007-2017 was used to assess any land use change. The figures below indicate that no land use change occurred in the first project instance boundaries during the period 2008-2017.

[20] Mucina, L. & Rutherford, M.C. (eds) 2011. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

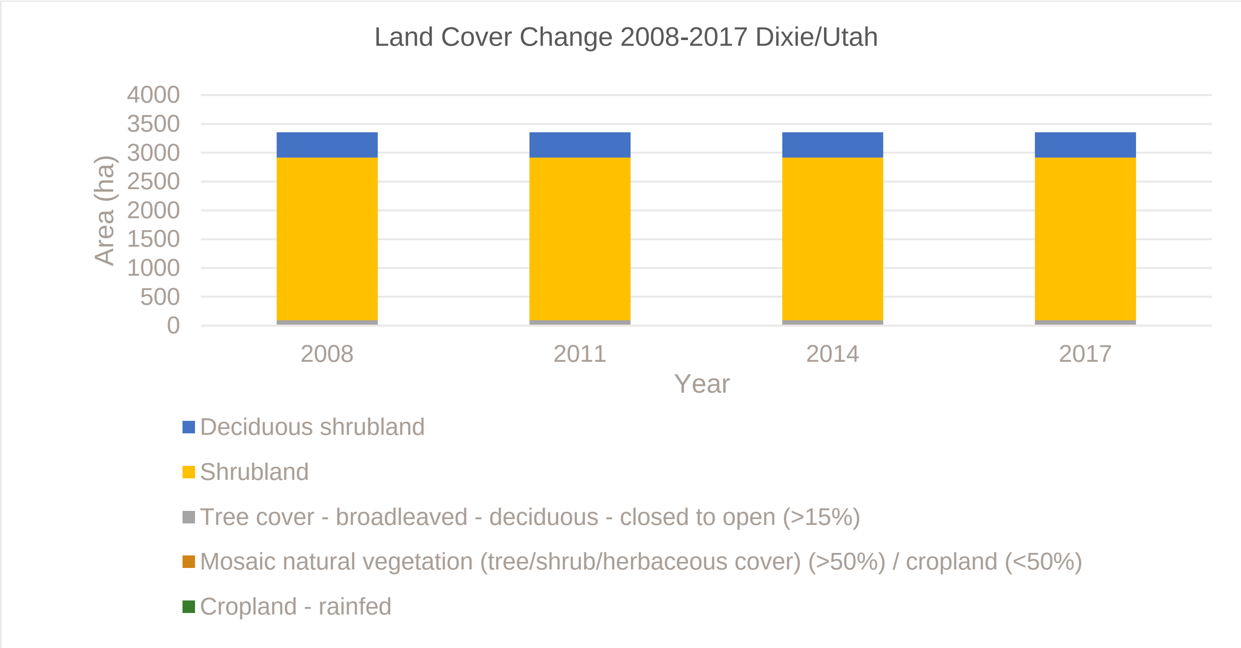

Figure 17: Land use history of Dixie/Utah based on ESA Land Cover CCI v2.1.1 from 2008-2017.

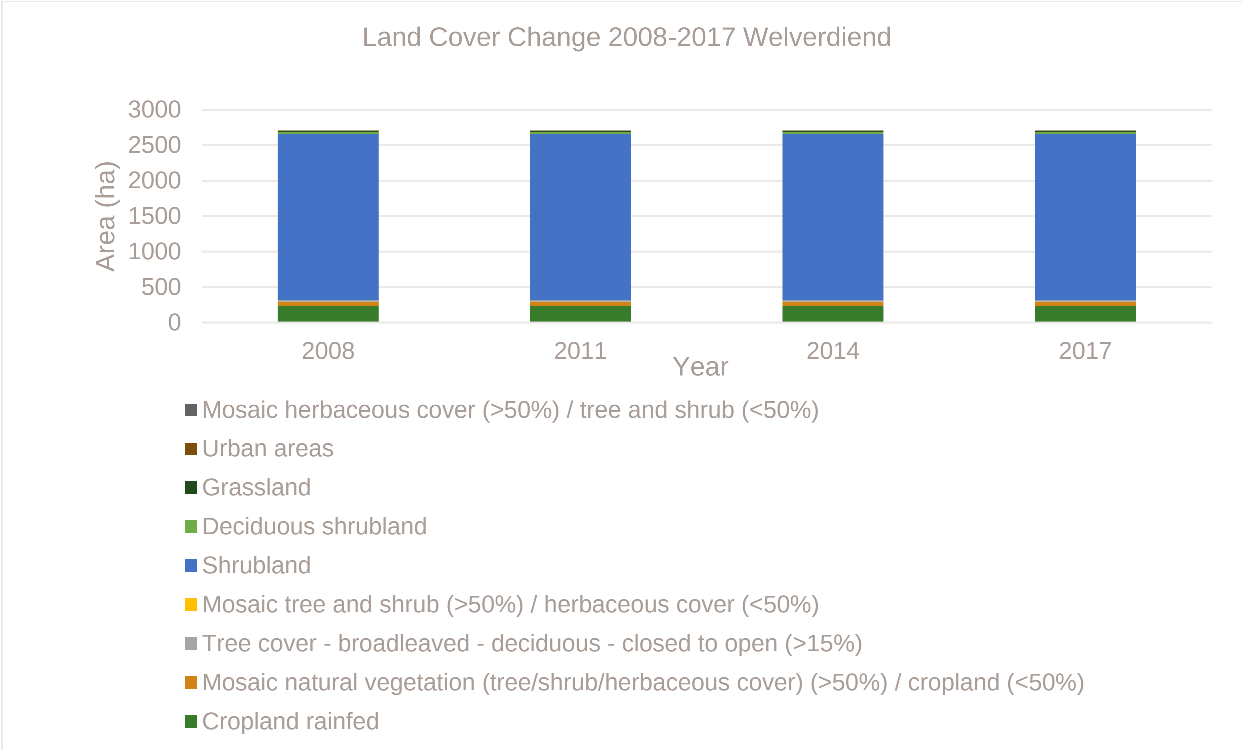

Figure 18 Land use history of Welverdiend based on ESA Land Cover CCI v2.1.1 from 2008-2017.

- **The project must be structured to keep livestock within the project area, and the project proponent must be able to enforce the boundaries of the project area**. The land tenure system of communal grazing lands, supervised by an elder-based authority system, generally anchors community members and their livestock within the project boundaries. In addition, this area is large enough to potentially supply sufficient grazing during wet and dry seasons, although fodder supplements are currently supplied ad hoc as an incentive under conservation agreements. The first activity instance area (Dixie, Utah, Welverdiend villages) are fenced and aware of their boundaries from grazing plans and maps associated with conservation agreements, as well as fence signs indicating closure of camps. Quarterly monitoring and presence of CSA staff in the current engagement area as well implementation of GPS cattle collars indicate that CA signatories have been largely compliant with CAs in the 2020/2021 growing period. In the general K2C area, including some of the expansion area, 77% of communal farmers interviewed aspired to use herding and kraaling as means to manage and protect livestock in the area (internal monitoring).

- **The project must result in no net increase in the density of, or time spent by animals in confined corrals where dung can pile up and begin to decompose anaerobically and result in CH_4 and N_2O emissions, such as an increase in the number of livestock aggregated (e.g., kept in corrals or pens) that would result in more than 50 percent of the ground area covered by dung**. Livestock numbers in general are not expected to change due to project activities. Livestock will be sold to market via MNP with the aim of providing income to farmers but is not intended to foster destocking. Rather farmers will be encouraged to improve their herd structure as older male animals are sold and younger (mostly female) animals and climate-smart breeds are brought in. No net increase (or decrease) in livestock units implies there will be no net increase in the number of kraals (corrals or bomas) and thus no net increase in dung deposition that exceeds the anaerobic threshold. Ad hoc feeding with fodder in times of drought or dry periods will involve feeding on live grass, hay, or silage in-field rather than feedlots and will thus not lead to increased kraaling. Any kraals will be overnight, short-term (7 days or less) or be moved before dung cover is 50%.

- **Baseline emissions derived from livelihood-driven human impacts on aboveground woody biomass (e.g., cutting for fuel wood, charcoal or timber sales) must be deemed de-minimis (i.e., not included in the cumulative 95 percent of total baseline emissions) and project activities cannot significantly alter such livelihood-driven activities**. **This applicability condition was modified in an issued *Errata and Clarifications* to VM0032 and restated as "…must be deemed de minimis (not greater than 5% of the total greenhouse gas benefit of the project)…"** There is fuelwood harvesting in the project area, but activities have resulted in increased woody biomass from more trees in a relatively small height class (thus emissions from harvesting are near zero or negative). An increase in younger trees in lower height classes due to wood harvesting is a concern and probably exacerbates the existing woody plant encroachment due to climatic and herbivory changes. One of the K2C biosphere activities is to thin savanna tree canopies (through pruning, not tree removal) and use this biomass to brush-pack eroded areas. Brush packs that are 1-3 years old have not yet resulted in increased or decreased SOC. Thus, neither fuelwood harvesting, nor bush thinning and brush packing will be prevented by the project and can be deemed de minimis activities. Fuelwood harvesters are stakeholders that will be consulted as part of the Free Prior and Informed Consent (FPIC) process.

  For projects that propose to modify grazing, the maximum individual project size is 3 million ha or 5 percent of a country's land area currently or potentially used to graze livestock, as judged by national government land use inventories or other documentation. The project area (82,300 ha) does not exceed the maximum allowable project size.

The methodology is not applicable under the following conditions:

- Project activities that involve mechanical vegetation removal or soil tillage
- The project area receives a net import of inorganic or organically derived fertilizer.

Neither of these conditions applies to the project area. Communal rangelands with a relatively high density of woody shrubs and trees do not allow for any mechanical operations. Also, fertilization with imported fertilizers is not common for communal rangelands. In summary, the project meets all applicability conditions of the methodology.

3.1.3 Project Boundary

There is only one major carbon pool, soil organic carbon, considered by the methodology, since changes in carbon stocks from changes in woody biomass are assumed to be negligible because of a lack of fire in the baseline conditions and project scenarios and because people use a negligible amount of woody carbon for fuel.

Pool	Selected (Y/N/O)	Explanation/justification
Soil organic carbon (SOC)	Y	Major sink for GHG covered by SGMAFG
Aboveground non-woody biomass	N	Transient carbon pool with high carbon turnover; no stable sink.
Belowground biomass	N	Change in below ground woody biomass is assumed to be negligible in the project. There is no tillage allowed in the project scenario by applicability conditions, fuel wood collection regime does not change and there is little to no fire in the project. As there is no threat to this carbon pool but rather an

		improvement due to better shrub management in the project, this carbon pool can be conservatively excluded.
Aboveground woody biomass	N	Project activities prevent intentional fires. Accidental fires jumping over from neighboring areas are fought when detected by community members, Eco-rangers, or herders. Furthermore, change in woody biomass is assumed to be negligible and conservatively excluded because human harvesting of wood reduces aboveground woody carbon stocks by less than 5%. It is therefore conservative to exclude this carbon pool from accounting.
Aboveground non-woody litter biomass	N	In grasslands, litter exhibits high turnover, and is thus a transient carbon pool.
Aboveground dead wood biomass	N	Negligible in grasslands, particularly those with fire
Wood products	N	An optional pool for VCS ALM projects, it is considered negligible for untilled grasslands. There is no timber harvesting

This methodology has applicability conditions for no tillage and activities that do not include avoided conversion of grasslands. **Consequently, aboveground non-woody biomass, aboveground non-woody litter biomass, and belowground biomass are considered negligible sinks because they turn over considerably through the year, sometimes by as much as 100%.** They may later be used as potential parameters for soil carbon models because they influence the input of carbon to the soil, but they conservatively do not represent significant, permanent GHG sinks or reservoirs in grasslands.

Source		Gas	Included?	Justification/Explanation
Baseline	Grazing animals	CO_2	N	Respiration of animals is not accounted for.
		CH_4	Y	Target removal of methodology. Changes in herd structure changes emissions from enteric fermentation by livestock.
		N_2O	N	No increase in concentration of dung, and forage is not fertilized (applicability conditions).
	Burning biomass	CO_2	N	Balanced by CO_2 uptake by plants
		CH_4	N	The project activities prevent intentional fires. Accidental fires jumping over from neighboring areas are fought as well as possible if detected by community members, Eco-rangers, or herders. Furthermore, change in woody biomass is assumed to be negligible or conservatively excluded because human harvesting of wood reduces aboveground woody carbon stocks by less

Source		Gas	Included?	Justification/Explanation
				than 5%. It is therefore conservative to exclude this carbon pool from accounting.
		N_2O	N	As above, emission source can be conservatively excluded since fires are rather reduced in the project.
	Soil emissions	CO_2	N	Assumed to be in balance with C inputs to SOC (SOC at equilibrium)
		CH_4	N	Negligible since project is not in wetland
		N_2O	N	Negligible under applicability conditions
Project	Grazing animals	CO_2	N	Balance with CO_2 uptake by plants
		CH_4	Y	Target removal of methodology. Changes in herd structure changes emissions from enteric fermentation by livestock.
		N_2O	N	No increase in concentration of dung (applicability conditions) and forage is low in N
	Burning biomass	CO_2	N	Balanced by CO_2 uptake by plants
		CH_4	N	Project activities prevent intentional fires. Accidental fires jumping over from neighboring areas are fought as good as possible if detected by community members, Eco-rangers, or herders. Furthermore, change in woody biomass is assumed to be negligible or conservatively excluded because human harvesting of wood reduces aboveground woody carbon stocks by less than 5%. It is therefore conservative to exclude this carbon pool from accounting.
		N_2O	N	Negligible under applicability conditions
	Soil emissions	CO_2	Y	Accounted for in measured ΔSOC
		CH_4	N	Negligible since project is not in wetlands
		N_2O	N	Negligible under applicability conditions

The physical boundary of the project is shown in the map below.

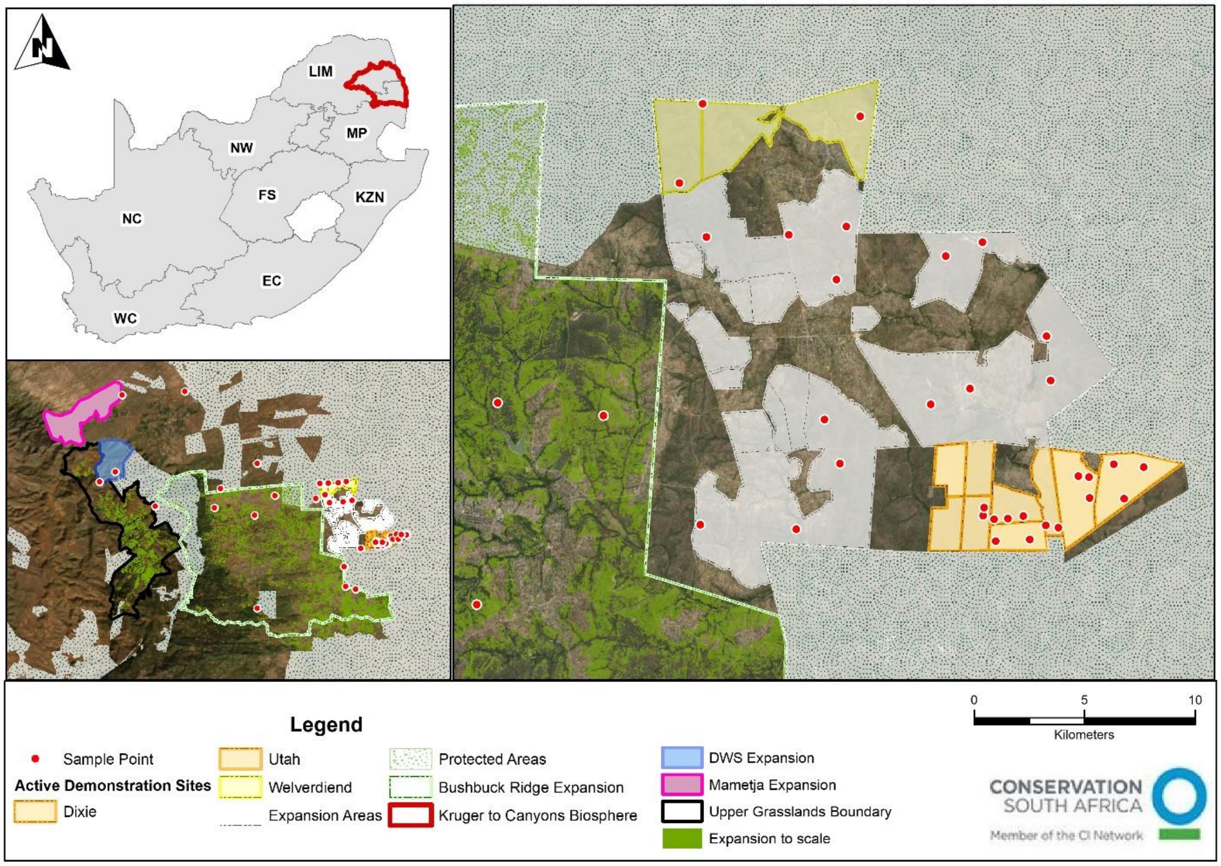

Figure 7: *Project area boundary.*

3.1.4 Baseline Scenario

Communal lands in the project area have been used for livestock grazing for at least 90 years. In 1934, the Sabi Sand Wildtuin moved people out of the reserve into the current project area. With the advent of apartheid in 1948, indigenous people were segregated into “homelands” and often restricted to the most marginal lands. This was intensified by the erecting of foot-and-mouth disease control fences in 1961. Currently, the baseline scenario includes grazing practices that are largely unrestricted, continuous and with little or no herding. This has detrimental effects on the productivity of the existing plants. The herbaceous layer is dominated by tropical C4 perennial grasses, which have relatively high lignin and cellulose contents as well as large belowground root components favourable for soil carbon sequestration. The lack of recovery time for grasses during the growing season reduces vegetation and seed production of perennial and other palatable grass species. This in turn results in a relatively higher proportion of annuals vs. perennials and, eventually, bare soil. This effect can be seen in a NDVI-analysis such as in the grazing camps of Welverdiend (Figure 19), as prescribed by VCS VM0032, grazing history was demonstrated using NDVI.. While NDVI showed a deteriorating trend from 2009 until 2018, there is a stark, sustained increase in NDVI with the introduction of rotational grazing and other project activities.

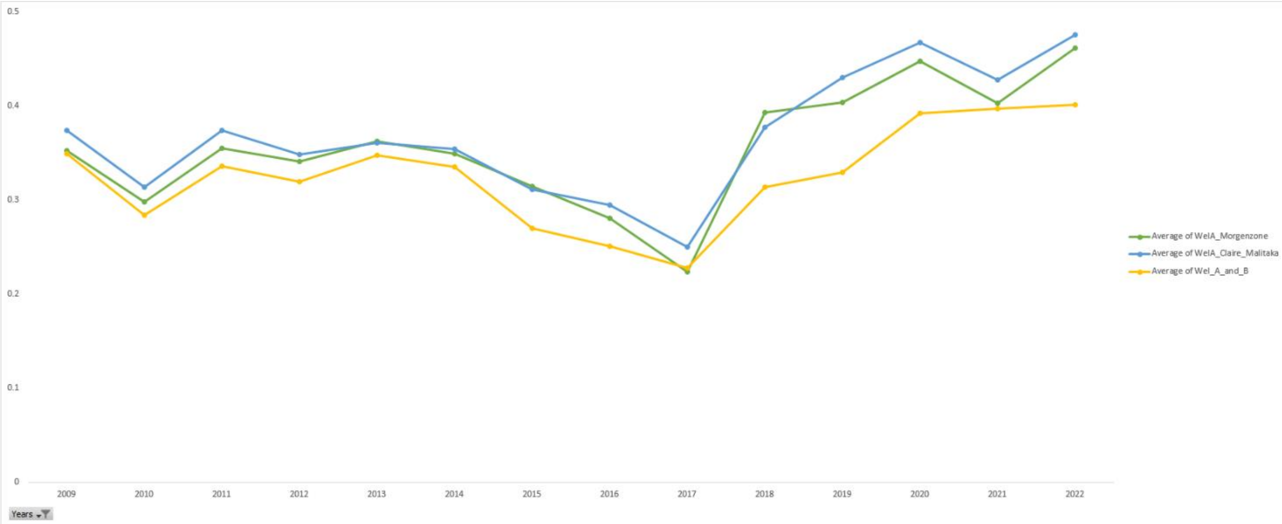

Figure 19 NDVI of Welverdiend grazing camps show a significant increase at the start of the project in 2018

The effect of rotational grazing on NDVI is significant. In Dixie, the NDVI of a rested camp (0) has been compared with a camp that had livestock present (1) as seen in Figure 20. NDVI is significantly higher in rested camps.

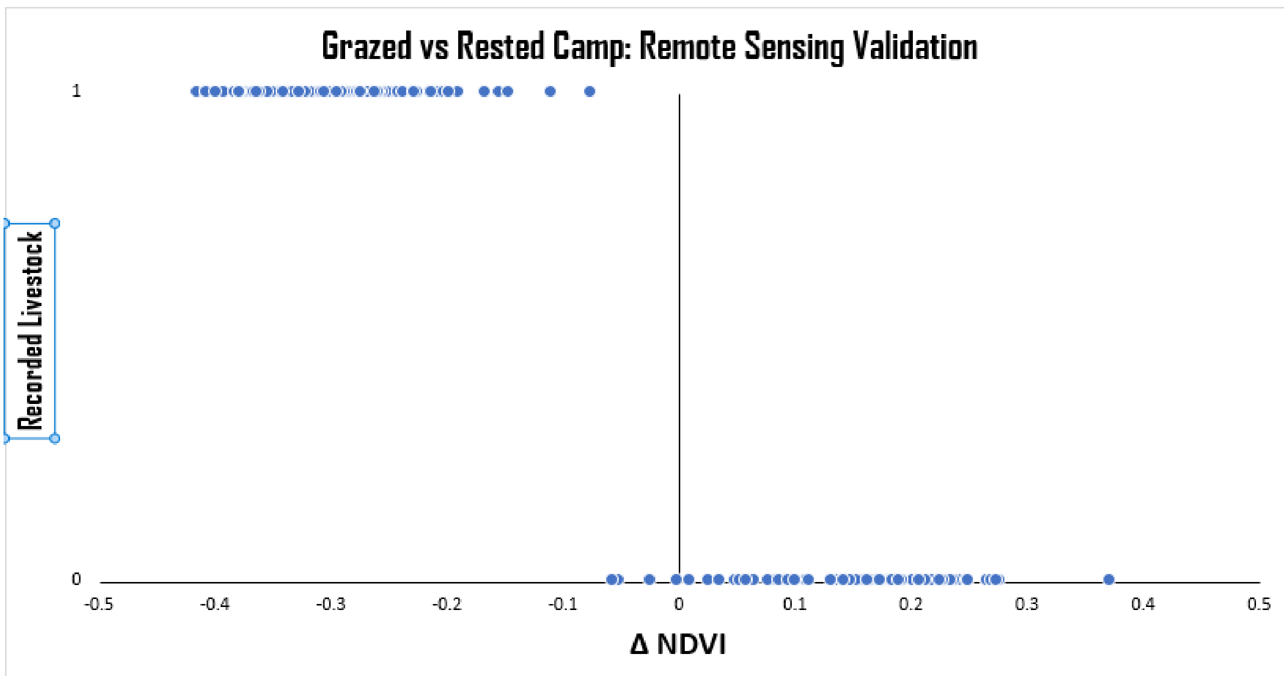

Figure 20 Validation Rested camps have a significant effect on NDVI

The lack of vegetation and high occurrence of bare soil leads to high run-off and loss of topsoil during the rainy season. Poor infiltration into the soil results in localized flooding events and creates siltation, reducing river discharge and affecting flora and fauna downstream in protected and other areas (Mararakanye & Sumner 2017). Fire is a natural disturbance in savanna and grassland, and fire frequencies of 3 to 5 years in K2C are similar or less than those recommended for Greater Kruger National Park (GKNP) due to relatively low fuel loads, and too frequent fires is not presently a threat.

Historical fire assessment
For the assessment of fire history, the MCD64A1 v061 MODIS/Terra+Aqua Burned Area Monthly L3 Global 500 m SIN Grid provided the basis for the data. The burned area map was adjusted to the project area to determine the scope and frequency of fires in the period of 2007-2017. The final product is depicted below.

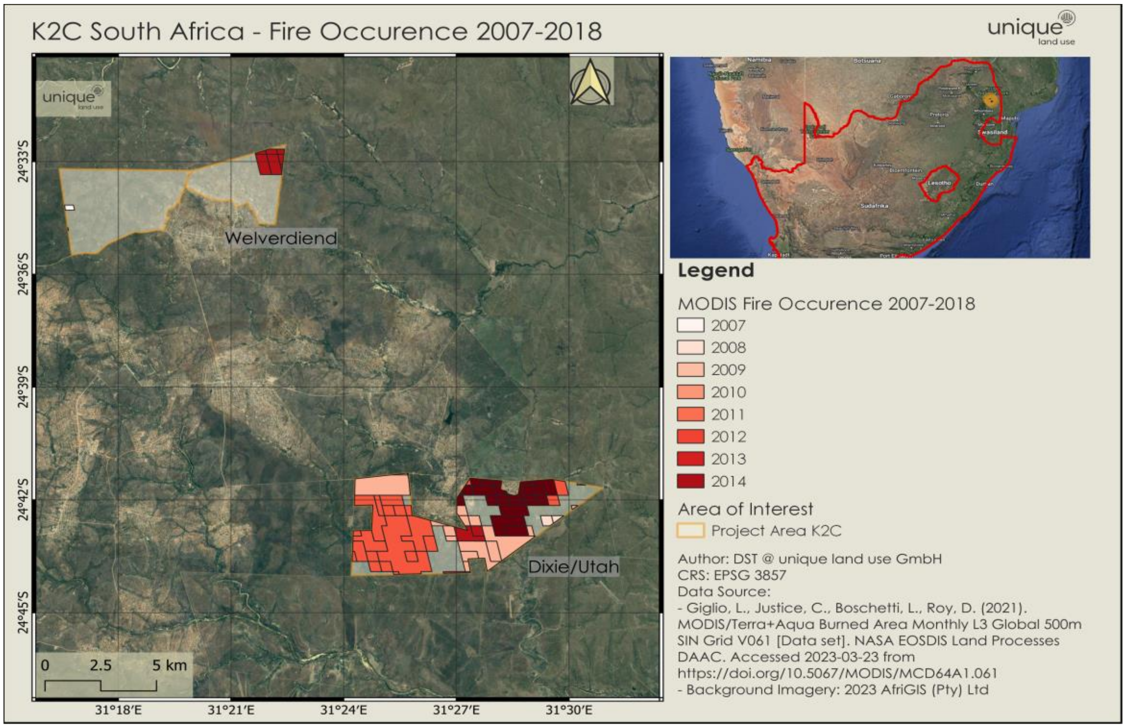

Figure 21: Historical fire assessment for area of interest. Dataset utilized for analysis: MCD64A1 v061 MODIS/Terra+Aqua Burned Area Monthly L3 Global 500 m SIN Grid

It is worth noting that the fire occurrence had a strong seasonal tendency, correlating with the dry season (May-August) of the region. Furthermore, no fire events occurred after 2014 within the first instances. The results of the analysis demonstrating the frequency of the fires within the period of 2007-2018 are presented in Table 10.

Table 10 : Fire frequency and intensity (ha) within the project area from 2007-2017.

Year	Frequency of fire events	Burnt area (ha)
2007	2	10.33
2008	4	38.57
2009	21	863.17
2010	2	100.00
2011	24	1,485.05
2012	1	6.63
2013	10	236.58
2014	22	616.81

2015	-	-
2016	-	-
2017	-	-
Total	**86**	**3,357.13**

3.1.5 Additionality

The additionality analysis was conducted according to the VT0001 "Tool for the demonstration and assessment of additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) project activities", adapted from the CDM "Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities" (Version 02). Following the stepwise approach, the initial task was to identify alternative land use scenarios proposed to the VCS AFOLU project activity.

STEP 1. Identification of alternative land use scenarios to the AFOLU project activity
Scenario 1: Continuation of pre-project land use: Persistent, unmanaged grazing**.** Without the proposed carbon project, livestock management will likely remain continuous grazing (no resting), resulting in loss of primary productivity and forage for livestock with continued loss of soil organic matter and carbon due to soil erosion. Due to an ongoing population increase of 3.5% per year, there is a growing reliance on free-ranging livestock (largely cattle) as a source of income, intensifying the "tragedy of the commons" problem. Even though the project area falls within a UNESCO Biosphere reserve, it does not offer the level of protection nor funding to stop communal rangeland degradation. Degradation may in turn result in land abandonment, as well as land use change (LUC) and loss of biodiversity if the current native vegetation is transformed to urban or agricultural land uses. Prior to the project initiation, there were notable increases in soil erosion and loss of SOC, with topsoil flooding away during summer. This was the effect of unpredictable droughts that led to an increase in soil trampling by livestock, as well as increased evaporation, which leaves the soil bare and more prone to erosion after the next rains. Also, our preliminary estimates of forage quality indicate that quality is low relative to reference sites; this would result in relatively high emissions from enteric fermentation, adding to emissions in the without-project scenario.

Scenario 2: Incorporating communal rangelands into private nature reserves / Eco-tourism:
Another potential land use scenario is the conversion of grazing lands to wildlife reserves for ecotourism. This forms part of the Greater Kruger Strategic Development Plan, which was established in 2020[21]. There have been informal discussions with the Traditional authorities regarding the expansion of formal protected areas into their communal rangelands. While this scenario may benefit wildlife, it is not assured that local people would benefit, since they presently have little training in ecotourism or resources to develop tourist facilities. Such a land use change could limit resource users' access and amend rangeland management strategies. While continuous grazing offers no potential for rangeland restoration and its attendant benefits, conversion to wildlife reserves has potential for emissions removals (Sitters et al. 2020) but would have to be carefully designed so that communities are involved and can reap a benefit. On the other hand, maintaining both livestock and wildlife on communal land could enable a mix of income from carbon finance, livestock sales and ecotourism, while maintaining ecosystem and biodiversity corridors.

Scenario 3: Conversion of communal rangeland to cropland. In the project region, there are examples of communal rangelands that have been converted to croplands, typically subsistence cereal crops; this is the most likely scenario in communal rangelands. Another possibility, which may be accompanied by a change in land tenure from communal land to private land, is the establishment of commercial fruit orchards and other cash crops. Fruit orchards especially could lead to carbon sequestration although these orchards are monocrops with limited biodiversity benefits. Typically, irrigation and large capital investment is required to establish fruit orchards, making them less likely, but still a possibility.

[21] https://www.greaterkrugerlandscape.co.za

Scenario 4: Project activities without VCS project registration. The project consists of implementing planned rotational-rest grazing for cattle, sheep, and goats by collective herding and kraaling. This is achieved with community grazing cooperatives by means of conservation agreements across project sites. Planned rotational-rest grazing, also called season-long grazing, is known to increase recovery and cover by perennial grass species while being more profitable and less labour-intensive compared to continuous or other grazing patterns. Usually, one camp will be rested from grazing during the growing season while an adjacent area is open to grazing. Camps may be rotated as agreed with communities via Farmers Cooperatives (Grazing Associations). Sustainability of project activities is enabled and incentivized through market-access opportunities for compliant producers, provided by our commercial partner Meat Naturally Pty (MNP). Project activities are aimed at improving livelihoods, biodiversity, climate change adaptation as well as mitigation.

SUB-STEP 1b Consistency *of credible land use scenarios with enforced mandatory applicable laws and regulations;*
The project activity involving livestock grazing in communal lands is a legal activity. Communal rangelands are recognized under the Communal Land Rights Act 11 (2004). The customary land tenure system in South Africa is currently governed by the Interim Protection of Informal Land Rights Act 31 of 1996 (IPILRA). In summary, below is a list of laws that are applicable to the project. All laws are strictly adhered to.

1. National Environmental Management Act (No. 107 of 1998)
2. National Environmental Management: Biodiversity Act (No. 10 of 2004)
3. National Water Act (No. 36 of 1998)
4. National Veld and Forest Fire Act (No. 101 of 1998)
5. Communal Land Rights Act (No. 11 of 2004)
6. Animal Protection Act (No. 71 of 1962)
7. Carbon Tax Act (No. 15 of 2019)
8. Upgrading of Land Tenure Rights Act (No. 112 of 1991)
9. Basic conditions of Employment Act ((No. 75 of 1997)
10. Labour Relations Act (No. 24 of 1956)
11. Employment Equity Act (No. 55 of 1998)
12. Occupational Health and Safety Act (No. 85 of 1993)
13. Local Government Municipal Systems Act (No. 32 of 2000)
14. Interim Protection of Informal Land Rights Act (No. 31 of 1996)
15. Local Government: Municipal Finance Management Act (No. 56 of 2003)

Therefore, all plausible alternative land use scenarios of the VCS AFOLU project activity comply with mandatory legislation and regulations, taking into account their enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

STEP 2. Investment analysis;
Grant funding as provided currently by CI is supposed to be paid back and replaced by the carbon funding. The project does not have any other income streams, and all potential profits from carbon credits will be funnelled back to the project to finance the upscaling of the project either in size (new instances) or in quality (new services to farmers such as improved animal husbandry, market access and jobs created locally). Hence, the analysis does not include investment as a barrier, and the assessment of current practices provide a better basis for additionality.

STEP 3. Barrier analysis;
SUB-*STEP 3a. Identify barriers that would prevent the implementation of the type of proposed project activity*

Governance Barriers
Before the start of the project, a few of the livestock farming communities had pre-existing market-related governance structures in place, such as livestock committees, cooperatives and dip tank committees (through which farmers organize information sharing, mandatory dipping of cattle, or develop contribution systems to maintain or purchase resources that government is not able to provide). However, these structures were often not developed or well-known, as demonstrated in the Mnisi baseline survey (only 30% respondents confirmed the existence of a farming cooperative in their village), nor did they involve planning of grazing activities. Without strong governance, project activities are unlikely to be implemented and enforced on communal lands. Similarly, an expansion of private game or eco-reserves is unlikely, as no alternative living space for communities exists.

Barriers due to prevailing practice
There is no other similar carbon project known to the project proponent operational in the region. There is another carbon project under VM0032 being developed in the Eastern Cape, but it has a different focus. Holistic grazing combined with biodiversity and community benefits associated with the neighboring iconic Kruger National Park is a challenge and has not been done before.

Barriers regarding skills and competences
Communal farmers in South Africa have been marginalized by the previous apartheid government, with limited extension services, veterinary services, and market access. Unfortunately, much of this situation has persisted due to poor economic conditions, and the uplifting of rural farmers is lower on government priorities than are other activities. Training and skills development offerings for locals are rare. The majority of livestock farmers in rural communal rangelands have had no formal training in animal husbandry nor modern livestock farming.

Through the project, communities that farm livestock will receive training that not only enables sustainable grazing and climate-smart animal husbandry practices, but also will support broader community development objectives. Participants will have enhanced capacity to understand their role as a governing body; approach and engage with local government as a valid stakeholder; make ecologically informed decisions about how to manage their rangelands; and share lessons from their experience with other farmers cooperatives (grazing associations). Thereby, they can build a local community of practice and cultivate pride amongst themselves. Additionally, selected community members are formally trained as herd monitors (also called Eco-rangers) and 'Eco-trainers', i.e., in herding, kraaling and other critical skills and are directly employed by the project to provide services to the members of farmers cooperatives. Women in the communities are trained in valuable skills, such as arts and crafts, recycling, clothes-making, and retail business, which are potential sources of income. Diversified sources of income further increase the resilience of communities to the impacts of climate change. Without the project activities, unplanned grazing on the rangelands is expected to continue due to a widespread lack of access to services, training, and infrastructure to support sustainable grazing practices.

Barriers due to local ecological conditions
Pressure from continuous grazing reduces the abundance of palatable perennial grass species. This change in species composition decreases the quantity and quality of forage available for livestock as well as overall land productivity, potentially resulting in increased conflict within communities as they compete for scarce forage resources. Continued depletion of soil cover and poor infiltration due to unplanned grazing also negatively influence water quality and quantity in rivers and tributaries that flow through the rangelands. This water is central to livestock alimentation as well as overall rangeland productivity. The dry conditions in the area constrain cropland management. Irrigation is mostly necessary for crop production, requiring associated technical know-how and investment. Both are typically absent from disadvantaged communities.

Barriers related to local tradition
There is a cultural tendency to maintain a herd structure that is unfavourable for productivity and climate mitigation, i.e., older, larger male animals that have inefficient digestive systems leading to higher methane emissions from enteric fermentation. The tendency to keep older animals, including large bulls, arises because livestock represent personal wealth and status and are integral to the ethnic groups in the project area. Furthermore, this barrier also makes a conversion to cropland unlikely. Communal rangelands are key to sustain livestock herds. Livestock is mostly considered an asset more than an income stream. Herds are managed to be maintained with small amounts of inputs. Croplands require higher labor inputs and are unsuited to satisfy the cultural need for an “asset". In addition, while the incorporation of communal rangelands into private nature reserves potentially expands tourism and therefore benefits wildlife, this would require a large reduction in livestock. Since livestock owner desire to demonstrate wealth via livestock, this stands as a barrier against the expansion of private nature reserves.

Barriers relating to location, land tenure, ownership, inheritance, and property rights
Communal farmers and rangelands have a long history of degradation and marginalization in South Africa. Communal farmers have very limited access to markets, extension services, and veterinary services. Farming practices are subsistence-based, and there are very few opportunities to escape this poverty trap. Furthermore, communal rangelands typically face the tragedy of the commons, as mentioned above.
In addition, due to proximity with the Greater Kruger National Park (GKNP), the project area is a red zone for foot-and-mouth disease. This causes a barrier to market access, since livestock owners in this zone can only sell meat locally to avoid the spread of the disease. Naturally, their market is smaller, and they face higher risks and overhead costs. Before the project, farmers reported to only have one buyer (Makhona) for their cattle, who basically had a buying monopoly. Cattle prices reached only around 60% of the national price.

*SUB-*STEP *3b. Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios (except the proposed project activity):*
Scenario 1, the continuation of pre-project land use with continuous and unmanaged grazing, faces no significant barriers. Each family is free to acquire and herd livestock in the way that they choose, within the broad constraints of seasonal shifts in the available grazing land. All other scenarios face a set of barriers, as shown above.

STEP 4. Common Practice Analysis
Practicing rotational grazing with the aim of restoring rangelands and improving herd structure, productivity, and market access is not common practice in communal rangelands in South Africa. Communal rangelands in South Africa have a long history of degradation (Hoffman & Ashwell, 2001). On communal lands, most pastoralists currently do not have sufficient resources and financial security to manage planned grazing as is done through activities in the proposed project scenario. A lack of control over fodder resources as a result of the 'tragedy of the commons' contributes to an inability to manage fodder resources. Additional facilitation to implement a holistic herding approach – also considering the needs of non-livestock owners, such as youth and women – with the necessary continuous extension and training via Eco-rangers is required to implement project activities. Financing for all of this is barely existent in the landscape and thus not common practice. Therefore, the income from the proposed soil carbon project for grassland management is essential for the implementation of the project activities.

3.1.6 Methodology Deviations

Limited data were collected for baseline carbon stocks at the project start in 2018 due to logistical constraints; while project activities had already commenced by that time in the first project instances, the full implementation of this complex and far-reaching project was still in its infancy. Thus, most baseline carbon stock measurements have only been collected since 2021, three years after the project start date.

However, this is not thought to affect the accuracy or conservativeness of estimated GHG benefits for several reasons.

First, the three-year delay is unlikely to have a significant effect on estimated GHG benefits, since changes in SOC stock between two distinct land use types happen gradually, in a time frame of about 20 years (Lal 2004).

Second, baseline carbon stock sampling included the first project instances as well as areas within the K2C biosphere/project region outside of the first project instances. Samples collected starting in 2021 within the first project instance may overestimate baseline carbon stocks, since project activities could have already produced increases in carbon stocks; based on these data, the change between baseline and project SOC stocks could appear to be lower than if the samples had been collected in 2018, reducing estimated emissions removals and increasing the conservativeness of estimated GHG benefits. However, even this impact may have been insignificant due to the aforementioned delay in SOC stock changes after a land use change occurs.
Third, the rest of the K2C biosphere/project region (outside of the first project influence) is unlikely to have experienced significant changes to baseline carbon stocks between 2018 and 2021, since grazing practices remained similar to those of the baseline scenario. In addition, these areas have long been used as pasture lands, even before the land area has been assigned to the Tribal Authorities, with the land use of unmanaged grazing having persisted for more than 30 years. Thus, due to the continuity of the land use, any changes to SOC stock would be minor. Based on the findings of Lal (2004), the baseline SOC stock equilibrium should have been reached for at least a decade prior to the collection of baseline soil samples, and the three-year delay in data collection would have had a minor impact.

Cattle numbers for the baseline scenario are well recorded in a yearly count by the State Vet as of 2015. To estimate the harmonic mean of the cattle numbers in each category, this dataset has been used. Though it does not cover the required 10 years baseline period, it is the most accurate dataset and therefore can better represent baseline conditions than any other means proposed in the methodology. Animal numbers are likely to have declined in recent years due to degradation of grasslands. Thus, by not accounting the full 10-year period, the baseline estimate of methane emissions of cattle is rather underestimating. Therefore, this methodology deviation is considered conservative. Cattle numbers are counted at the end of January each year by the State Veterinary Services. The years of 2015 to 2018 represent the baseline.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

Methane emissions
Baseline methane emissions from grazing animals is estimated from data on livestock categories that reflect species, age, sex, and average weight in the project area. Annual calculations are based on estimations of daily methane emissions (for each livestock category as a function of the body weight, kg) multiplied by the number of animals in each category and the number of days in a year (365). Emissions from all categories are summed to provide the baseline annual methane emissions from livestock in the project area.

Per methodology requirements, the equation below was followed to obtain the annual methane emissions in year *t* from grazing animals of each category, which only consists of cattle (ruminants).

$$BEM = \sum_{c=1}^{k}(BN_c * DMEF(W_c)) * GWP_{CH4} * 365 * 6.26 * 10^{-7}$$

where:

BEM Baseline annual emissions from grazing animals (tCO_2e)

BN_c	Baseline number of animals of category *c* (head), measured as per equation below
$DMEF(W_c)$	Daily emission factor as a function of animal weight category *c* (L CH_4 day^{-1})
W_c	Average body weight during the baseline period for animals of category *c* (kg)
GWP_{CH4}	Global warming potential for methane (28 tCO_2e / tCH_4),
C	Category of grazing animal
K	Number of categories of grazing animals, e.g., species, gender, age combinations
365	Number of days in a year to convert daily to annual emissions
6.26×10^{-7}	Conversion factor for L CH_4 day^{-1} to t CH_4 day^{-1}

In the project area, most livestock are cattle. Cattle is also the target livestock type for project activities. Thus, the accounting focusses only on this type. Therefore, DMEF(W_c) is $\mathbf{0.66 * W_c^{0.97}}$ for ruminants, with an uncertainty of 9.5% (see Table 4 in VM0032 methodology). Forage quality is not included in the VM0032 methodology since it would require the measurement of dry matter intake by animals and accurate estimations for free-living animals on grasslands, which is impractical and prohibitively expensive.

BN_c (harmonic mean number of animals in each category during the period 2015-2018 prior to the project start date of 2018) was calculated as in equation (2) as per VM0032:

$$BN_c = \left(\frac{1}{n}\right) * \left(\frac{1}{\sum_{i=1}^{n} \frac{1}{N_{c,i}}}\right)$$

The harmonic mean of baseline cattle numbers as per the State Veterinary Services report (counting livestock at weekly dipping events) is as follows:

Table 11 Baseline livestock population by project instance yearly (Source: State Veterinary Services South Africa)

Year	Welverdiend A	Welverdiend B	Utah A	Dixie
2015	2,157	1,091	923	246
2016	1,961	749	742	137
2017	1,911	619	694	124
2018	1,946	905	802	141

The weights per cattle class are based on IPCC default values and crosschecked with average measured weights in K2C communal areas as well as with expert opinion of Meat Naturally (Table 12). The proportion of each cattle class in the total herd has been similarly estimated by Meat Naturally and in consultation with livestock owners.

Table 12: Share of cattle sex and age classes from total livestock and the respective average weights.

Cattle classes	Proportion of herd (%)	Average weights based on IPCC 2006 (Table 10 A2) (kg)
Bulls	10	400
Oxen (castrated bulls)	25	400
Cows	25	350
Tollies (young bulls)	10	240
Heifers (pre-reproductive females)	10	240
Male calves	10	100
Female calves	10	100

Applying these shares and average weights to the harmonic mean of baseline livestock population in Equation 1 above gives the following baseline emissions as a result. BEM of any future project instances will be calculated similarly.

Table 13 Calculation and results table of baseline methane emissions from animal census

Animal category									Animal Census (Number of cattle)							Methane Emissions	
village	Sex/Age category	Estimated proportion of total herd	Weight (kg) as of Tab10A2_IPCC	DMEF_Wc (L CH4/day)	Per Animal Uncertainty (UDME_c)	GWP_CH4	conv_L_t	2015	2016	2017	2018	Harmonic Mean (BNc)	SD (1/N_C,i)	SEBN_c	Uncertainty in project mean of animals (UBN_c)	Annual Baseline methane emissions (BEM_t) (tCO2e/yr)	Uncertainty in project methane emissions (UBEM_c)
Dixie	bulls	10%	400	220,6	9,5%	28	6,26E-07	25	14	12	14	15	0,0152	2,0	50,98%	21,3	51,86%
	oxen	25%	400	220,6	9,5%	28	6,26E-07	62	34	31	35	38	0,0061	5,0	50,98%	53,2	51,86%
	cows	25%	350	193,8	9,5%	28	6,26E-07	62	34	31	35	38	0,0061	5,0	50,98%	46,7	51,86%
	tollies	10%	240	134,4	9,5%	28	6,26E-07	25	14	12	14	15	0,0152	2,0	50,98%	13,0	51,86%
	heifers	10%	240	134,4	9,5%	28	6,26E-07	25	14	12	14	15	0,0152	2,0	50,98%	13,0	51,86%
	calves_m	10%	100	57,5	9,5%	28	6,26E-07	25	14	12	14	15	0,0152	2,0	50,98%	5,5	51,86%
	calves_f	10%	100	57,5	9,5%	28	6,26E-07	25	14	12	14	15	0,0152	2,0	50,98%	5,5	51,86%
Utah	bulls	10%	400	220,6	9,5%	28	6,26E-07	92	74	69	80	78	0,0013	4,7	22,95%	110,3	24,84%
	oxen	25%	400	220,6	9,5%	28	6,26E-07	231	186	174	201	195	0,0005	11,7	22,95%	275,7	24,84%
	cows	25%	350	193,8	9,5%	28	6,26E-07	231	186	174	201	195	0,0005	11,7	22,95%	242,2	24,84%
	tollies	10%	240	134,4	9,5%	28	6,26E-07	92	74	69	80	78	0,0013	4,7	22,95%	67,2	24,84%
	heifers	10%	240	134,4	9,5%	28	6,26E-07	92	74	69	80	78	0,0013	4,7	22,95%	67,2	24,84%
	calves_m	10%	100	57,5	9,5%	28	6,26E-07	92	74	69	80	78	0,0013	4,7	22,95%	28,7	24,84%
	calves_f	10%	100	57,5	9,5%	28	6,26E-07	92	74	69	80	78	0,0013	4,7	22,95%	28,7	24,84%
Welverdiend	bulls	10%	400	220,6	9,5%	28	6,26E-07	325	271	253	285	281	0,0003	14,5	19,84%	396,7	22,00%
	oxen	25%	400	220,6	9,5%	28	6,26E-07	812	678	633	713	703	0,0001	36,3	19,84%	991,7	22,00%
	cows	25%	350	193,8	9,5%	28	6,26E-07	812	678	633	713	703	0,0001	36,3	19,84%	871,2	22,00%
	tollies	10%	240	134,4	9,5%	28	6,26E-07	325	271	253	285	281	0,0003	14,5	19,84%	241,7	22,00%
	heifers	10%	240	134,4	9,5%	28	6,26E-07	325	271	253	285	281	0,0003	14,5	19,84%	241,7	22,00%
	calves_m	10%	100	57,5	9,5%	28	6,26E-07	325	271	253	285	281	0,0003	14,5	19,84%	103,4	22,00%
	calves_f	10%	100	57,5	9,5%	28	6,26E-07	325	271	253	285	281	0,0003	14,5	19,84%	103,4	22,00%
												Total Animals	3743	Total Annual Baseline emissions (tCO2e/year)	3928	Uncertainty in baseline methane emissions (UBEM)	23,8%

Baseline Soil Organic Carbon

As outlined in the VCS VM0032 methodology (page 22), the total number of sampling stations *n* for the project area under a modeled approach must be determined using an online calculator. Sampling stations must be selected to encompass as much of the variability in these factors as possible to test that the model is appropriate for use in the project area. In a modeled approach, the total number of sampling stations should be sufficient to ensure representation of the full range of soil carbon densities found on the project area, so as to properly evaluate the model.

Sample size determination

Using the online calculator Free Statistics Calculator V 4.0[22], the anticipated effect size of changing grazing management on soil carbon density was 0.2. The VM0032 methodology requires a minimum power, corresponding roughly to required R^2 of 0.8, which confers a p-value < 0.01. There are 8 predictor variables in the SNAPGRAZE model. With these inputs, the calculator recommends the number of sampling sites to be n = 83.

Initially, this number was almost doubled to give room for a post-stratification of the sample. In total, 162 plots have been sampled across the landscape in order to be representative of the project area (Figure 22). Further information on the sampling design is also reflected and described in chapter 3.3.3.

Monitoring Sites: Kruger to Canyons

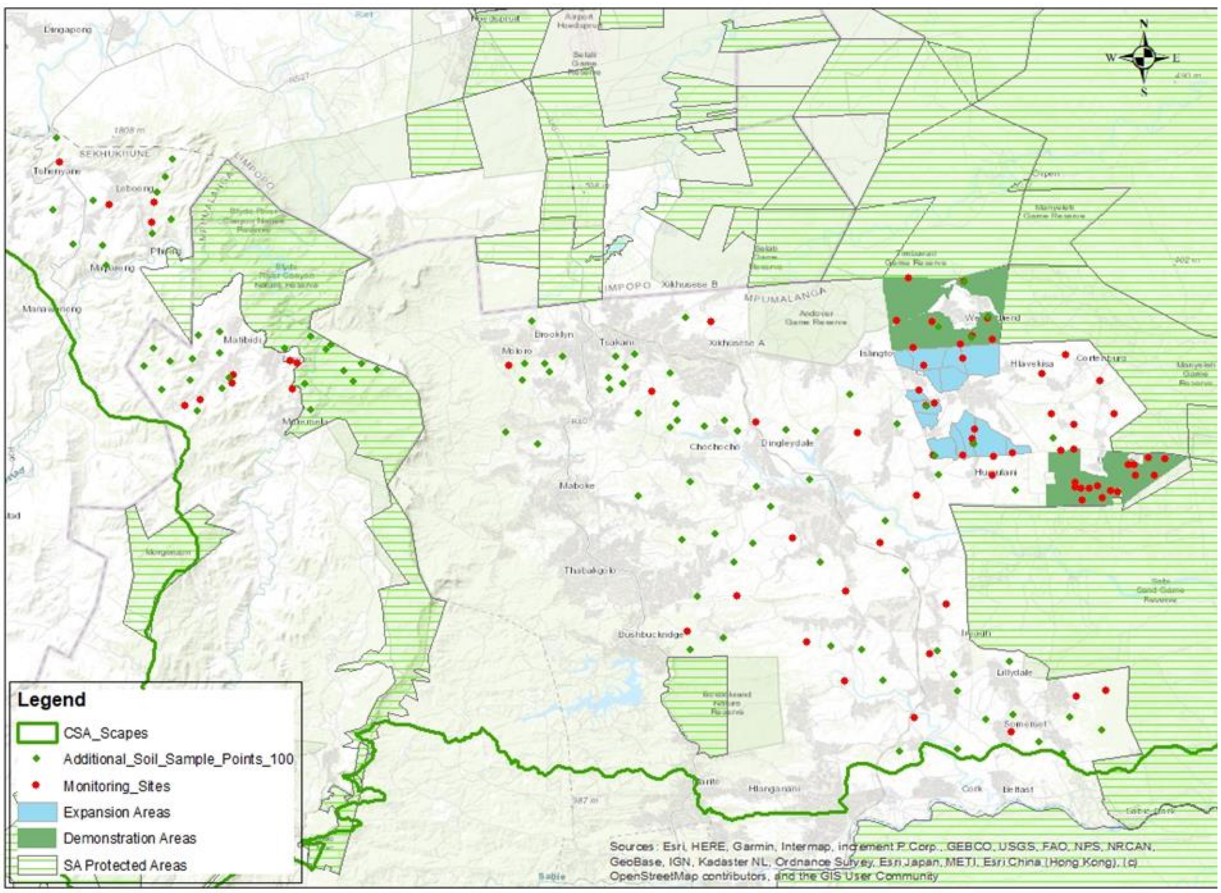

Figure 22 Location of 162 soil sampling stations (kml in supporting documents)

Stratification

22 http://www.danielsoper.com/statcalc/calculator.aspx?id=1

The stratification is done by altitude. The western sample cluster of 46 samples in Figure 22 represents the “Highveld”, the higher altitude, mountainous region of the project located near the Blyde River Canyon. There, lower temperatures and higher precipitation is expected to impact soil characteristics and soil carbon dynamics. The right sample cluster of 116 samples represents the “Lowveld”, which is characterized by lower altitude, rather flat terrain, and higher temperature. Measured soil carbon at the sampling points in 2021 revealed that there is high variability of soil carbon stocks in the project area. Correlations with sand content and community proved to be rather low further stratification was therefore omitted. As shown below the model was calibrated to differences in livestock density, which proved to be the main predictor of soil carbon dynamics at individual sampling points. This makes sense for large, unmanaged grazing camps as present in the baseline. Livestock roams freely and tends to concentrate grazing (and even defecation) unforeseeably and randomly wherever there is the most palatable grass in easiest reach. This is again then influenced by external factors of timing of livestock movements by herders. The soil carbon model validation was conducted for the lowveld stratum only.

Modeled approach: Soil Organic Carbon model
Baseline soil organic carbon for the proposed activity-based modeled approach, per the VM0032 methodology requires the measurement of the necessary model parameters to calibrate and validate the model. The project will use the SNAPGRAZE model for soil organic carbon dynamics (Ritchie 2020) which is an extension of the SNAP carbon model that was developed in a savanna grazing system in the Serengeti National Park (Ritchie 2014).

The SNAPGRAZE model has 18 input parameters:

- *MAP* = Long-term mean annual precipitation
- *MAT* = Long-term mean annual temperature
- *Fire* = Average number of fires per year
- *CG* = Daily biomass consumption rate
- *Density* = Livestock stocking density
- *Edays* = Number of days within the growing season prior to grazing episode
- *Ddays* = Number of days of grazing episode
- *Fdays* = Number of days left in the growing season after the grazing episode
- *Gdays* = Total number of days in the growing season
- *N* = Number of paddocks per total grazing area
- *W* = Average animal body size (live weight)
- *Depth* = Depth of soil sampling
- *Sand* = Sand content in top 30 cm soil in %
- *APCorrection* = Correction factor for the influence of annual vs perennial plant growth strategies on belowground production
- *LIGCELL* = Lignin and cellulose content of livestock feed
- *R* = Maximum relative growth rate of grass biomass
- S_K = Steady state biomass in the absence of grazing

- S_0 = Biomass condition at the onset of the growing season

Data / Parameter	$MAP_{j,m}$
Data unit	mm/year
Description	Mean annual precipitation in stratum m at station j
Source of data	ERA 5 climate dataset[23]
Description of measurement methods and procedures to be applied	Fifth generation ECMWF re-analysis for the global climate and weather for the past 8 decades. Data is available from 1940 onwards. Best data source to use spatially explicit.
Frequency of monitoring/recording	ERA 5 and related data is collected daily to hourly which over-satisfies the methodology requirements: Annually if obtained from government sources or local weather stations, daily if collected on the project area,
QA/QC procedures to be applied	Data collected form official weather stations or other official sources
Purpose of data	Calculation of baseline emissions
Comments	A key variable that affects a number of processes driving SOC

Data / Parameter	$MAT_{j,m}$
Data unit	°C
Description	Mean annual temperature in stratum m at station j
Source of data	ERA 5 climate dataset[23]
Description of measurement methods and procedures to be applied	Fifth generation ECMWF reanalysis for the global climate and weather for the past 8 decades. Data is available from 1940 onwards. Best data source to use spatially explicit.

[23] https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means?tab=form [April 16, 2023]

Frequency of monitoring/recording	ERA 5 and related data is collected daily to hourly which over-satisfies the methodology requirements: Annually if obtained from government sources or local weather stations, daily if collected on the project area,
QA/QC procedures to be applied	Data collected form official weather stations or other official sources
Purpose of data	A key variable that affects a number of processes driving SOC. Baseline emissions
Comments	

Data / Parameter	*Fire*
Data unit	
Description	Numbers of fire per year
Source of data	Measured/Observed in the project area
Description of measurement methods and procedures to be applied	Estimated based on observed fires as in Historical fire assessment as shown in chapter 3.2.1
Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	As in data source used.
Purpose of data	Influences the biomass at the onset of the growing season
Comments	

Data / Parameter	*CG*
Data unit	g/animal/day
Description	Daily biomass consumption rate

Source of data	Ritchie 2020
Description of measurement methods and procedures to be applied	Not applicable, as value comes from literature source.
Frequency of monitoring/recording	Static
QA/QC procedures to be applied	Application of correct value
Purpose of data	A key variable that affects the grazing intensity
Comments	

Data / Parameter	*Density*
Data unit	Animals/ha
Description	Livestock density in the project area
Source of data	Animal counts from the weekly dip tank procedures divided by the grazing camp area combined with livestock density estimates at sampling stations based on typical local herd movement. **Category** / **Cattle density** / **Value applied** 1 / no / 0.01 2 / light / 0.2 3 / medium / 0.4 4 / high / 0.7 5 / very high / 1.2
Description of measurement methods and procedures to be applied	Animal counts are done by the StateVet during weekly dip tank procedures. These are supported by the Eco-Rangers.

Frequency of monitoring/recording	Weekly
QA/QC procedures to be applied	Double checks of StateVet records by Eco-rangers
Purpose of data	A key variable that affects the grazing intensity and dung-derived SOC changes
Comments	Quantified data on livestock density is only available at the community level since all cattle is joined at the dip tank events. The resolution needed for the model however, is the level of individual sampling stations. Therefore, in the model adaptations at these sampling stations needed to be made to account for local livestock movements. These adaptations were documented directly in the model and are based on consultations with the technical team of CSA. To ensure model consistency over the project lifetime, this input parameter is fixed at each sampling station for the duration of the project. It shall only be changed with substantial changes in livestock numbers, which are not expected for the project.

Data / Parameter	*Edays*
Data unit	days
Description	Number of days within the growing season prior to the grazing episode
Source of data	Management plan
Description of measurement methods and procedures to be applied	Data estimated based on growing season
Frequency of monitoring/recording	Yearly
QA/QC procedures to be applied	Checked by project administration

Purpose of data	Determines the total biomass at the beginning of a grazing episode
Comments	

Data / Parameter	*Ddays*
Data unit	days
Description	Number of days of grazing episode
Source of data	Management plan
Description of measurement methods and procedures to be applied	Data estimated based on growing season
Frequency of monitoring/recording	Yearly
QA/QC procedures to be applied	Checked by project administration
Purpose of data	Determines the total biomass at the end of a grazing episode
Comments	

Data / Parameter	*Fdays*
Data unit	days
Description	Number of days left in the growing season after the grazing episode
Source of data	Management plan

Description of measurement methods and procedures to be applied	Data estimated based on growing season
Frequency of monitoring/recording	Yearly
QA/QC procedures to be applied	Checked by project administration
Purpose of data	Determines the total biomass at the end of the vegetation period
Comments	A key variable that affects a number of processes driving SOC

Data / Parameter	*Gdays*
Data unit	days
Description	Length of the vegetation period
Source of data	NDVI analysis
Description of measurement methods and procedures to be applied	The length of the vegetation period has been assessed in the frame of the NDVI analysis as shown in chapter 3.1.4.
Frequency of monitoring/recording	Yearly
QA/QC procedures to be applied	Checked by project administration
Purpose of data	A key variable for plant aboveground and belowground productivity
Comments	

Data / Parameter	*N*

Data unit	-
Description	Number of paddocks
Source of data	Management plan
Description of measurement methods and procedures to be applied	In the baseline scenario there is only one big paddock covering the whole pasture area, since it is unrestricted and unmanaged grazing. As soon as the grazing area is subdivided into camps (or paddocks in the language of the model), this number increases.
Frequency of monitoring/recording	Yearly
QA/QC procedures to be applied	Eco-rangers are present during meetings of the grazing association and can report back on this number easily. In the baseline scenario it is simply assured that this number is correctly reported by the communities.
Purpose of data	Important to determine the livestock density in the project
Comments	In the project then, every village has two camps that alternate between grazing and resting. Therefore n = 2.

Data / Parameter	*W*
Data unit	kg
Description	Average animal body size (kg)
Source of data	Weekly dip tank inspections and cattle sale numbers
Description of measurement methods and procedures to be applied	Scaling happens typically at a sale event. Based on body condition scoring, Eco-rangers can estimate monitor average body weight.
Frequency of monitoring/recording	Weekly
QA/QC procedures to be applied	Assured by presence of Eco-rangers

Purpose of data	Important to determine the livestock density in the project
Comments	

Data / Parameter	*Depth*
Data unit	cm
Description	Depth of soil sampling
Source of data	Measured in project area
Description of measurement methods and procedures to be applied	Sampling at each station according to stratum, soil taken at 30 cm, 4 sub-samples are taken at each station and mixed into a single station sample for analysis. Procedure followed described in Soil SOP
Frequency of monitoring/recording	At least every five years
QA/QC procedures to be applied	-All monitoring staff that undertake soil sampling have received training and refresher training for new field campaigns
Purpose of data	Determines the depth to which SOC is modeled
Comments	Default = 30. Can be adapted. In the project the modeled depth is 20 cm.

Data / Parameter	*Sand*
Data unit	%
Description	Sand content in 20 cm topsoil
Source of data	Measured at the permanent sampling plots

Description of measurement methods and procedures to be applied	Measured using standard soil laboratory analysis
Frequency of monitoring/recording	Every 5 to 7 years
QA/QC procedures to be applied	Good sampling practice assures data quality, as shown in the Monitoring Plan (chapter 3.3.3)
Purpose of data	Influences microbial respiration and therefore modeled SOC equilibrium
Comments	

Data / Parameter	*APCcorrection*
Data unit	-
Description	Correction factor for the influence of annual vs. perennial plant growth strategies on belowground production
Source of data	Default value from Ritchie 2020
Description of measurement methods and procedures to be applied	As shown in data source
Frequency of monitoring/recording	-
QA/QC procedures to be applied	As shown in data source
Purpose of data	Influences the belowground production
Comments	

Data / Parameter	*LIGCELL*
Data unit	-
Description	Lignin and cellulose content of plant biomass/ livestock feed
Source of data	Measured at permanent sampling plots
Description of measurement methods and procedures to be applied	SOC is often closely related to inputs of these forms of carbon because they resist microbial decomposition. Lignin and cellulose were measured as acid digestible fibre as per Richie (2014), using the Ankom commercial digestion products and process. Samples were taken from 67 sites in Welverdiend, Dixie and Utah, whereby clippings of the three dominate species were dried, weighed, and then subjected to a sulfuric acid hydrolysis method, as per the AnkomTechnology Corp commercial digestion products. The lignin cellulose data were captured in the K2C Carbon LIGCELL_measured11112021 dataset and stored in the MEL Database.
Frequency of monitoring/recording	Measured in the beginning of the project
QA/QC procedures to be applied	Collaboration with academic staff ensures quality of the sampling and analysis results
Purpose of data	Key variable that influences the plant derived and dung derived SOC change
Comments	

Data / Parameter	*R*
Data unit	-
Description	Maximum relative growth rate
Source of data	van der Plas, F., Zeinstra, P., Veldhuis, M., Fokkema, R., Tielens, E., Howison, R., & Olff, H. (2013). Responses of savanna lawn and bunch grasses to water limitation. *Plant ecology*, *214*, 1157-1168.

Description of measurement methods and procedures to be applied	As shown in source
Frequency of monitoring/recording	Once
QA/QC procedures to be applied	Dependent on source
Purpose of data	Influences the growth rate of grass biomass
Comments	Ecosystem specific value

Data / Parameter	S_K
Data unit	g/m²
Description	Biomass in the absence of grazing
Source of data	Measured from grazing exclosures at permanent sampling plots
Description of measurement methods and procedures to be applied	Eco-rangers measure regularly during the year with pasture-meters the growth in exclosures and clip at the end of the year.
Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	SOPs assure that measurements were taken according to plan. Collaboration with academia assures quality.
Purpose of data	Model input to estimate the growth of biomass in the absence of grazing
Comments	

Model version

The SNAPGRAZE model was developed by Mark Ritchie and published in 2020 (Ritchie 2020). The output of the model is the soil organic carbon at equilibrium that will be achieved with the given input data on climate, vegetation, soil, and cattle management. Although the paper was peer-reviewed, we found some errors in the equations of the paper. Therefore, the model version that was used for this project deviates in some equations from the original description. A model version report is put into Appendix 2: SNAPGRAZE model version. The model version for this project was constructed in the application Microsoft Excel.

Model calibration
The parameters for soil and vegetation (sand content in % and lignin-to-cellulose ratio) of the SNAPGRAZE model were entered. SNAPGRAZE was built as an extension of the SNAP model which was developed using extensive data on plant growth and soil properties in the Serengeti National Park (Ritchie 2014; Ritchie 2020). For climate data, the mean annual precipitation (MAP) and mean annual temperature (MAT) from 2013 to 2017 were used. The fire frequency for the project area was analyzed for the ten years prior to the project start. The formula for the daily cattle biomass consumption rate *CG* was altered; in the paper, it has a factor of 2 to account for lactating cows, but this was eliminated since the project does not include dairy cows. The maximum relative growth rate *r* was obtained from a literature review and taken from van der Plas et al. (2013). The inputs for livestock density at each sampling station are based on the total cattle size over the baseline period and estimation of grazing history at individual sampling stations by herders and the technical team of CSA. Based on its location in the landscape each sampling station within the project area was assigned to a livestock density category. There are five categories ranging from no, light, medium, high and very high livestock density. The livestock density calculated over the lowveld stratum based on cattle numbers from the diptank inspections in all villages is 0.6 [24]. We assumed that livestock density at a certain sampling station can at maximum only double to 1.2. Each livestock category was then given a value of 0.01, 0.2, 0.4, 0.7 and 1.2.the applicable value was then applied for each sampling station in the model. The average assigned cattle density over all sampling points had to be 0.6 in order to have the qualitative assignment of local cattle density connected to the measured cattle density data of the Lowveld. This ensures that the classification does not lead to an over- or underestimation of cattle density in the project area.
The model has two equations to calculate the microbial respiration in dependence of the soil organic carbon density. An exponential function is sought to be applied in a low SOC range, as the second linear function which is to be applied starting from 4600gC/m² h has a negative intercept below that value. The switch between these functions is determined by the linear equation. Thus, if the linear function results in a predicted SOC equilibrium of < 4600 gC/m² then the exponential function is applied.
We conducted a Monte Carlo simulation of 1000 iterations with random input values within set value ranges to test the range of the model output. The result is a normal distribution with a positive skew and a mean of ~33.5 tC/ha which is in line with a predicted mean and distribution derived by ISRIC Soilgrids. Files and data are provided in the supporting documentation for the project validation.

Model validation

The variance in measured SOC stocks across the landscape is large, due to complex topography, underlying geology and biogeochemical heterogeneity (e.g. grazing and fire),. Furthermore, the resolution of the model input variables differ, for example SOC is measured at the sub m^2 resolution and rainfall almost at a landscape level. This makes fitting a model predicting SOC at fine resolution challenging. Other soil data sources such as ISRIC SoilGrids show a much narrower range of SOC across the project area. For this reason the ISRIC SoilGrids data was used as a reference to validate measured sampling plots and categorize sample plots. [25].

Due to this high variability in measured SOC stocks, the sample size for validation had to be reduced to the minimum 83 from the 116 sites samples in the lowveld strata by removing most of the outliers. A value was considered an outlier when it was one standard deviation away from the mean. Only 77 samples were non-outliers. In order to achieve the minimum required total of 83 samples, six additional samples were added to the total. To increase conservativeness of the model and subsequently the baseline model run, these six additional samples were the next six samples from the upper range of outliers.
At each permanent sampling station four soil samples to a depth of 0 – 20 cm were taken within a 10 m radius of the plot center. Deeper sampling proved to be difficult due to a higher compaction with

[24] See supporting documentation – SNAPGRAZE Model; sheet “Raw data”
[25] Supporting document – “Sampling_plots_validation”

increasing depth. Samples for each layer were pooled to form a composite sample which was then dried and sent to a laboratory to be analyzed for total organic carbon using the Walkley-Black method. Furthermore, a bulk density measurement was taken at every sampling station using a cylinder with a known volume. This sample was weighed to determine the soil bulk density.

The parameters measured to validate the model were:

Data / Parameter	$SOC\%_{j,m,0}$
Data unit	Dimensionless proportion expressed as a percent
Description	Proportion soil organic carbon at station j in stratum *m* at time (year) = 0, i.e., at the start of the project or since the last verification
Source of data	Measured in project area
Description of measurement methods and procedures to be applied	Tracked at the level of j = 1 to z_m individual sampling stations in each stratum because net removals will be based on demonstrating how a soil carbon dynamic model, in this case SNAPGRAZE, can successfully predict current SOC from past conditions at individual stations.
Frequency of monitoring/recording	Every model validation
QA/QC procedures to be applied	The organic carbon concentrations are measured in appropriate academic or industrial laboratories with chemical automated, calibrated analytical machines.
Purpose of data	Baseline for performance-based removals based on increasing SOC
Comments	

Data / Parameter	$BULK_{m,j}$
Data unit	g/cm^3
Description	Bulk density
Source of data	Measured in project area
Description of measurement methods and procedures to be applied	Measured by taking a 20 cm soil core with a known volume at each sampling station, spreading the contents on a flat surface to identify and remove any stones or gravel, drying the soil core at 45°C to a constant weight, and weighing of the dried soil.
Frequency of monitoring/recording	Every model validation

QA/QC procedures to be applied	A consistent system of soil storage to prevent loss of mass prior to weighing, accurate estimation of rock volume, paper and digital archiving, corroboration with literature values
Purpose of data	Necessary to convert proportion of SOC in soil to mass of SOC/area.
Comments	

The soil and vegetation parameters as well as the climate input parameters were entered into the SNAPGRAZE model. The model was used to predict SOC stocks in 2021 based on the estimated history of grazing. The predicted SOC stocks for every sampling station were then compared to the observed SOC stocks at the same site. The results suggest that within the K2C project area, the model predicts mean and individual SOC values with more than 90% accuracy.

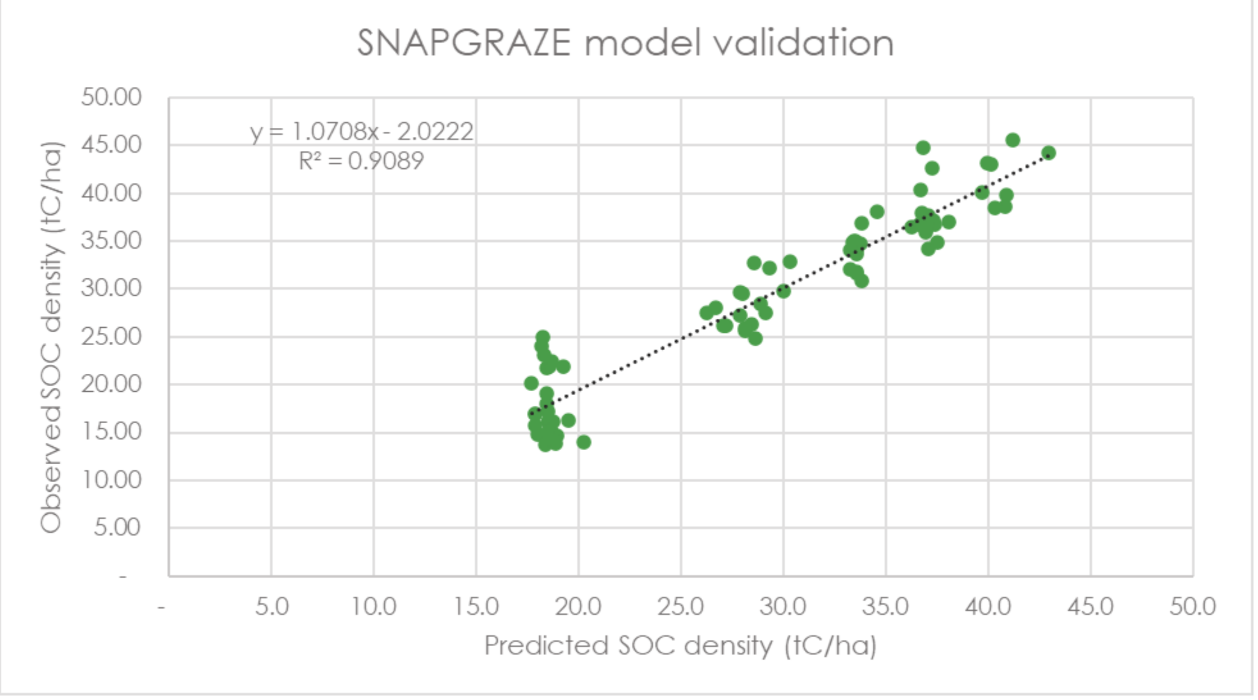

Figure 23 Regression of observed SOC density at each of the survey sites versus the predicted SOC density from the SNAPGRAZE model based on averages on mean annual precipitation and temperature, fire frequency, sand content, sampling depth, plant relative growth rate, lignin to cellulose content in plant biomass, biomass in absence of grazing, annual to perennial grass ratio, livestock density and grazing history, and grazing management.

The SNAPGRAZE model results suggest that unsustainable rangeland management and overgrazing have caused SOC losses in the past 30 years. It is assumed that the period of overgrazing started in the early 1980s and that, based on the results from Lal (2004), SOC stocks had been at equilibrium for more than 15 years at the time soil sampling and carbon density observations were conducted in 2021. As required by the VCS VM0032 methodology, the model must generate a coefficient of determination R^2 > 0.80 across all strata. The slope of the regression line must have a 95% confidence interval that includes a slope gradient of 1 and include the origin as a y-axis intercept. Bias must be determined by evaluating the percent bias of a simulation (carbon model) relative to observed data.

$$MBIAS = \frac{\sum_{j=1}^{n}(Y^{obs}{}_{j} - Y_{j}^{pred})}{\sum_{j=1}^{n} Y^{obs}{}_{j}}$$

Where:

MBIAS = Percent bias of carbon model predictions relative to observed data

n = number of sampling stations tested

$Y^{obs}{}_j$ = observed SOC density at station *j*

$Y^{pred}{}_j$ = SOC density predicted at station *j*

Bias of the model chosen for this methodology must be between -20% and +20%

The SNAPGRAZE model met all of these criteria (Table 14). The $R^2 = 0.91$ exceeds the required 0.80. The slope of the regression is 1.07 (+- 0.02 SE) with a 95% confidence interval from 0.9959 to 1.14, thus including 1.00. The y-axis intercept is -2.02 (+- 1.14SE) with a 95% confidence interval from -4.3 to 0.25 and thus includes the origin 0. The model bias MBIAS is -0.2% and therefore well below the criterion of 20%. These outcomes show that the SNAPGRAZE model meets the criteria for successful assessment of carbon stocks as prescribed in the VM0032 methodology.

Table 14 SNAPGRAZE model performance

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.953373694
R Square	**0.908921401**
Adjusted R Squ	0.907796974
Standard Error	2.780625962
Observations	83

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	1	6250.001966	6250.001966	808.3417445	6.65171E-44
Residual	81	626.2823399	7.73188074		
Total	82	6876.284305			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	***Lower 95%***	***Upper 95%***
Intercept	-2.02221603	1.142769237	-1.769575138	0.080561511	**-4.29596835**	**0.251536291**
X Variable 1	1.070840676	0.037664079	28.43135144	6.65171E-44	**0.995900973**	**1.14578038**

Furthermore, VM0032 requires that the predicted modeled mean baseline SOC and its 95% CI overlap with the 95% CI of the observed baseline SOC. This analysis was performed and confirms the suitability of the model in the project area (Figure 24).

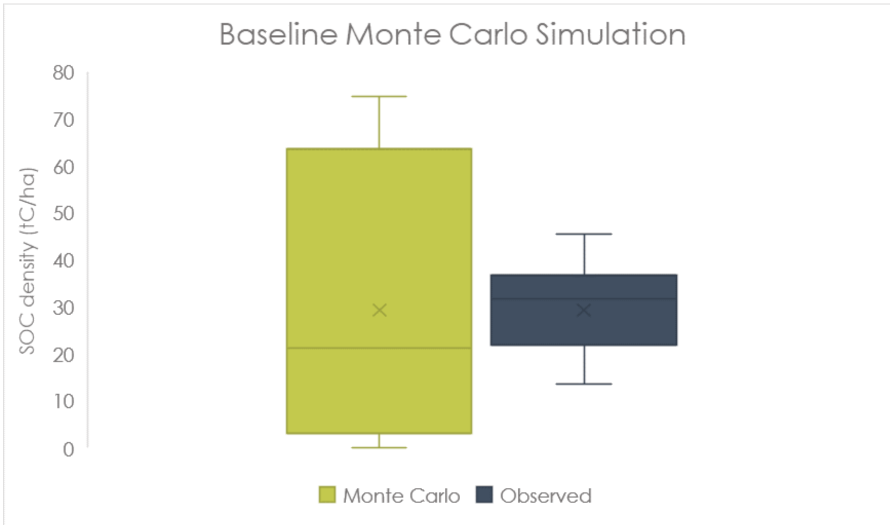

Figure 24. Predicted mean and 95% confidence intervals from Monte Carlo simulation (blue boxplot) for predicted baseline SOC compared to observed mean SOC (with 95% CI). Note that the 95% confidence intervals overlap, as required by the VM0032 methodology.

Estimation of baseline SOC

Under a modeled approach, VM0032 requires that the chosen soil carbon model estimate the maximum SOC at each station *j* in each stratum *m* during the 10 years prior to the project start date using a technique called back casting. This estimate, $MSOC_{m,j,0}$, is then used as a conservative estimate of baseline SOC at the project start date. Back casting implies knowledge of a prior condition (in this case, SOC) from which the model is run forward to estimate the current measured SOC, or $SOC_{m,j,0}$. From this model run, the predicted SOC for 10 years prior to the current time ($MSOC_{m,j,0}$) can be determined. This is, however, a directive based on the SNAP model. As SNAPGRAZE was developed later, this step is not applicable (nor feasible) anymore. The output of the SNAPGRAZE model is the soil organic carbon equilibrium that is achieved with the given input data on climate, vegetation, soil characteristics, and cattle management. As shown in chapter 3.1.6, the baseline SOC equilibrium 10 years prior to the project start (2008) can be assumed to be the same as at project start (2018) because baseline practices of uncontrolled cattle management and overgrazing of the communal rangeland had been practiced for more than the prior 20 years. No significant land use change has happened since the early 1980s.
The output of the SNAPGRAZE model is the soil organic carbon equilibrium that is achieved with the given input data on climate, vegetation, soil and cattle management. The baseline cattle management was determined by consultations of local cattle farmers. The model was used to calculate the soil organic carbon equilibrium at each permanent sampling station.

Uncertainty in baseline emissions

Since the project does not account for emission reductions produced by adjusting the fire frequency, baseline uncertainty is represented by *UBEM* alone.

$$UBEM = \frac{\left(\sum_{c=1}^{k}(BEM_c \times UBEM_c)^2\right)^{\frac{1}{2}}}{\sum_{c=1}^{k} BEM_c}$$

Where:

UBEM = Uncertainty in baseline methane emissions from grazing animals (%)

$UBEM_c$ = Uncertainty in baseline methane emissions from animals in category c (%)

BEM_c = Baseline emissions from animals in category *c* (tCO_{2e})

$UBEM_c$ is the uncertainty in methane emissions from animals in category *C*, as dictated by whether the animals are ruminants, equids, or pigs (see Table 4, section 8.1.3.1 in VM0032), $UBEM_c$ is calculated from the uncertainty for each animal category in the regression equations that predict daily methane emissions per animal (DME_c) based on the mean body weight ($UDME_c$) and the uncertainty in the harmonic mean of animal counts (UBN_c) during the baseline period.
To obtain UBN_c , one must first calculate $SEBN_c$, the standard error[31] of the harmonic mean BN_c of the series'

$$SEBN_c = (BN_c)^2 \times \frac{SD\left(\frac{1}{N_{c,i}}\right)}{(n-1)^{1/2}}$$

Where:

$SEBN_c$ = Standard error of the harmonic mean of animal counts in category *c*

$SD(1/N_{c,i})$ = Standard deviation of the inverses of the count *I* of animals in category *c*

$N_{c,I}$ = Animals in category *c* in census *I* (head)

BN_c = Harmonic mean number of animals in category *c* (head) during the baseline period (head)

n = Number of censuses

The 95 percent confidence interval-based uncertainty in the estimated number of animals in category *c* is:

$$UBN_c = 3.84 \times 100 \times \frac{SEBN_c}{BN_c}$$

Where:

UBN_c = Uncertainty in the harmonic mean of animal counts (%)

$SEBN_c$ = Standard error of the harmonic mean of animal counts

BN_c = Baseline number of animals of category *c* (head)

3.84 = Multiplier converts expression into a 95% confidence interval

100 = Multiplier converts expression into percent

$$UBEM_c = (UBN_c^2 + UDME_c^2)^{1/2}$$

Where:

$UBEM_c$ = Uncertainty in baseline methane emissions from animals in category *c* (%)

UBN_c = Uncertainty in the baseline harmonic mean of animals of category *c* (%)

$UDME_c$ = Uncertainty in the regression for predicting daily methane emissions for animals of category *c* (%) = **9.5%** (as per Table 4 in VM0032)

Estimation of baseline emissions and uncertainty

The results of this calculation for the first project instances following the above protocols are all presented in Table 13. SOC emissions are conservatively assumed to be zero, ΔSOC = 0, so

$$BER = BEM$$

3.2.2 Project Emissions

Calculation of project emissions and removals

Net annual GHG emissions and removals of the project, *NPR_t*, are determined by the sum of methane emissions, *PEM_t*, and net removals from SOC sequestration, *PRS_t*.

$$NPR_t = PEM_t + PRS_t$$

Methane emissions

Project activities do not focus on the reduction of livestock numbers per se and thus, no market leakage is applicable. Activities rather focus on grassland productivity, animal health, and, consequently, meat productivity increase, which may lead to changes in livestock numbers and even more so on herd structure. Such changes in number and structure may lead to decreased methane emission in the project scenario. Since no displacement of cattle via market leakage can be expected, this should be accounted for following the below calculation. Calculations are based on animal counts and emission factor data based on project area-applicable body weight (Table 12) of each category as shown in the previous sub-chapter.

Project methane emissions from livestock enteric fermentation are calculated as shown below:

$$PEM_t = \sum_{c=1}^{k}(PN_c * DMEf(W_c)) * GWP_{CH4} * 365 * 6.26 * 10^{-7}$$

where:

PEM_t	= Project emissions of CH_4 from grazing animals in year *t* (tCO_2e)
PN_c	= Number of animals in category *c* (head)
$DMEf(W_c)$	= Daily emission factor as a function of animal weight category c (L CH_4 day^{-1})
W_c	= Average body weight during year t for animals of category c (kg)
GWP_{CH4}	= Global warming potential for methane (28 tCO_2e / tCH_4),
C	= Category of grazing animal
K	= Number of categories of grazing animals, e.g., species, gender, age combinations
365	= Number of days in a year to convert daily to annual emissions
6.26×10^{-7}	= Conversion factor for L CH_4 day^{-1} to t CH_4 day^{-1}

Soil carbon removals

The SNAPGRAZE model predicts a SOC equilibrium that will be achieved with the given input parameters on climate, vegetation, soil properties and livestock management. Improved grazing management has the potential to restore SOC stocks. Current estimates shows that an increase from the baseline average of

29.2 tC/ha (107.16.0 t CO_2e/ha) to a SOC equilibrium of about 44.9 tC/ha (164.78 t CO_2e/ha) is possible. The model does not calculate nor indicate the time to reach equilibrium and therefore does not by itself calculate an annual SOC change. Therefore, we have to assume a time frame of 20 years to reach the new SOC equilibrium based on Lal (2004). Annual project removals due to changes in SOC stocks (PRS_t) were calculated using the following equations. First, removals were calculated for each stratum:

$$PRS_{m,t} = \frac{44}{12}\left(\frac{\sum_{j=1}^{Z_m}\left(PSOC_{m,j}^{eq} - MSOC_{m,j,0}\right)}{Z_m}\right) \times \frac{1}{D}$$

Where:

$PRS_{m,t}$ = Annual project removals due to changes in SOC stocks in stratum *m* in year *t* (tCO_2e/ha)

$PSOC^{eq}_{m,j,}$ = Project modelled equilibrium *SOC* at station *j* in stratum *m* (tC/ha) based on parameter values from z_m sampling stations in stratum *m*

z_m = Number of sampling stations in stratum *m*

$MSOC_{m,j,0}$ = Modeled baseline *SOC* at station *j* for stratum *m* at time *t* =0 (tC/ha) (see previous subchapter)

D = Years required to achieve equilibrium (project-wide value); Term not required by SNAPGRAZE

44/12 = Conversion factor from tC to tCO_2e

Then, removals across all strata were estimated using the following equation:

$$PRS_t = \sum_{m}^{s}\left(PA_{m,t} \times PRS_{m,t}\right)$$

Where:

PRS_t = Project removals due to changes in SOC stocks in year *t* (tCO_2e)

$PA_{m,t}$ = Project area of stratum *m* in year *t* (ha)

s = Number of strata in the project area

$PRS_{m,t}$ = Annual project removals due to changes in SOC stocks in stratum *m* in year *t* (tCO_2e/ha)

Uncertainty in project emissions and removals

Total uncertainty is calculated by weighting uncertainties according to the magnitude of emission or removal. In this case, uncertainty in net reductions and removals UNR_t is driven by uncertainty in baseline emissions, project emissions, and project net changes in carbon stocks.

$$UNR_t = \frac{((UPEM_t \times PEM_t)^2 + (UNCCS_t \times NCCS_t)^2 + (UBE \times BEM)^2)^{1/2}}{PEM_t + NCCS_t + BEM}$$

Where:

UNR_t = Uncertainty in net emission reductions and removals, not including leakage, at time *t* (%)

$UPEM_t$ = Uncertainty in project emissions at time *t* (%)

$UNCCS_t$ = Uncertainty in net change in carbon stocks at time *t* (%)

UBE = Uncertainty in baseline emissions (%)

BEM = Baseline animal methane emissions (tCO_2e)

PEM_t = Project animal methane emissions at time *t* (tCO_2e)

$NCCS_t$ = Net project changes in carbon stocks (tCO_2e)

Uncertainty in annual project methane emissions is calculated as:

$$UPEM = \frac{(\sum_{c=1}^{k}(PEM_c \times UPEM_c)^2)^{1/2}}{\sum_{c=1}^{k} PEM_c}$$

Where:

UPEM = Uncertainty in project methane emissions from grazing animals during the monitoring period (%)

$UPEM_c$, = Uncertainty in project methane emissions from animals in category *c* (%)

PEM_c = Project methane emissions from animals in category *c* (tCO_2e)

$UPEM_{c,}$ is the uncertainty in methane emissions calculated from the uncertainty, for each animal category, in the regression equations for per animal daily methane production and the uncertainty in the arithmetic mean of animal censuses for category *c*, PN_c, during the monitoring period.

$$UPEM_{c,} = (UPN_c^2 + UDME_c^2)^{1/2}$$

Where:

UPN_c = Uncertainty in the project mean of animals in category *c*

$$UPN_c = 3.84 \times 100 \times \frac{SD(PN_{c,Y})}{PN_c \times (n-1)^{1/2}}$$

$SD(PN_{c,Y})$ = Standard deviation of animal counts in category *c* across *Y* years of the monitoring period

PN_c = Arithmetic mean of animal numbers in category *c* (head)

Y = Years in the monitoring period

3.84 = Multiplier converting expression into a 95% confidence interval

100 = Multiplier converting expression into percent

$UPME_c$ = Uncertainty in the regression for predicting daily methane emissions for animals of category *c* (%) = **9.5%** (as per Table 4 in VM0032)

Uncertainty in changes in soil carbon stocks under a modelled approach, $UNCCS_{m,t}$ is obtained from the calculated 95% confidence interval as required by the current VCS Standard 3.7 and the VM0032 methodology using a Monte Carlo simulation of $NCCS_{m,t}$ based on parameter values in each stratum *m*. This interval is determined by iterated calculations that sample from hypothetical normal distributions of values of each parameter in the calculation, defined by the mean and standard errors of each parameter for that stratum. Repeated calculations, with random draws from the distributions from each parameter, give a distribution of calculation outcomes with an overall mean and standard error for the calculation. Such Monte Carlo simulations were done using the SNAPGRAZE model software. The standard error for the SNAPGRAZE SOC prediction, $SE(PRS_m)$ for each stratum generated by the Monte Carlo simulations was then then be used to calculate 95% confidence intervals (95% CI) for SOC removals.

Under a modelled approach, $UNCCS_t$ is obtained from the calculated 95% CI, as required by the VCS VM0032 methodology from a Monte Carlo simulation of modelled changes in soil carbon averaged across *n* model runs in stratum *m* and across all strata *s*. For each stratum:

$$UPRS_{m,t} = 3.84 \times 100 \times \frac{SD(MOD\Delta SOC)}{MOD\Delta SOC \times (n-1)^{1/2}}$$

Where:

$UPRS_{m,t}$ = Uncertainty in project removals through increased soil carbon in stratum *m* at time *t* (%)

$SDMOD\Delta SOC_m$ = Standard deviation of more than 100 modelled differences between product SOC ($PSOC_m$) and estimated modelled baseline SOC ($MSOC_m$) estimates for stratum m from Monte Carlo simulation.

$MOD\Delta SOC_m$ = Mean modelled difference between project equilibrium SOC for stratum m ($PSOC_m$) and modelled baseline SOC ($MSOC_m$) from more than 100 simulations of project equilibrium SOC, (tC/ha)

n	= Number of times simulation is run (must be greater than 100)
3.84	= Multiplier to convert standard error into a 95% confidence interval
100	= Multiplier to convert to percent

3.2.3 Leakage

Leakage can result from displacement of livestock to areas outside of the project area (displacement leakage) and from the replacement of livestock, reduced intentionally by project activities to reduce methane emissions, by producers outside the project area to meet market demand (market leakage).

Displacement leakage

Movement of livestock to areas outside of the project area could result in losses of carbon from higher levels of overgrazing in these areas, a phenomenon known as displacement leakage. Displacement leakage can be determined using the tool *VMD0040 Leakage from Displacement of Grazing Activities* for a measured approach or by using the penalty approach based on a reduction in net removals proportional to the total livestock-days spent off the project area. The project uses the penalty approach. In this case, displacement leakage (LD_t) must be calculated as a proportion of net removals from increased soil carbon in year *t* (PRS_t), based on the proportion of total project livestock-days in project year *t* (365 x $PN_{C,t}$) that occurred outside the project area.

$$LD_t = \frac{\sum_{x=1}^{d} \sum_{c=1}^{k} DN_{c,x}}{365 \times \sum_{c=1}^{k} PN_{c,t}} \times PRS_t$$

Where:

LD_t	= Leakage emissions from displaced livestock (tCO_2e)
$DN_{c,x}$	= Number of livestock of each category *c* that were off the project area on day *x* (head)
D	= Total number of days livestock of class *c* were off the project area
K	= Total number of livestock categories
$PN_{c,t}$	= Number of animals of each category *c* in year *t* (head)
PRS_t	= Project removals due to changes in *SOC* in year *t* (tCO_2e)

Market Leakage

Market leakage is considered negligible since livestock numbers are rather connected to carrying capacity than to market dynamics. Project participants cannot access any market outside the foot-and-mouth disease red zone, which renders the market with very few buyers and leads to high market inefficiencies.

Consequently, with market leakage = 0, total leakage is calculated as:

$$LE_t = LD_t$$

Total leakage uncertainty is calculated as:

$$ULE_t = UPRS_t$$

For the *ex-ante* calculation below, we assume that even displacement leakage is 0. Fences around the grazing camps as well as the presence of Eco-rangers should minimize events of cattle roaming outside the project area to an insignificantly low level.
In addition, these areas outside of the project area, where displaced livestock could be moved, have been used for unmanaged livestock grazing by the same communities in the past. Thus, reductions in SOC stock through displacement leakage of livestock is not expected to have a significant leakage effect. It is

more likely that pressure on these out-of-project areas will be reduced through managed grazing within the project areas, causing a positive spillover effect for grassland restoration.

3.2.4 Net GHG Emission Reductions and Removals

The estimation of net project emission reductions, PER_t, and net change in carbon stocks, $NCCS_t$, for each year of the monitoring period is calculated using the following equations:

$$PER_t = PEM_t - BEM$$

Where:

PER_t = Net project emission reductions in year *t* (tCO_2e)

PEM_t = Project methane emissions from livestock in year *t* (tCO_2e)

BEM = Baseline methane emissions from livestock (tCO_2e)

Changes in carbon stocks, in absence of changes in aboveground woody plant carbon, which is *de minimis* in this ecosystem without fire, are given by

$$NCCS_t = PRS_t$$

Where:

$NCCS_t$ = Net change in carbon stocks in year *t* (tCO_2e)

PRS_t = Project removals due to sequestration of soil carbon in year *t* (tCO_2e)

Note that there is no term included for changes in carbon stocks due to changes in woody plant biomass because there are no project activities that should significantly reduce aboveground woody carbon and any increases in aboveground woody carbon are conservatively excluded. Bush thinning through pruning and brush packing activities do not reduce the total number of trees, but rather promote growth of pruned trees that will ultimately shade out small encroaching trees.

The net GHG benefit is calculated using the following equation:

$$R_t = PER_t + NCCS_t - LE_t$$

Where:

R_t = Net GHG emission reductions and removals in year *t* (tCO_2e)

PER_t = Net project emission reductions in year *t* (tCO_2e)

$NCCS_t$ = Net change in carbon stocks in year *t* (tCO_2e)

LE_t = Total leakage changes in soil carbon in year *t* (tCO_2e)

Total project uncertainty is given by:

$$UT_t = \frac{((NR_t \times UNR_t)^2 + (LE_t \times ULE_t)^2)^{1/2}}{NR_t + LE_t}$$

Where:

UT_t = Total project uncertainty (%)

UNR_t = Uncertainty in net emissions and removals, not including leakage (%)

ULE_t = Uncertainty in leakage emissions and losses from soil carbon stocks at time *t* (%)

NR_t = Net emissions reductions and removals at time *t*, not including leakage (tCO_2e)

LE_t = Leakage emissions and losses from soil carbon stocks at time *t* (tCO_2e)

If total project uncertainty in year *t*, based on 95% CI, $UT_t \leq 30\%$, then no deduction is applied. If $UT_t > 30\%$, then the modified discounted value, $R_t = R_{t\,disc}$ for net anthropogenic GHG removal by sinks to account for uncertainty is calculated as:

$$R_{tdisc} = \frac{(100 - UTt)\ x\ Rt}{100}$$

Where:

$R_{t\,disc}$ = Discounted net GHG emission reductions and removals by year t (tCO_2e)

UT_t = Total project uncertainty

R_t = Net GHG emission reductions and removals by year t (tCO_2e)

For each year *Y* of the monitoring period,

$$R_Y = \sum_{t=1}^{d} R_t^{disc} + \sum_{t=1}^{u} R_t$$

Where:

d = Number of years in which net removal must be discounted

u = Number of years in which removals are not discounted

Y = Number of years in the monitoring period (d + u)

R_t^{disc} = Discounted net GHG emission reductions and removals by year t (tCO_2e)

R_t = Net GHG emission reductions and removals by year t (tCO_2e)

The following ex-ante estimate has been calculated based on the internal upscaling plan. It is assumed that after 20 project years on a particular area the new SOC equilibrium is reached as modelled by SNAPGRAZE. This explains the decrease in net GHG emission reductions or removals at the end of the project. The estimated net GHG emission reductions or removals include also a deduction of a 10% non-permanence risk buffer contribution, as well as a general deduction of 5% for uncertainty of prediction.[26]

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2019	3928	-18274	0	-15508
2020	3928	-18274	0	-15508
2021	3928	-18274	0	-15508
2022	3928	-18274	0	-15508
2023	6473	-30113	0	-25554
2024	9017	-41951	0	-35601
2025	11562	-53789	0	-45647
2026	14162	-65887	0	-55913
2027	17069	-79411	0	-67390
2028	20031	-93191	0	-79084
2029	23054	-107254	0	-91019
2030	26077	-121318	0	-102954
2031	29100	-135382	0	-114889
2032	32123	-149446	0	-126824
2033	35146	-163510	0	-138759
2034	38169	-177573	0	-150694
2035	41191	-191637	0	-162628
2036	44214	-205701	0	-174563
2037	47237	-219765	0	-186498
2038	50260	-233829	0	-198433
2039	50260	-215554	0	-181073
2040	50260	-215554	0	-181073

[26] Detailed calculations can be found in supporting documents → ex ante → K2C_Ex-Ante Estimate_2023

2041	50260	-215554	0	-181073
2042	50260	-215554	0	-181073
2043	50260	-215554	0	-181073
2044	50260	-203716	0	-169826
2045	50260	-191878	0	-158580
2046	50260	-180040	0	-147334
2047	50260	-167942	0	-135841
2048	50260	-154418	0	-122993
Total	**963,199**	**-4,118,620**	**0**	**-3,458,420**

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation

Project Design

Per the VCS VM0032 methodology, the following data and parameters will be presented at validation:

(1) Maps of the project area, indicating all land parcels included in the project, as indicated in accompanying shape files with vector coordinates of project and stratum boundaries.

(2) Maps, with accompanying georeferenced shape files, of the locations of the permanent sampling stations overlaid on a map of project strata.

(3) Results of analysis to determine the number of sampling units and their allocation among strata.

(4) Results of cluster analysis to determine project strata.

(5) Table of all project strata, their description, and area, PA_m

(6) Legal statements of the usage rights of conservancy members to graze livestock and benefit from carbon sales, and governmental permissions for conducting the project.

(7) Justification of planned rotational grazing practices.

(8) Justification of methane as the major emission source and methane and soil carbon as the major sink for carbon dioxide in the project.

Data / Parameter	$PA_{m,g}$
Data unit	ha
Description	Project area in stratum *m*
Source of data	Measured in project area
Value applied	Total project area of first instances is 6,432 ha.

Justification of choice of data or description of measurement methods and procedures applied	This is only the project area of the first project instances Utah, Dixie, and Welverdiend, which all are in the "lowveld stratum". New project instances will join the project over time, so no final value can yet be fixed here. It is estimated to be ca. 80,300 ha. Area data will come from shape files in a GIS.
Purpose of data	Calculation of project and baseline emissions Computation of project soil carbon removals
Comments	

Data Unit / Parameter	GWP_{CH4}
Data unit	$tCO_2e/t\ CH_4$
Description	Global-warming potential (GWP) for CH_4
Source of data	100-year GWP_{CH4} without climate change feedback obtained from the IPCC 5th Assessment Report
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	Recent and common value, not substantially different than value of IPCC 6th Assessment report (27.2)
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comment	

Baseline Methane Emissions

Data / Parameter	$W_{c,t}$
Data unit	kg
Description	Average body weight for animals of category *c* in year *t*
Source of data	IPCC default values
Value applied	**Cattle classes** — **Average weights based on IPCC 2006 (Table 10 A2) (kg)** Bulls — 400 Oxen (castrated bulls) — 400 Cows — 350 Tollies (young bulls) — 240 Heifers (pre-reproductive females) — 240

	Male calves 100 Female calves 100
Justification of choice of data or description of measurement methods and procedures applied	Necessary to estimate emission factor for grazing animals using allometric equations. Measurements must be taken in accordance with the procedures described in Section 9.1.2 of the VM0032 Methodology.
Purpose of data	Calculation of baseline emissions Calculation of project emissions
Comments	

Data / Parameter	$N_{c,i}$
Data unit	Number
Description	Baseline number of animals of category *c* in census *i*
Source of data	Measured in project area by State Veterinary Services
Value applied	See Table 11
Justification of choice of data or description of measurement methods and procedures applied	The number of animals in each census *i* are measured to calculate the harmonic mean of the multiple counts *i* of *n* censuses of animals in category *c*. The methodology requires at least four measurements within the baseline period, with at least two during the period 5-10 years prior to the project start. However, data were not available for the entirety of the required 10-year baseline period, and, therefore, a methodological deviation was taken. Cattle numbers of the baseline are well recorded in a yearly count by State Veterinary Services as of 2015. To estimate the harmonic mean of the cattle numbers in each category *c*, a dataset was used that covered each year in the period 2015-2018. Though it does not cover the entire 10-year baseline period, this is the most accurate dataset available, and, therefore better represents baseline conditions than any other means proposed in the methodology. Animal numbers are likely to have declined in recent years due to degradation of grasslands. Thus, by not accounting the full 10-year period, the baseline estimate of methane emissions of cattle is rather underestimating. Cattle numbers are counted at the end of January each year by the State Veterinary Services. The years 2015 to 2018 represent the baseline. Measurements must be taken in accordance with the procedures described in Section 9.1.2. of the VM0032 Methodology.

Purpose of data	Calculation of baseline emissions
Comments	This document provides in Table 11 historical estimates for number of grazing animals, BN_c, for each year in which counts or estimates are available. The breed is national and homogenous. Sex and age plus the respective live body weights (W_c) of each category, with 95% CI and uncertainties are provided. The project description also provides a data table showing calculations of methane emissions based on the equations in VM0032 for each animal category for each year the data are available. The table includes calculated total emissions for that year and a cell containing the harmonic mean of total annual calculated methane emissions. This is the baseline BEM. The harmonic mean appropriately and conservatively weights the average methane emissions towards the lower values of a time series of measurements. The table also shows the uncertainty in daily methane emissions and the harmonic mean and its uncertainty.

Parameters for Baseline Calculation of Emissions from Burning of Biomass

The project does not plan to increase fire intensity. Therefore, the data/parameters within VM0032 for monitoring burning of biomass are not applicable.

Parameters for Calculation of Baseline SOC

Data / Parameter	$DEPTH_{m,j,0}$
Data unit	cm
Description	Soil core depth at station *j* in stratum *m* at time *t = 0* (ie, at the start of the project or since the last verification)
Source of data	Measured in project area
Value applied	20
Justification of choice of data or description of measurement methods and procedures applied	At each sampling station *j*, according to standard methods, soil is taken from four (4) soil cores to a depth that reflects depth to the general hardpan and until deeper auger measurements were not possible. The four sub-sample cores were well-mixed into a single composite sample for analysis.

Purpose of data	Calculation of baseline emissions
Comments	

Data / Parameter	$SOC\%_{j,m,0}$
Data unit	Dimensionless proportion expressed as a percent
Description	Proportion soil organic carbon at station *j* in stratum *m* at time *t = 0* (i.e., at the start of the project or since the last verification)
Source of data	Measured in project area
Value applied	Shown for each station
Justification of choice of data or description of measurement methods and procedures applied	The baseline for the measured offset approach is based on increasing SOC. Tracked at the level of j = 1 to z_m individual sampling stations in each stratum because offset will be based on demonstrating changes in SOC at individual stations and then summing increments. At each sampling station *j*, according to standard methods, measurements as above were applied. Organic carbon concentrations were measured in an appropriate academic laboratory that used either chemical combustion or the Walkley-Black method.
Purpose of data	Calculation of baseline emissions
Comments	

Data / Parameter	$BULK_{m,j,0}$
Data unit	g/cm^3
Description	Bulk density at station *j* in stratum *m* at time *t = 0* (i.e., at the start of the project or since the last verification)
Source of data	Measured in project area
Justification of choice of data or description of measurement methods and procedures applied	At each sampling station *j*, according to standard methods, soil was taken from at least 4 soil cores to the depth that reflects the depth to hardpans. A volumetric ring with known volumes of soil was used. Cores were sieved to remove rocks, pebbles, and coarse fragments. The remainder was dried (5 days at 45°C or equivalent) and weighed to determine bulk density.
Purpose of data	Calculation of baseline emissions
Comments	

Parameters for Soil Carbon Models

Data / Parameter	MAP_m
Data unit	mm/yr
Description	Mean annual precipitation in stratum *m*
Source of data	ERA 5 climate dataset
Value applied	604.6
Justification of choice of data or description of measurement methods and procedures applied	A key variable that affects a number of processes driving SOC. ERA 5 gave the best value accounting for local differences.
Purpose of data	Calculation of baseline emissions
Comments	Five-year averages used (2013 – 2017)

Data / Parameter	*MAT*
Data unit	°C
Description	Mean annual temperature over the project area
Source of data	ERA 5 climate dataset
Value applied	20.9
Justification of choice of data or description of measurement methods and procedures applied	A key variable that affects a number of processes driving SOC, especially microbial respiration. ERA 5 gave the best value accounting for local differences.
Purpose of data	Calculation of baseline emissions
Comments	Five-year averages used (2013 – 2017)

Data / Parameter	*n*
Data unit	

Description	Number of pastures per village
Source of data	Measured in project area
Justification of choice of data or description of measurement methods and procedures applied	A key input variable that influences the grazing intensity during grazing events
Purpose of data	Calculation of baseline emissions
Comments	

Data / Parameter	$SAND\%_{j,m}$
Data unit	Dimensionless proportion, expressed as percent
Description	Proportion of soil that is sand, silt, and or clay at station *j* in stratum *m*
Equations	Model input
Value applied	Individual values for each sampling station
Source of data	Measured in project area
Justification of choice of data or description of measurement methods and procedures applied	Soil collected to desired depth at each sampling station must be mixed, and subsample analyzed for clay, silt, and sand fractions in a professional laboratory. Some models require percent sand, some percent clay and some percent of all three particle classes, sand, silt, and clay.
Purpose of data	Calculation of baseline emissions
Comments	

Data / Parameter	*w*
Data unit	kg
Description	Average animal body size (live weight) as an input to the SNAPGRAZE model
Source of data	Estimated average based on diptank inspections & market value assessment crosschecked with the IPCC default values as used above
Value applied	320

Justification of choice of data or description of measurement methods and procedures applied	Average animal body size determines the biomass consumption rate in the model.
Purpose of data	Calculation of baseline soil carbon emissions through SNAPGRAZE
Comments	

Data / Parameter	*Livestock density*
Data unit	Number/ha
Description	Cattle density in the project area and at every sampling station
Source of data	Total cattle numbers are measured in project area by State Veterinary Services. Livestock density at individual sampling stations is then estimated based on cattle movements for each sampling stations
Value applied	Individual at each sampling station, average = 0.6
Justification of choice of data or description of measurement methods and procedures applied	Livestock density is an important input variable for the SNAPGRAZE model as it determines the grazing intensity when a camp is open for cattle
Purpose of data	Calculation of baseline and project emissions through SNAPGRAZE
Comments	Classification for each sampling station based on grazing history/ frequency of herd movements. Will remain a fixed value for each sampling station as long as there is no substantial change in the cattle herd numbers.

Data / Parameter	*FIRE*
Data unit	Number/year
Description	Average number of fires per year
Source of data	MCD64A1 v061 MODIS/Terra+Aqua Burned Area Monthly L3 Global 500 m SIN Grid
Value applied	0.055
Justification of choice of data or description of measurement methods and procedures applied	A variable that influences the aboveground grass biomass that is lost due to fire during the dormant season. QC: In field surveillance and of fires and their intensity.
Purpose of data	Calculation of baseline emissions through SNAPGRAZE
Comments	The model accounts for fires in the calculation of plant derived SOC inputs and multiplies the aboveground biomass with (1-FIRE), thus assumes that during a fire event all aboveground

	biomass is burnt. Although there were fires in the project area in the 10 years prior to the project, on no occasion the complete project area burnt. Therefore our fire analysis was not only focused on the number of fires but also their intensity and extent.

Data / Parameter	*Gdays*
Data unit	days
Description	Total number of days in the growing season
Source of data	NDVI analysis of plant growth
Value applied	212
Justification of choice of data or description of measurement methods and procedures applied	A key input variable that influences the plant aboveground and belowground productivity.
Purpose of data	Calculation of baseline emissions through SNAPGRAZE
Comments	Long-term average

Data / Parameter	*Edays*
Data unit	days
Description	Number of days within the growing season prior to grazing episode
Source of data	Camp management plans
Value applied	31
Justification of choice of data or description of measurement methods and procedures applied	Input for the SNAPGRAZE soil carbon model. Because there is a management plan with a bi-annual cycle of opening and closing camps, a 2-year average is applied. For conservativeness, the average was reduced by 20 days to account for potential non-compliance.
Purpose of data	Calculation of baseline emissions through SNAPGRAZE
Comments	2-year average describing the baseline

Data / Parameter	*Ddays*
Data unit	days
Description	Number of days of grazing episode
Source of data	Camp management plans
Value applied	181

Justification of choice of data or description of measurement methods and procedures applied	Input for the SNAPGRAZE soil carbon model. Because there is a management plan with a bi-annual cycle of opening and closing camps, a 2-year average is applied. For conservativeness, the average was reduced by 20 days to account for potential non-compliance.
Purpose of data	Calculation of baseline emissions through SNAPGRAZE
Comments	2-year average describing the baseline

Data / Parameter	*Fdays*
Data unit	days
Description	Number of days left in the growing season after the grazing episode
Source of data	Camp management plans
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	Input for the SNAPGRAZE soil carbon model. Because there is a management plan with a bi-annual cycle of opening and closing camps, a 2-year average is applied. For conservativeness, the average was reduced by 20 days to account for potential non-compliance.
Purpose of data	Calculation of baseline emissions through SNAPGRAZE
Comments	2-year average describing the baseline

Data / Parameter	*APCcorrection factor*
Data unit	
Description	A correction factor that is applied to the model when forage is dominated by annuals instead of perennials
Source of data	Measured in project area during vegetation assessments
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	An input variable that determines belowground and aboveground productivity. If annuals dominate, then a value of 0.291 is applied. If not, then the default value is 1.
Purpose of data	Calculation of baseline emissions through SNAPGRAZE

Comments	

Data / Parameter	*LIGCELL*
Data unit	Dimensionless proportion
Description	Mean aboveground plant cellulose plus lignin at sampling plot *j* in stratum *m*
Equations	Model input
Source of data	Measured in project area
Value applied	Individual value for each sampling station
Justification of choice of data or description of measurement methods and procedures applied	SOC is often closely related to inputs of these forms of carbon because they resist microbial decomposition. Lignin and cellulose were measured as acid digestible fibre as per Richie (2014), using the Ankom commercial digestion products and process. Samples were taken form 67 sites in Welverdiend, Dixie and Utah, whereby clippings of the three dominant species were dried, weighed, and then subjected to a sulfuric acid hydrolysis method, as per the Ankom Technology Corp commercial digestion products. The lignin and cellulose data were captured in the K2C Carbon LIGCELL_measured11112021 dataset and stored in the MEL Database.
Purpose of data	Calculation of baseline emissions
Comments	

Data / Parameter	$MSOC_{m,j,b}$
Data unit	tC/ha
Description	Modeled SOC at station *j* in stratum *m* for each year *b* during the baseline period
Source of data	SOC model
Value applied	Individual value for each sampling station
Justification of choice of data or description of measurement methods and procedures applied	The SNAPGRAZE model applied meets the modeling requirements described in Section 8.1.3.4 of VM0032 as shown above
Purpose of data	Calculation of baseline emissions

Comments	

Grazing intensity $GI_{j,m}$ is not required by SNAPGRAZE.

$PSOC^{eq}_{m,j}$ (Project modeled equilibrium SOC at station j in stratum m (tC/ha) based on parameter values from zm sampling stations in stratum m) is not a value that can be produced at validation and will be demonstrated in the first monitoring report.

D (Years required to achieve equilibrium) is not required by SNAPGRAZE.

Parameters for Removals from Woody Plant Biomass

Woody plant biomass removals are conservatively assumed to be *de minimis* and, therefore, are not applicable to this project.

3.3.2 Data and Parameters Monitored

Data / Parameter	$PA_{m,t}$
Data unit	ha
Description	Project area in stratum *m* in year *t*
Source of data	Measured in project area
Description of measurement methods and procedures to be applied	Using shapefiles in a GIS or from known coordinates of stratum boundaries or from legal descriptions of the property included in the project area.
Frequency of monitoring/recording	Annual
Value applied	To be determined. Total project area is around 80,300 ha.
Monitoring equipment	None
QA/QC procedures to be applied	Areas will be determined from accurate GIS layers of classified project area or from legal descriptions of property included in the project area. Verification will be with Global Positioning Systems (GPS) with an accuracy of 10 m or less. Ground points may include permanent sampling stations but also may include points at defined stratum boundaries or along roads.
Purpose of data	Calculation of project emissions
Comments	Projects must ensure that the following information in regard to the project area of each stratum is provided within the relevant area of the project description: 1) Map(s) of the locations of the permanent sampling plots overlaid on a map of project strata. 2) Results of cluster analysis to determine project strata. 3) Table of all project strata, their description, and area, PA_m 4) Results of analysis to determine the number of sampling units and their allocation among strata

Project Animal Methane Emissions

Data / Parameter	$PN_{c,t}$
Data unit	Number
Description	Mean number of animals of category *c* in the project area during year t

Source of data	Measured in project area via State Veterinary Services of South Africa combined with support of Eco-rangers present during counting events at the dip tanks.
Description of measurement methods and procedures to be applied	Monitoring values are measured as total cattle numbers in January of the respective year. Based on the estimated cattle structure, this total cattle herd is then subdivided into subcategories of adult and juveniles. The arithmetic mean number of animals in each category over the verification period is then calculated based on VM0032 guidance.
Frequency of monitoring/recording	Annual
Value applied	Will vary by community
Monitoring equipment	Pen and paper
QA/QC procedures to be applied	Reviews of records of livestock numbers, interviews of grazing managers, coordinators, herders, or other administrative staff. Records should be kept as paper and electronic copies.
Purpose of data	Calculation of project emissions
Comments	

Project Emissions from Burning of Biomass

Emissions from burning biomass are expected to be *de minimis* because fire events are rather reduced due to project activities. The parameters are therefore not applicable for monitoring.

Parameters for Calculating SOC Removals

After crediting periods long enough to detect changes in SOC at sampling stations, e.g., 5-7 years, the soil organic carbon $SOC_{m,j,Z}$ will be re-measured in order to re-validate and recalibrate the SNAPGRAZE soil carbon model.

Data / Parameter	$DEPTH_{m,j,t}$
Data unit	cm
Description	Soil core depth at station j in stratum *m* at time t = 0 (ie, at the start of the project or since the last verification)
Source of data	Measured at sampling stations

Description of measurement methods and procedures to be applied	Soil will be taken from at least four three soil cores (with 10 cores at each site recommended to reduce uncertainty) at each station j to a depth that accounts for the vast majority (> 80 percent) of SOC in the soil column, reflects depth to hardpans or bedrock, or matches calculations from soil carbon models. Multiple cores may be well-mixed into a single composite sample for analysis.
Frequency of monitoring/recording	For modeled approach, after a desired monitoring period for re-calibrating the chosen soil carbon model on the basis of its ability to predict changes in soil carbon during the monitoring period.
Value applied	20
Monitoring equipment	Measuring tape
QA/QC procedures to be applied	Depth cored must be the same as for baseline soil carbon sampling. However, the depth used in calculating SOC after *Y* years of project activities must be adjusted to account for changes in bulk density such that $DEPTH_{m,j,Y}$ x $BULK_{m,j,Y}$ = $DEPTH_{m,j,0}$ x $BULK_{m,j,0}$. This ensures that equal masses of soil are compared between year 0 and year Y
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	$SOC\%_{m,j,t}$
Data unit	Dimensionless proportion expressed as a percent
Description	Proportion soil organic carbon at station *j* in stratum *m* at time *t*
Source of data	Measured in project area
Description of measurement methods and procedures to be applied	Soil will be taken from at least three soil cores (with 10 cores at each site recommended to reduce uncertainty) at each station j to a depth that accounts for the vast majority (> 80 percent) of SOC in the soil column, reflects depth to hardpans or bedrock, or matches calculations from soil carbon models. Multiple cores may be well-mixed into a single composite sample for analysis. The organic carbon concentrations will be measured in appropriate academic or industrial laboratories with chemical automated, calibrated analytical machines or with project-area calibrated infra-red IR spectrometers.
Frequency of monitoring/recording	At the end of the monitoring period for measured approach projects, or, for modeled approach, after a desired monitoring period for re-validating the chosen soil carbon model on the basis

	of its ability to predict changes in soil carbon during the monitoring period. This is expected to be every 7 years.
Value applied	Will vary with location
Monitoring equipment	Equipment for taking soil cores (augers, metal pipes, etc.) and lab equipment for doing loss on ignition (drying ovens, furnaces) or autoanalyzer for estimating carbon loss on combustion, or spectrophotometers for measuring infrared light reflectance.
QA/QC procedures to be applied	The organic carbon concentrations will be measured in appropriate academic or industrial laboratories with chemical automated, calibrated analytical machines or with project-area calibrated infra-red IR spectrometers. IR methods in case necessary will be calibrated by regression, with $R^2 > 0.90$, of IR measurement with measurement by chemical or combustion methods. Graphs of regression of IR versus combustion or chemical methods must be shown. There must be no significant bias (i.e., slope of 95% CI must include 1). The intercept of the 95% CI must include 0, which will ensure that MBIAS, following equation (5) of the VM0032 Methodology is between -10% and +10%. If an IR spectrometer is to be used, the project proponent must show all calibration data in a table with spectral emissions and measurements of soils or plants and graphs showing the regressions of spectral data against measurements.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	$BULK_{m,j,\ t}$
Data unit	g/cm^3
Description	Bulk density in stratum m, station j, year t
Source of data	Measured in project area
Description of measurement methods and procedures to be applied	Necessary to convert proportion of SOC in soil to mass of SOC/volume following changes in SOC, after Z crediting years 5-7 crediting years. Soil will be taken from at least three soil cores (with 10 cores at each site recommended to reduce uncertainty) at each station j to a depth that accounts for the vast majority (> 80 percent) of SOC in the soil column, reflects depth to hardpans or bedrock, or matches calculations from soil carbon models. Multiple cores may be well-mixed into a single composite sample for analysis. Known volumes of soil from the cores must be sieved to remove rocks, pebbles, and coarse fragments, and then the remainder dried (5 days at 45ºC or equivalent) and weighed to determine bulk density.

Frequency of monitoring/recording	At the end of the monitoring period for measured approach projects, or, for modeled approach, after a desired monitoring period for re-validating the chosen soil carbon model on the basis of its ability to predict changes in soil carbon during the monitoring period. This is expected to be every 7 years.
Value applied	Will vary by location
Monitoring equipment	Metal pipe of known volume, sledge hammer, metal plate to prevent soil from leaking, drying oven, sieve (2mm mesh). Heavy duty plastic bags, graduated cylinder.
QA/QC procedures to be applied	A consistent system of soil storage to prevent loss of mass prior to weighing, accurate estimation of rock volume, paper and digital archiving, corroboration with literature values
Purpose of data	Calculation of project removals
Comments	

Parameters for Project Soil Carbon Models

Data / Parameter	$MAP_{m,Y}$
Data unit	mm/yr
Description	Mean annual precipitation in stratum m over the project crediting period *Y* years.
Source of data	Precipitation maps or nearby weather stations or ERA 5 climate dataset
Description of measurement methods and procedures to be applied	A key variable that affects a number of processes driving SOC
Frequency of monitoring/recording	Annually if obtained from government sources or local weather stations, daily if collected on the project area
Value applied	Will vary by location and year
Monitoring equipment	None
QA/QC procedures to be applied	Data should be obtained from government sources or local official weather stations or datasets combining these.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	MAT
Data unit	°C
Description	Mean annual temperature over the project area
Source of data	ERA 5 climate dataset
Description of measurement methods and procedures to be applied	A key variable that affects a number of processes driving SOC
Frequency of monitoring/recording	Annually if obtained from government sources or local weather stations, daily if collected on the project area
Value applied	Will vary by location and year
Monitoring equipment	None
QA/QC procedures to be applied	Data should be obtained from government sources or local official weather stations or datasets combining these.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*FIRE*
Data unit	n/year
Description	Average number of fires per year
Source of data	MCD64A1 v061 MODIS/Terra+Aqua Burned Area Monthly L3 Global 500 m SIN Grid
Description of measurement methods and procedures to be applied	A variable that influences the aboveground grass biomass that is lost due to fire during the dormant season.
Frequency of monitoring/recording	Annually
Value applied	Will vary by year. Averaged over the project area.
Monitoring equipment	None
QA/QC procedures to be applied	In field surveillance of fires and their intensity

Purpose of data	Input for the SNAPGRAZE soil carbon model for the calculation of project emissions
Comments	

Data / Parameter	*SAND*
Data unit	%
Description	Sand content as percent at a sampling station
Source of data	Measured at the sampling stations
Description of measurement methods and procedures to be applied	A key variable that affects a number of processes driving SOC
Frequency of monitoring/recording	At every model validation
Value applied	Will vary by location and year
Monitoring equipment	Soil auger; volumetric cylinder
QA/QC procedures to be applied	Collaboration with academia to ensure quality sampling and analysis.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*LIGCELL*
Data unit	Dimensionless proportion
Description	Lignin and cellulose content of livestock feed for year t
Source of data	Measured at the sampling stations
Description of measurement methods and procedures to be applied	A key variable that affects a number of processes driving SOC. Lignin and cellulose were measured as acid digestible fibre as per Richie (2014), using the Ankom commercial digestion products and process. Samples were taken form 67 sites in Welverdiend, Dixie and Utah, whereby clippings of the three dominant species were dried, weighed, and then

	subjected to a sulfuric acid hydrolysis method, as per the Ankom Technology Corp commercial digestion products. The lignin and cellulose data were captured in the K2C Carbon LIGCELL_measured11112021 dataset and stored in the MEL Database.
Frequency of monitoring/recording	At every model validation
Value applied	Will vary by location and year
Monitoring equipment	Knive, sample bags, labelling
QA/QC procedures to be applied	Collaboration with academia
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*Gdays*
Data unit	days
Description	Total number of days in the growing season
Source of data	NDVI analysis of plant growth
Description of measurement methods and procedures to be applied	A key input variable that influences the plant aboveground and belowground productivity.
Frequency of monitoring/recording	At every model validation
Value applied	Long-term average
Monitoring equipment	None
QA/QC procedures to be applied	Reporting by Eco-herders and exchanges during technical meetings of CSA.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*Edays*
Data unit	days
Description	Number of days within the growing season prior to grazing episode
Source of data	Camp management plans
Description of measurement methods and procedures to be applied	Input variable that influences grass biomass accumulation prior to a grazing event
Frequency of monitoring/recording	Annually
Value applied	2-year average
Monitoring equipment	None
QA/QC procedures to be applied	Reporting by Eco-herders and exchanges during technical meetings of CSA.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*Ddays*
Data unit	days
Description	Number of days of grazing episode
Source of data	Camp management plans
Description of measurement methods and procedures to be applied	Input variable that determines the biomass removed during a grazing episode, when a camp is opened for cattle
Frequency of monitoring/recording	Annually
Value applied	2-year average
Monitoring equipment	None

QA/QC procedures to be applied	Reporting by Eco-herders and exchanges during technical meetings of CSA.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*Fdays*
Data unit	days
Description	Number of days left in the growing season after the grazing episode
Source of data	Camp management plans
Description of measurement methods and procedures to be applied	Input variable that influences grass biomass regrowth/accumulation after a grazing event
Frequency of monitoring/recording	Annually
Value applied	2-year average
Monitoring equipment	None
QA/QC procedures to be applied	Reporting by Eco-herders and exchanges during technical meetings of CSA.
Purpose of data	Calculation of project emissions
Comments	

Data / Parameter	*n*
Data unit	
Description	Number of pastures per village
Source of data	Measured in project area

Justification of choice of data or description of measurement methods and procedures applied	A key input variable that influences the grazing intensity during grazing events
Frequency of monitoring	Annually
Value applied	Most conservative for calculation
Monitoring equipment	None
QA/QC procedures to be applied	Rechecked by Eco-trainers and CSA technical team
Purpose of data	Calculation of project emissions
Comments	A value of 2 gives the most conservative results in the modelling of project SOC sequestration. Communities decide every year on the number of defined pastures. Typically only 2 are defined but this number can also be higher.

Data / Parameter	*w*
Data unit	*kg*
Description	Average animal body size (live weight)
Source of data	Diptank inspections & market value assessment
Description of measurement methods and procedures to be applied	Input variable that influences grass biomass consumption by the cattle
Frequency of monitoring/recording	Weekly/Monthly
Value applied	Average over the whole project area
Monitoring equipment	None controlled by the project proponent
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Comments	Estimated from measurements in project area combined with expert estimates

Data / Parameter	*Livestock density*

Data unit	Number/ha
Description	Cattle density in the project area and at every sampling station
Source of data	Total cattle numbers are measured in project area by State Veterinary Services. Livestock density at individual sampling stations is then estimated based on cattle movements for each sampling stations
Frequency of monitoring/recording	Before each verification
Value applied	Individual at each sampling station (recorded in model),
Justification of choice of data or description of measurement methods and procedures applied	Livestock density is an important input variable for the SNAPGRAZE model as it determines the grazing intensity when a camp is open for cattle
Purpose of data	Calculation of project emissions
Comments	Classification for each sampling station based on grazing history/ frequency of herd movements. Will remain a fixed value for each sampling station as long as there is no substantial change in the cattle herd numbers.

Data / Parameter	*APC correction factor*
Data unit	Dimensionless
Description	Factor that is applied when grasslands are dominated by annual grasses
Source of data	Vegetation assessments
Description of measurement methods and procedures to be applied	Grass species identified by experts (e.g., ecorangers) during vegetation assessments
Frequency of monitoring/recording	Yearly
Value applied	0.291 if the project area is dominated by annuals. If not, default factor of 1.
Monitoring equipment	Visual assessment
QA/QC procedures to be applied	Eco-herder training in correct assessment. Checks by supervising Eco-trainers.
Purpose of data	Calculation of project emissions

Comments	

$GI_{j,m}$ is not required by SNAPGRAZE.

Parameters for Project Removals from Woody Plant Biomass

Project Removals from woody plant biomass are conservatively excluded and thus monitoring not applicable.

Parameters for Leakage

Data / Parameter	$DN_{C,x}$
Data unit	Head (Number)
Description	Number of livestock (cattle) that were outside the project area (outside the fence defining the community boundary of the project area)
Source of data	Measured
Description of measurement methods and procedures to be applied	Through K2C Environmental Monitors, Eco-rangers and Yes 4 Youth, compliance to the conservation agreement shall be verified and feedback provided to CSA through daily reports and to farmers during weekly farmers meetings. Records of compliance shall be archived and utilized to determine the extent of provision and dissemination of the benefit package to stewards as well as to recommend corrective measures should there be extensive non-compliance. GPS collars are also used in some herds to track compliance.
Frequency of monitoring/recording	Monthly
Value applied	Depends on month
Monitoring equipment	Where used, GPS-collars
QA/QC procedures to be applied	Records will be kept as paper and electronic copies
Purpose of data	Calculation of leakage
Comments	

Data / Parameter	*d*
Data unit	days
Description	Total number of days livestock were off the project area
Source of data	Measured
Description of measurement methods and procedures to be applied	Through K2C Environmental Monitors, Eco-rangers and Yes for Youth, compliance to the conservation agreement shall be verified and feedback provided to CSA through daily reports and to farmers during weekly farmers meetings. Records of compliance shall be archived and utilized to determine the extent of provision and dissemination of the benefit package to stewards as well as to recommend corrective measures should there be extensive non-compliance. GPS collars are also used in some herds to track compliance.
Frequency of monitoring/recording	Monthly
Value applied	Depends on month
Monitoring equipment	None
QA/QC procedures to be applied	Records shall be kept as paper and electronic copies, with at least one electronic copy kept off the project as an online database
Purpose of data	Calculation of leakage
Comments	

3.3.3 Monitoring Plan

Organizational structure of monitoring activities

CSA has a three-tiered approach to rangeland monitoring. The first tier, or first “point of contact”, is the data collection based on field activities on the ground. This is done by community members, Eco-rangers, Environmental Monitors and Yes 4 Youth. The ground-based data collection aims to collect data on cattle numbers, grazing activities, herd health, etc. The second tier is where the Monitoring Officer captures project activities. This includes the number and character of training sessions held, job opportunities, number of beneficiaries, and area under improved management. The third and final tier has strong focus on scientific data collection and analysis.

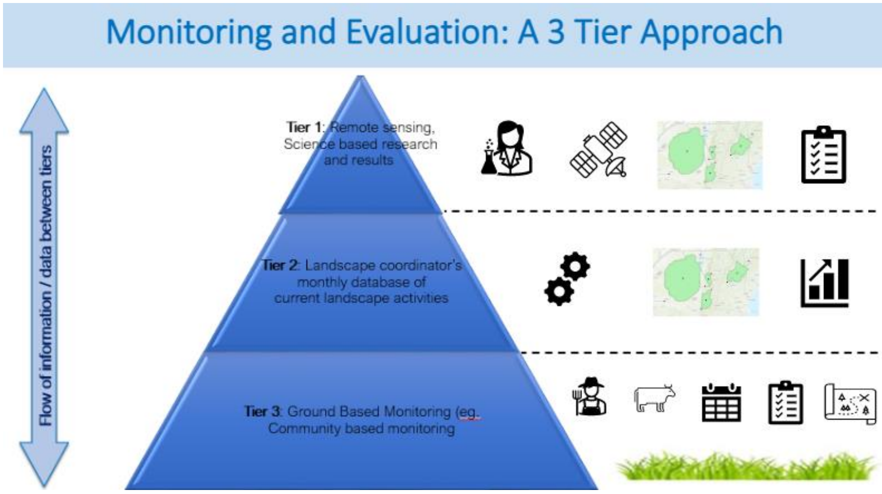

Figure 25: CSA monitoring and Evaluation framework - a three-tiered approach.

To measure improvement, CSA had to choose indicators that are both representative of the key properties of the Monitoring and Evaluation (ME) system and that relate directly to the planned interventions. In monitoring the effect of an intervention on the monitoring system, CSA compares changes in indicator values over time and/or relative to a standard or target (e.g. GOOD Matrix or Natural Resource Management targets). This can happen at various levels: the river catchment, landscape, or farm level. Indicators can measure activities or outputs (e.g., hectares of rangeland cleared of invasive plants) but should also aim to measure longer-term outcomes (e.g., hectares of natural habitat restored, markets accessed through green economic development).

In line with Conservation South Africa's strategic plan, interventions fall within the following categories and form the basis for establishing good indicators:

- rehabilitation and restoration in native rangelands used as production landscapes, principally through erosion control, removal of invasive alien plant (IAP), and planned grazing;
- social upliftment in production landscapes (mostly via skills development, conservation knowledge and market opportunities);
- influencing disaster risk reduction (DRR); and
- sustainable investments.

CSA has a strong focus on building capacity of Eco-rangers and livestock farmers on monitoring methods and relating scientific indicators in a language that is easily grasped. The monitoring coordinator is responsible for vetting the ground data with the Eco-rangers and environmental monitors, this is done through fact checking and comparisons on previous data collected. A second vetting process is undertaken by the Monitoring and Evaluation Manager through a quarterly survey that is captured online through the CSA Monitoring, Evaluation, Learning and Research (MERL) SharePoint.

All monitoring activities are guided by standardized operating procedures (SOP) and by the K2C monitoring plan, which was derived from the CSA ME framework. Quality control of data is done through the SOP on data management. Ground activities are captured through dedicated WhatsApp groups and Teams Channels, vetted monthly and captured in the K2C Monitoring Schema. The timely capture of data is a core element of the monitoring systems. All trainings and engagements are captured through a Teams reporting channel whereby attendance registers are shared as well as a brief description of the activity or event. This data flow contributes to capturing data mostly related to social upliftment indicators. A second stream of data capture is used to monitor rangeland restoration activities. Depending on the indicators, monitoring activities are captured in the field on a weekly, quarterly, and/or annual basis and captured electronically in the MERL SharePoint. The data is collected according to the indicators listed in Table 15.

The three-tiered monitoring approach allows for all project data to be vetted through various forms of submission and the quarterly survey. The three-tiered approach aims to mitigate non-conformities, alongside storing and making use of the online database to capture all raw and processed data. Working from an online database allows senior staff to spot-check data uploaded and the frequency thereof.

Sampling Design

The initial monitoring sites were established prior to this project (2009-2015) within homogenous vegetation units of varying altitude in the communal rangelands of Dixie, Utah, and Welverdiend. The sites were established as part of a long-term ecological monitoring programme (Mnisi Community Programme – University of Pretoria) and are used to assess and determine seasonal trends in rangeland dynamics and productivity across the interface.

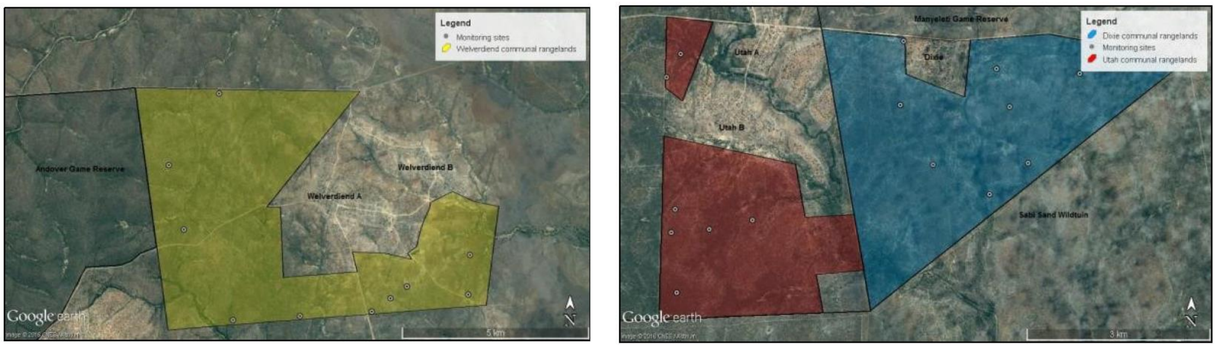

Figure 26: Initial monitoring sites incorporated into project scope.

The fieldwork phase of the research was undertaken using the Multiple Indicator Monitoring (MIM) method. The MIM method has been used to monitor rangelands across numerous vegetation types (mainly those associated with savanna and grassland biomes) throughout the Lowveld and surrounding regions of South Africa for the past 28 years. The MIM method provides sound scientific evidence for the development and implementation of sustainable rangeland management strategies. The method incorporates numerous facets from widely used and well-documented monitoring techniques and measures numerous rangeland health indicators associated with both the herbaceous and woody component. The MIM method includes conducting a survey of herbaceous vegetation, above-ground standing crops and grazing capacity (herbaceous biomass), a woody vegetation survey, and estimating biodiversity (Shannon-Wiener).The vegetation assessment protocol can be made available to the validator upon request.

Since 2016, the fixed monitoring sites were increased from 25 to 75, and they are monitored according to the MIM method. In 2021, the baseline soil sampling campaign measured soil samples from the 62 fixed sites, including a full vegetation assessment according to the MIM method. An additional 100 soil samples were collected across the landscape. These sites where stratified according to the sampling strategy in Figure 28.

Monitoring Sites: Kruger to Canyons

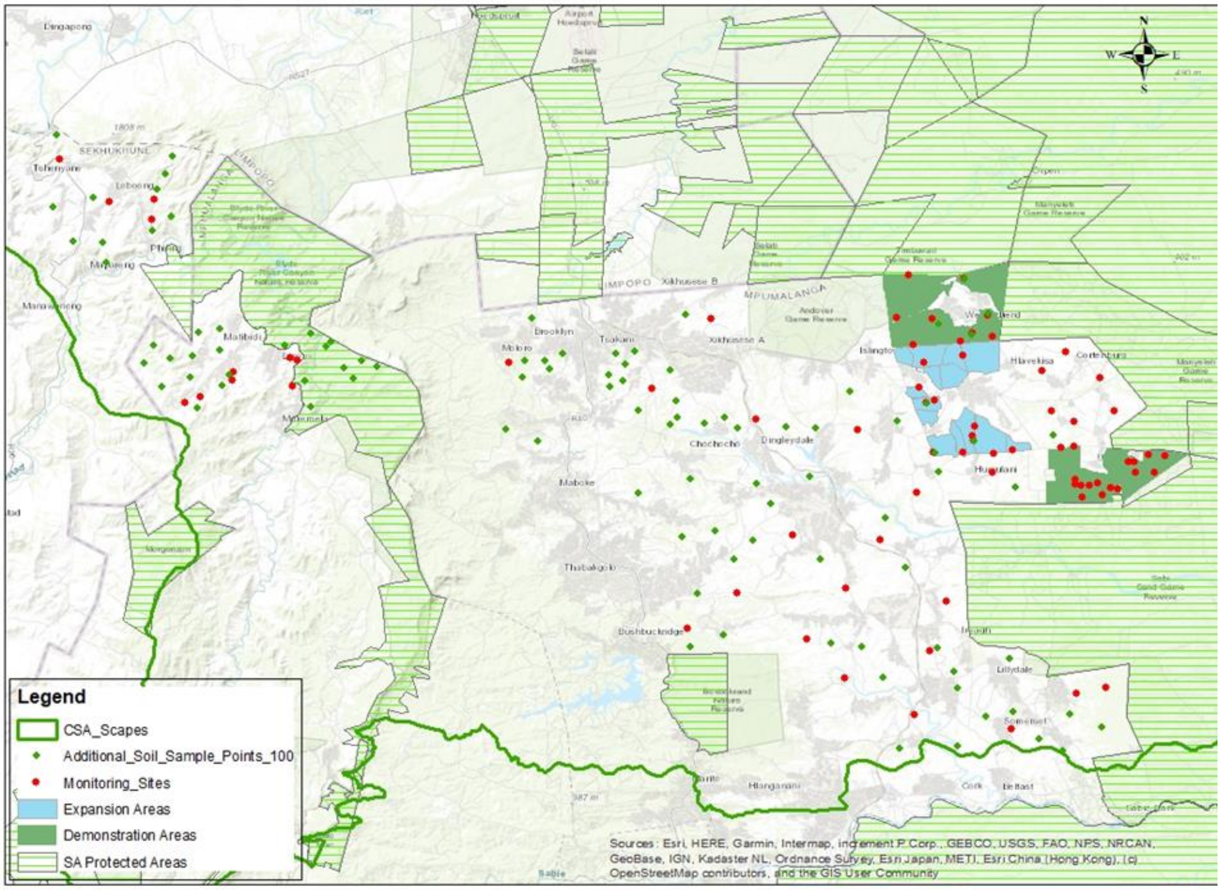

Figure 27: Monitoring sites across project area.

Sampling Strategy: Spatial Analysis and Planning

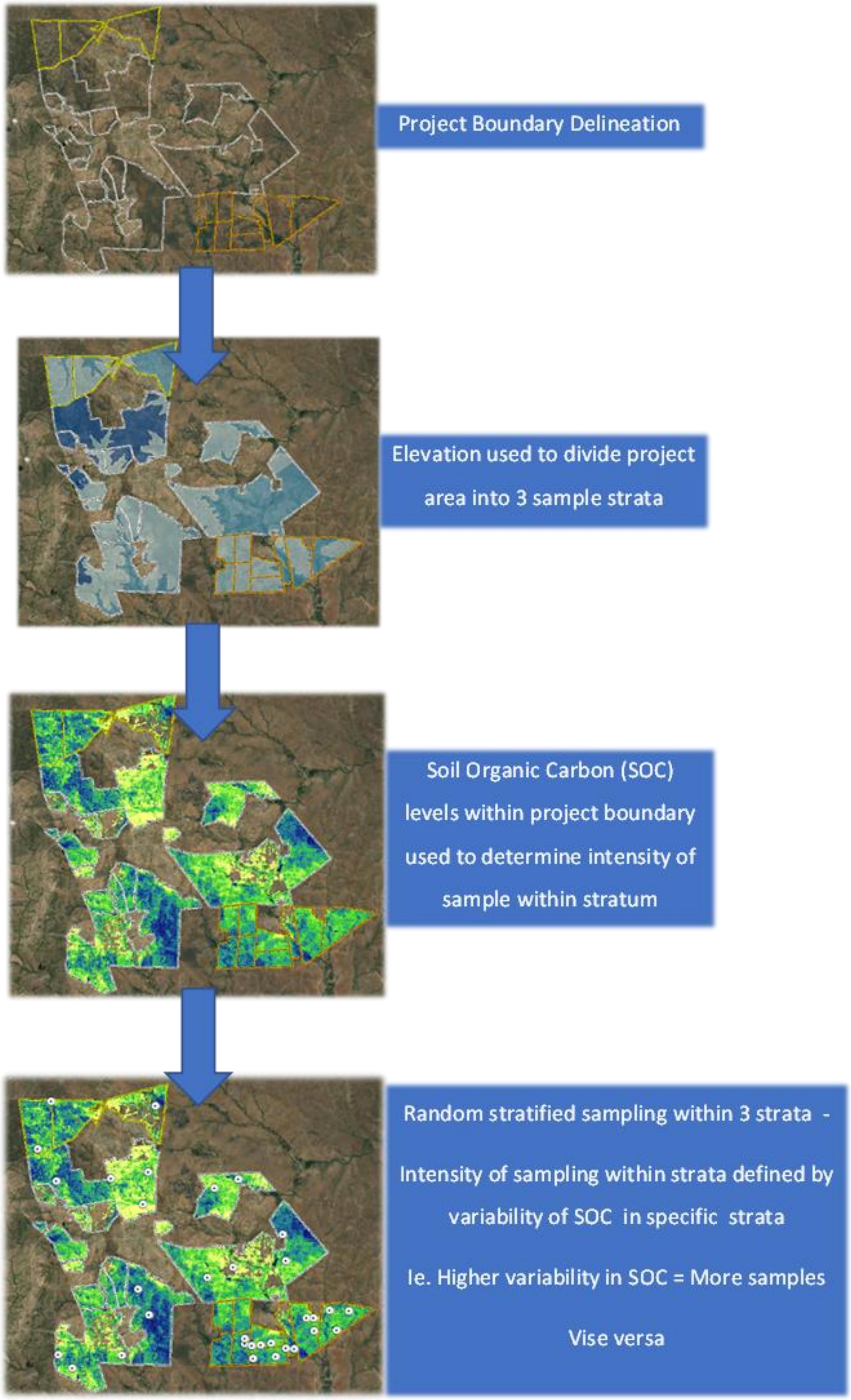

Figure 28: Sampling Strategy

Monitoring of animal numbers

In partnership with the State Veterinary Services, Eco-trainers work with the State Vet technicians to capture cattle numbers present at the dip tank on a weekly basis. This data is captured by the State Vet Technician in their data collection books, and the Eco-trainers report the data through the WhatsApp and Teams channels. Once the data has been reported, the data is captured in the MERL.

Table 15: Mean cattle number 2015-2022

	Welverdiend	Utah	Dixie
2015	3248	923	246
2016	2710	742	137
2017	2530	694	124
2018	2851	802	141
2019	2496	875	232
2020	2747	961	240
2021	3174	970	254
2022	3425	1076	252

K2C environmental monitors and CSA Eco-trainers conduct regular patrols in the designated grazing areas to ensure that cattle are grazing in the correct camps as outlined in the co-designed grazing plan. Cattle found to be grazing in a rested camp will be photographed and have their tag numbers and brand marks recorded; this information is reported to CSA via WhatsApp for record-keeping and to conservation stewards during weekly farmers meetings, where penalty for non-compliance will be issued by the cooperative committee. To ensure compliance, signs indicating closure or availability of camp for grazing will be placed on the gates of each camp.

Monitoring of grazing intensity

Above-ground grass standing crop is measured through the application of the disc pasture meter method (Bransby and Tainton 1977). In the MIM, this method entails recording above-ground grass standing crop every 1 meter along the length of a 100-m transect, giving a total of 100 measurements per monitoring site. The above-ground grass standing crop is then estimated using the equation (Trollope and Potgieter 1986):

$$y = -3019 + 2260\sqrt{x}$$

$$y = -3019 + 2260\sqrt{x}$$

where: y = mean above-ground grass standing crop (kg ha^{-1});
x = mean disc height (cm)

The project aims to improve the measurement of grazing intensity through establishing enclosures in close proximity to the permanent monitoring sites. An index for grazing intensity will be developed using temporal measurements of biomass within enclosure plots as well as outside enclosure plots. Disc pasture meter measurements of standing biomass within enclosure plots will be compared to standing biomass measurements outside the enclosures.

Monitoring of plant species composition

The plant species composition is conducted in accordance with the MIM method. The herbaceous vegetation survey is conducted on an annual basis by Sustineri Ecological Consulting PTY Ltd (by Graeme Wolfaard, ecologist) using the following methodology.

A 100-m tape measure is used to establish a 25 m x 25 m belt transect. Measurements are recorded at each meter mark up until the 50-m mark has been reached. Thereafter, measurements are recorded at every even number (i.e. 52, 54, 56, etc.), to give a total minimum of 75 herbaceous meter-recordings per monitoring site. A thin wire rod is dropped vertically to the ground at each of the relevant meter marks, where the following herbaceous indicators of rangeland health are determined:

- Record the closest rooted herbaceous individual:
    - Perennial grass species are recorded at the relevant meter marks.
    - Should the closest individual be a perennial grass species from the start, then the ‘annual’ column in the datasheet is left blank and only the necessary measurements of the perennial species are recorded.
    - If the closest individual is an annual, it is measured first. Thereafter the closest perennial grass species is measured as a “2nd species”. Annual grass species are recorded by species name, herbaceous dicotyledons are recorded as “forb”, and species belonging to the family Cyperaceae are recorded as ‘sedge’.
- Distance-to-tuft and tuft diameter measurements (mm) of the above-mentioned individuals are recorded to provide an estimation of herbaceous basal cover.
- An estimate of percentage canopy cover is determined by extending a vertical projection above each meter mark. The growth of many palatable and productive grass species is associated with canopy cover.

The data is recorded by the ecologist and captured in the vegetation assessment database on the MERL SharePoint.

Monitoring of Plant Lignin and Cellulose

Lignin and cellulose are measured as acid-digestible fibre as per Richie (2014), using the Ankom commercial digestion products and process. Samples were taken form 67 sites in Welverdiend, Dixie, and Utah, whereby clippings of the three dominate species were dried, weighed and then subjected to a sulfuric acid hydrolysis method, as per the Ankom Technology Corp commercial digestion products.

The lignin and cellulose data were captured in the K2C Carbon LIGCELL_measured11112021 dataset and stored in the MEL Database.

Leakage monitoring

The monitoring plan for carbon-related parameters as outlined in the previous chapters is embedded in a larger monitoring framework to ensure compliance with the conservation agreements. Through K2C Environmental Monitors, Eco-rangers, and Yes 4 Youth, compliance with the conservation agreements shall be verified and feedback provided to CSA through daily reporting and to farmers during weekly farmers meetings. Records of compliance shall be archived and utilized to determine the extent of provision and dissemination of the benefit package to stewards as well as to recommend corrective measures should there be extensive non-compliance.

A pilot project was launched in collaboration with the University of Pretoria to track and record the movements of cattle in the Dixie community. Eight cattle were fitted with GPS collars for a period of 6 months toto track animal movements in accordance to the grazing management plan. (Figure 29). This data can support compliance monitoring of the grazing plans. Should the resources be made available the project will seek to extend the collaring activities into other communities.

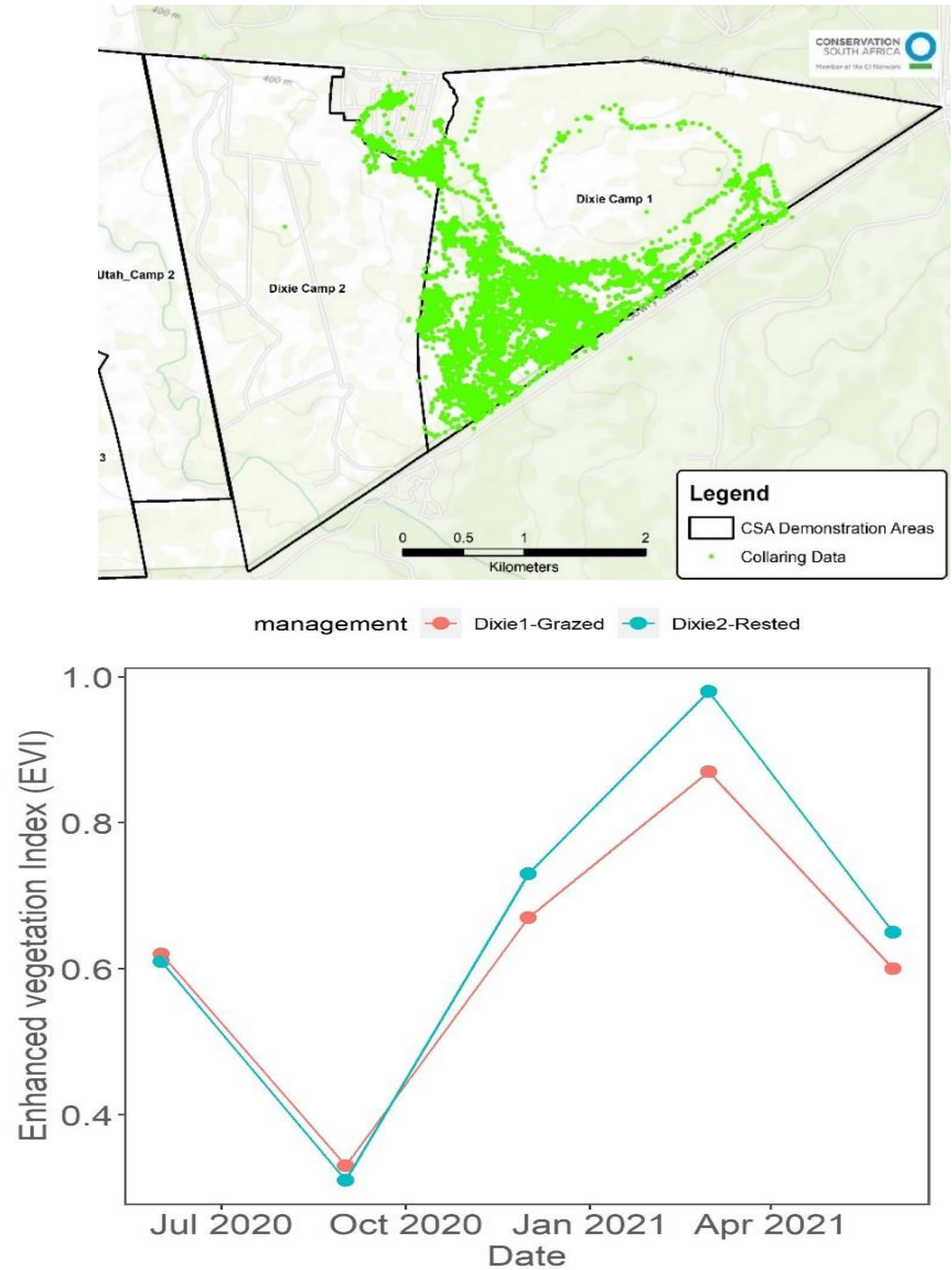

Figure 29. GPS collars on cattle (green dots) and remote sensing (EVI) are being used to track compliance in grazing/rested areas in Dixie. Here, Camp 1 is open for grazing while Camp 2 is closed and shows little encroachment of cattle (top) apparently resulting i

Table 16: CSA indicators per intervention.

Intervention	Indicator and (unit)	Type	Reference value *	Frequency
1. Rangeland restoration	1.1 Conservation Agreements (% of target area	Productivity	25,000 ha	Annual
-Conservation agreements	[ha])			
-Destocking	1.2 Sustainably managed rangeland (% of target	Productivity	80,000 ha	Annual
-Planned grazing	area [ha])			
-Kraaling	1.3 Sustainably managed mining (% target area	Productivity	30,000 ha	Annual
-Livestock improvement	[ha])			
(veterinary care, breeds)	1.4 De-trended NDVI	Productivity	Change over time	Quarterly
-IAP removal to 5%	1.5 Veld condition score	Productivity	650	Annual
-Skills development	1.6 Self-sufficiency (% herd sold relative to target)	Productivity	25%	Annual
	1.7 Self-sufficiency (% herd slaughtered relative to	Productivity		Annual
	target)	Productivity	25%	
	1.8 Employment generation (% person days target)		100%	Annual
	1.9 Compliance (% of required ha LSU^{-1})	Ecosystem		
	1.10 Plant species composition	Ecosystem	45 or 60 ha LSU^{-1}	Annual
	1.11 Percentage IAP cleared to maintenance level	Ecosystem	272	
	(Area [ha] at 5% /Total area [ha] infested)		100%	Monthly
	1.12 Skills development (% of target/ number of	Ecosystem		Annual
	people)		100%	Quarterly
	1.13 Households supported (% of target/ number of	Stability	100%	
	people)	Stability	100%	
	1.14 Livestock survival (% LSU reaching 6 months)	Stability	90	Quarterly
	1.15 Livestock resilience (LSU survival mm^{-1} MAP)	Reliability	100%	Annual
	1.16 Livestock resilience (LSU survival $degree^{-1}$ °C	Resil. & Adapt.	$Total\ LSU/Rainfall$	Annual
	MAT)	As above	$Total\ LSU/Temp$	-
				-
	1.17 Overall rangeland restoration score (no unit)	**All**	**1600**	
2. Wetland restoration	2.1 Sustainably managed wetlands (% target area	Productivity	Area (ha) TBD	Annual
-Gabions	[ha])			
-Stock exclusion	2.2 Employment generation (% target person days)	Productivity	100	
-IAP removal to 5%	2.3 Gully profile (Length [m]/Height [m])	Ecosystem	0	
-Skills development	2.4 Water table height (dip well height [m] as % of	Ecosystem	75	
	total well height [m])			
	2.5 Percentage IAP cleared to maintenance level	Ecosystem	100	
	(Area at 5% [ha]])			
	2.6 Skills development (% of target)	Stability	100	
	2.7 Water security (table height / mm rainfall (m mm^{-1})	Resilience	$Total\ Height/Rainfall$	
	2.8 Overall wetland restoration score (no unit)	**All**	**700**	

Intervention	Indicator and (unit)	Type	Reference value *	Frequency
3. Predator conservation -Skills development	3.1 Livestock loss to predators (% of control treatment / number of incidents) 3.2 Employment generation (% target person-days) 3.3 Wildlife populations on-farm (% of national reserve) 3.4 Skills development (% of target) 3.5 Cost of predator management (% of control) **3.6 Overall predator conservation score (no unit)**	Productivity Productivity Ecosystem Stability Stability **All**	50 TBD 100 12 100 **500**	Quarterly
4. Disaster Risk Reduction	4.1 No. gabions (% of target) 4.2 Wetland restoration (% of target) 4.3 Rangeland restoration (% of target communities) **4.4 Overall DDR score (no unit)**	Stability Ecosystem Ecosystem/ Productivity **All**	TBD TBD 2 TBD **300**	Quarterly
5. Sustainable investments	5.1 Sustainable business (% target engagements) 5.2 IDP engagement (% target engagements) 5.3 Knowledge & data sharing (% target reports) 5.4 Technical input (% target reports) 5.5 Skills development (% of target) **5.6 Overall sustainable investment score (no unit)**	Stability Stability Stability Stability Stability **All**	2 **500**	Quarterly
6. Social upliftment	6.1 Input into Local Economic Development plans (% target municipalities / number of plans adapted) 6.2 Improved governance (no. governing bodies) 6.3 Representation in governing body (% community / number of community members) 6.4 Other employment generation (% target households / number of employment opportunities)) 6.5 Overall skills development (% of target trained in intervention sections 1-5) 6.6 Conservation knowledge (index) 6.7 Conservation behavior (index) 6.8 Willingness to participate (index) **6.9 Overall social upliftment score (no unit)**	Stability Stability Stability Productivity Productivity Stability Stability Stability Stability **All**	1 3 100 100 1000 100 1 1 1 **800**	Quarterly
OVERALL LANDSCAPE SCORE	**IMPACT OF INTERVENTIONS**	**ALL**	**3900**	**Additive scores**

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

The Eco-trainers play a pivotal role in disseminating information to livestock owners and other community members that may have an interest in the project. Through the weekly meetings and continuous engagement, the Eco-trainers share information from the monitoring activities with the support of the monitoring coordinator. The different stakeholders of interest will be able to access the complete documents and monitoring reports of the project freely and through a means to which they have access; hard copies will be left with the traditional authorities in the communities and in schools/youth centers where CSA provides internet access. The project monitoring report will also be published on the Verra website and made available to the wider public for a public commenting period. CI and CSA will also share this link with other project stakeholders for their information and input.

3.4 Optional Criterion: Climate Change Adaptation Benefits

The proposed project seeks to be validated at the Gold Level for Exceptional Climate Change Adaptation Benefits.

3.4.1 Regional Climate Change Scenarios (GL1.1)

Because climate models differ in their predictions of whether average annual rainfall will increase or decrease, the expected climate change in the project area is uncertain. However, climate variability can be expected to intensify regardless, in the form of more consecutive dry or wet years, more frequent failed rainy seasons, and greater rainfall during the rainy season (Ziervogel et al., 2014). Looking at model ensemble predictions for South Africa and the project area, there is a trend for increasing mean temperature, depending on the CMIP6 scenario[27]. Figure 30 depicts the impact of climate change scenarios SSP2-4.5 (orange) and SPP5-8.5 (red). The difference between the historical reference period lack) and these scenarios is approximately 1°C independently of the climate change scenario since SSP2-4.5 and SSP5-8.5 do not differ significantly.

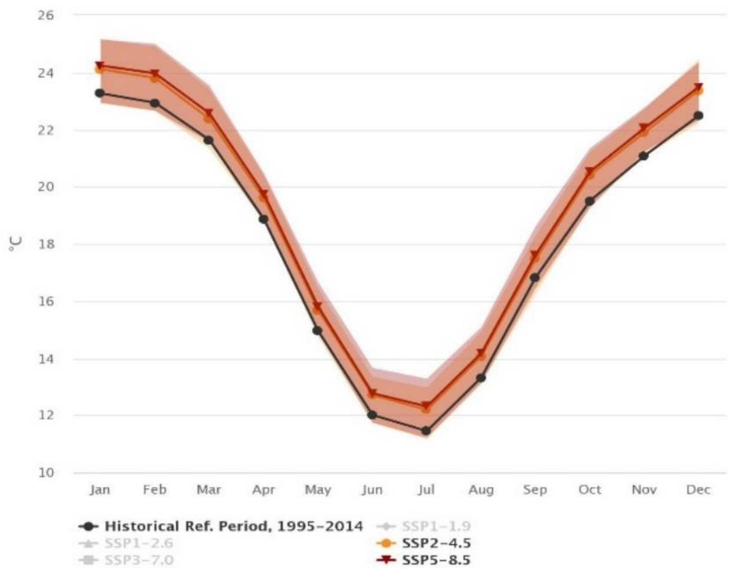

Figure 30 Projected Climatology of Mean-Temperature for 2020-2039 South Africa (Reference Period: 1995-2014), SSP2-4.5 and SSP5-8.5, Model Ensemble

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[27] A new set of scenarios was developed for ScenarioMIP, the part of the World Climate Research Programme's (WCRP) international Coupled Model Intercomparison Project 6 (CMIP6) that includes 21st century scenario runs. The updated Shared Socioeconomic Pathways (SSPs) include different socio-economic developments and trajectories of atmospheric greenhouse gas concentrations (SSP2-4.5: The “Middle of the road” or medium pathway and SSP5-8.5: “Fossil-fueled Development”). For further information on scenarios see https://www.dkrz.de/en/communication/climate-simulations/cmip6-en/the-ssp-scenarios?set_language=en [May 8, 2023]

Source: The World Bank Group. 2021. Climate Change Knowledge Portal

Similarly, the temperature anomalies are depicting a comparable trend. The annual temperature increase for the Mpumalanga province within the SSP2-4.5 Scenario is 0.67°C and 0.84°C for the SSP5-8.5 scenario.

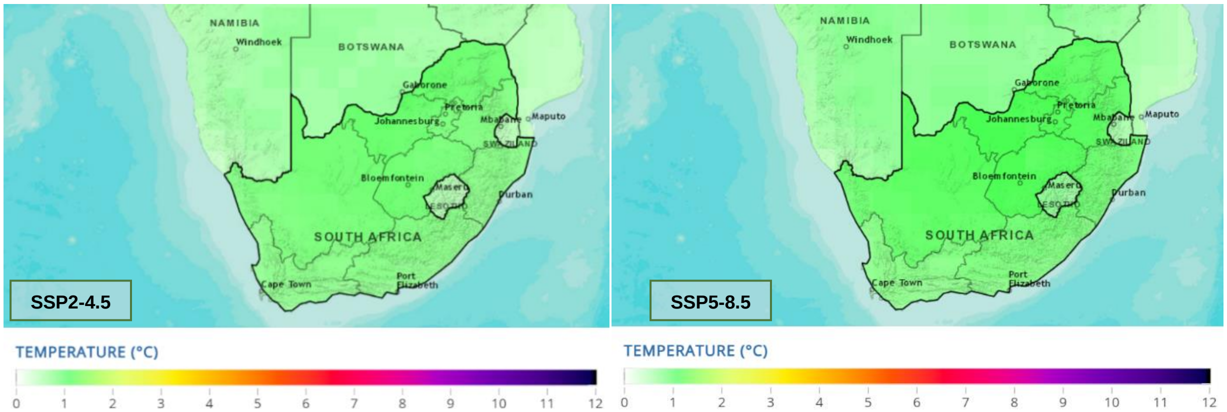

Figure 31: Projected Mean-Temperature Anomaly for 2020-2039 (annual) South Africa; (Reference Period: 1995-2014), SSP2-4.5 and SSP5-8.5; Multi-Model-Ensemble

Source: The World Bank Group. 2021. Climate Change Knowledge Portal

As described above, the precipitation anomalies show no clear indication of intensification or decrease. Figure 32 shows this precipitation trend for 2020-2039 within scenarios SSP2-4.5 and SSP5-8.5.

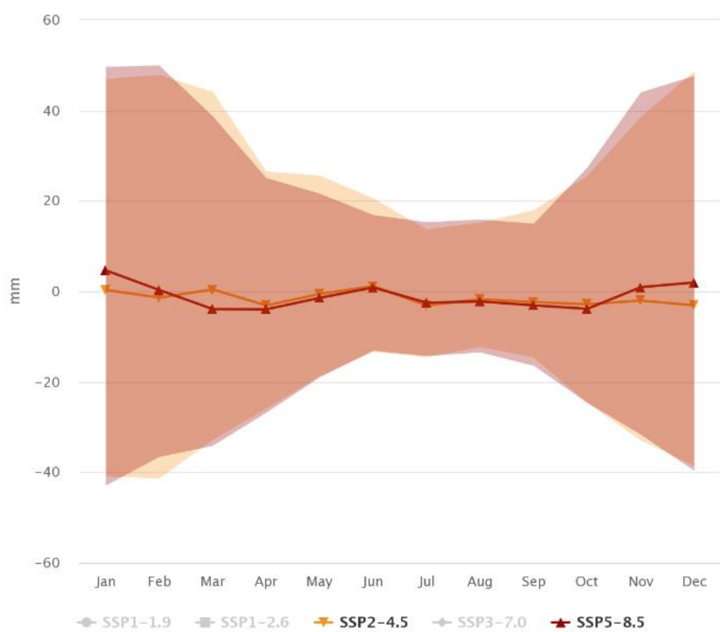

Figure 32 Projected Precipitation Anomaly for 2020-2039 South Africa; (Reference Period: 1995-2014), SSP2-4.5 and SSP5-8.5; Model Ensemble. Source: The World Bank Group. ***2021. Climate Change Knowledge Portal***

3.4.2 Climate Change Impacts (GL1.2)

Community Well-Being

The warmer temperatures under future climate conditions (SSP2-4.5 and SSP5-8.5) described in the scenario analysis above and the variation in time of rainfall are expected to lead to an intensification of drought periods. This would decrease the overall resource availability, which could lead to a livestock capacity reduction (Lohman et al., 2012; Boone et al., 2018). Declines in forage availability and livestock mortality could lead to severe economic losses for livestock herding communities within the project zone.

A recent study (Vetter et al 2020) on the effect of drought on pastoral livestock communities in South Africa showed that, during the nationwide 2014-2016 droughts, cattle farmers in the study area lost up to 43% of cattle herds when forage and water resources became too scarce. This impact was worse for smaller farmers, as larger herds suffered lower mortality rates, suggesting that owners of larger herds had greater means to support their herds. Furthermore, studies in southern Ethiopia suggest that land degradation, increased human population density, reduced herd sizes, and loss of key resources have left pastoralists increasingly vulnerable to repeated droughts and unable to recover fully in the periods between successive droughts (Desta and Coppock 2002; Angassa and Oba 2013).

The most vulnerable groups in this case would be the poorest households directly depending on rangeland resources in the project zone. In 2017, a vulnerability assessment was undertaken by Steven Holness. for CSA, building on previous spatial analysis done in the Alfred Nzo District in the Eastern Cape. The assessment focuses on identifying the location of the poorest people most dependent on direct use of local natural resources in the Kruger to Canyons Biosphere. This study primarily draws on analysis of 2011 census data to devise a social demand index for communities within the Kruger to Canyons Biosphere. The data-driven social demand index consists of two composite indices, namely a revised poverty index (incorporating subindices of people who are not employed, a dependency ratio, low income households, consumption, and access to services) and a local direct natural resource use dependency index (incorporating sub-indices of access to piped water, dependency on the environment for wood for cooking, dependency on the environment for wood for heating, and dependency on the environment for building materials). Figure 13 shows the areas with the highest direct resource dependency within the project zone.

Biodiversity Conservation Status

The identification of vulnerable areas is essential to estimate the effect of climate change impacts on biodiversity. To achieve this objective, two relevant provincial conservation plans, Mpumalanga Biodiversity Sector Plan (2014) and Limpopo Conservation Plan v2 (2013), were integrated into a coherent summary. These plans identify critical biodiversity areas and ecological support areas within both provinces.

Especially in these areas, the increased variability in water availability could intensify the competition between wildlife and livestock. It is important to note that the project zone contains important water catchments for rivers that feed into protected areas and provide water for thousands of households and communities. Changes to the river systems feeding GKNP have been evident since the 1960s, with records of progressive degradation in quantity and quality (Pienaar, 1970), from silt and other sediment eroding into the river from cultivated lands as well as reduced river flows through water abstraction, flow regulation via dams, and pollution (Pollard et al 2011). This trend is also negatively impacting the availability and quality of forage (Lal et al., 2013).

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

Measures Needed

Prior to the project initiation, the effect of unpredictable drought periods in the project area led to increased evaporation and soil trampling by livestock, leaving the soil bare and more prone to erosion and runoff after subsequent rains and to hardening during the dry season. As a result, there were notable increases in soil erosion, with topsoil flooding away during summer. Gully erosion and desertification has also been exacerbated along drainage lines and well used cattle paths in the savanna areas. Moreover, the effect of localized flooding events creates siltation which reduces flow levels and affects fauna and flora downstream in the protected areas.

Rangeland management measures are therefore needed to buffer against unpredictable droughts and increase water availability from surface water sources for people, flora, and fauna. Erosion control is also needed to reverse land degradation trends in the rangelands, which could be worsened by changing rainfall patterns (either too much or too little rain).

Measures Designed

The project activity of planned rotational-rest grazing is expected to improve soil cover (reduction of bare soil) and, therefore, enhance the water-holding capacity of the soil, providing a buffer against flooding and increasing water availability during drought. Moreover, the abundance of perennial grass cover resulting from this activity should ensure increased availability of fodder for livestock even during the dry season, making the livestock and the livestock-farming communities more adaptable to the effects of climate change.

The project also implements restoration activities in the grazing camps where severe erosion and bare ground are found. Branches are collected from encroached bush through pruning and bush thinning and used to cover (brush pack) gully and sheet erosion sites. This also serves as a control measure for alien invasive species which outcompete the indigenous vegetation.

Finally, the project supports income diversification as a strategy to build up resilience of communities in the project area to the impacts of climate change. Capacity building and skills development trainings are organized around the theme of green (climate friendly) businesses as a sustainable source of income especially for women in project communities.

4 COMMUNITY

4.1 Without-Project Community Scenario

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

The project is implemented on communal rangelands governed by tribal authorities stretching over Mpumalanga and Limpopo Provinces. An overview of communities involved in the first instance of the project is provided in Table 1; Section 2.1.6. The term ‘communities’ in this chapter refers to the villages and settlements within the tribal areas where the project takes place. These communities comprise distinct ‘community groups’ of livestock farmers, women, children, and youth.

Project sites (including proposed expansion sites) and participating villages fall under the ownership of Mnisi, Amashangaan, Jongilanga, Moletele and Bapedi Dinkwanyane Tribal Authorities. Tribal authorities are the “custodians of the land”. They are governed by Chiefs, who usually have a representative within the villages – a local headman called an “Induna”. The communities within this region are composed mainly of farmers and pastoralist livestock herders who depend on the land for resources and livelihoods. Households use the communal rangelands for agriculture, grazing lands and as a source of wood for household energy. The most spoken languages here are Northern Sotho, followed by Tsonga and Zulu. The entire project area has high levels of unemployment and low access to education, medical facilities, and infrastructure. Household earnings are typically below the national minimum wage of R21.7[28] per hour (R3,200 monthly). Over 50% of respondents surveyed[29] in the Mnisi tribal area earned less than R2000 in a month. The primary source of income was government grants, and only 22% of households had a member who has received tertiary education. Similarly, in Maruleng local municipality, 15%[30] of households earn below R1500.00 per month and about 33% of people live on grants. 89%[31] of the population in Maruleng is classified as rural, characterized by the prevalence of communal land tenure and villages or scattered groups of dwellings; typically located in former homelands. Economically active men in Maruleng tend to seek work outside of the municipality, while women are disproportionately likely to be unemployed.

Due to an ongoing population growth in the project area, there is increasing reliance on free-ranging livestock (largely cattle) as a source of income. Many community members also work within protected areas in the tourism industry. For the ethnic groups in the project area, livestock are integral and represent personal wealth and status. The most common livestock kept are cattle, chickens, goats, and pigs. Cattle rearing especially is of significant cultural and financial value in the area. 57% of respondents surveyed in the Mnisi baseline socio-economic survey keep their cattle for cultural reasons, 80% also keep cattle for asset purposes and money, and 95% keep cattle for household consumption.

Before the project start, a few of the livestock farming communities had pre-existing market-related governance structures in place such as livestock committees, cooperatives and dip tank committees through which farmers organize information sharing, mandatory dipping of cattle, or develop contribution systems to maintain or purchase resources that government is not able to provide. However, these structures were often not developed or well known as seen in the Mnisi baseline survey (only 30% respondents confirmed the existence of a farming cooperative in their village), nor do they concern planning of grazing activities.

4.1.2 Interactions between Communities and Community Groups (CM1.1)

Communities within each project site are positioned close to each other and therefore have strong ties to each other, especially familial ties. Neighboring communities also share common languages and people generally move freely between communities for both social (weddings, funerals, traditional events) and economic (livestock sales, market days, pension days) reasons.

The use of the communally owned land is decided through the Tribal Authority and local municipal government through consultation with communities and community structures. Rangelands are utilized by

[28] https://www.labour.gov.za
[29] 2018 Baseline Socio-economic Survey Report (in Annex)
[30] Maruleng Integrated Development Plan 2021-2026
[31] https://www.maruleng.gov.za

members of the communities under these governance structures and land users do not pay for the use of the land.
Since Ehlanzeni District Municipality falls within a Foot-and-Mouth Disease (FMD) vaccination zone, weekly dipping and inspection of all cattle is mandatory and sale / movement of cattle to and from the zone is restricted. Areas of Maruleng and Thaba Chweu District Municipalities fall outside of the FMD zone and therefore has no restriction on market, however the Maruleng and Thaba Chweu expansion areas have minimal veterinary assistance, infrastructure or governance structures around dip tanks and cattle management. Livestock owners within a village utilize designated communal dipping tanks. The larger project area has 106 dip tanks and 34 inspection crush pens that serve approximately 1,400 communal farmers/livestock owners.

4.1.3 High Conservation Values (CM1.2)

High Conservation Value	Tribal rangelands
Qualifying Attribute	The K2C biosphere region includes thousands of hectares of rich palatable rangelands for communities. The most important resource to the communities is a range of sensitive grass species that normally covers the soil in this area for cattle grazing. Cattle in the area provide food and revenue to local farmers and communities. The households within these communities also depend on the rangelands for agriculture and wood products, with many households cultivating food crops and harvesting Marula fruit in the savannah woodlands, along with wood for fuel and household furniture. Traditional healers from local communities also utilize the roots, leaves, bark and other fauna and flora harvested for traditional medicine.
Focal Area	Rangelands and grazing camps surrounding the villages of Welverdiend, Utah, Dixie and other villages of future project instances

High Conservation Value	Catchment areas for Rivers Olifants, Sabi and Sand
Qualifying Attribute	The entire project zone contains important parts of the catchments for the Olifants, Sabi and Sand rivers. Thousands of households, livestock, wildlife, and aquatic species in downstream communities of these water catchments depend on them as a primary source for daily use. A Climate Vulnerability Assessment (Figure 13) indicated a particularly high dependence of resident farming communities on water and grazing resources in the project zone.
Focal Area	All grazing camps in the project area play a role in conserving the water catchment areas. Specific importance however goes to grazing camps close to the major rivers or tributaries.

High Conservation Value	Buffer zone for protected areas

Qualifying Attribute	Project sites are in ecological buffer zones for protected areas. These areas contain wildlife and plant species that are important as a source of ecotourism to the surrounding communities. Maintenance of buffer zones is important for climate resilience of protected areas in which many members of the communities are employed in eco-tourism.
Focal Area	Rangelands directly bordering protected areas like the Manyeletti Game Reserve, Sabi-Sands private nature reserve, Timbavatti private nature reserve and the Kruger National Park

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

The most likely scenario without project activities is continued unplanned grazing on the rangelands leading to degradation. As described in section 2.2.2, livestock farmers in the project communities lack access to veterinary support services, training, and infrastructure to support a change to sustainable grazing practices. Per already observed trends, pressure from grazing would reduce the abundance of perennial grass species which are palatable for cattle grazing.
In the baseline scenario, human – predator conflicts are reported when wildlife leaves (randomly or seasonally) the protected areas and enters the rangelands through damaged fences. This often results in retaliatory killing of wildlife following an attack on livestock. In addition, poaching is a common problem, with occasional conflict between law enforcement and poachers that are embedded in the communities. Some villages in the project area are also red zones for Foot and Mouth Disease due to proximity with the GKNP. Livestock owners in this zone can only sell meat in the same zone. Naturally, their market is smaller, and they face higher risks and overhead costs. Before the project, farmers reported to only have one buyer (Makhona) for their cattle who basically had a buying monopoly. Cattle prices reached only around 60% of the nationally estimated market price.
Without the project interventions, the situation as-is is expected to continue as worsening rangeland conditions deplete the resources on which communities within the area greatly rely on for livelihood. Decreasing quantity and quality of available livestock forage could result in increased conflict within communities as they compete for scarce forage resources on communal lands. Scarcity of forage could also prompt increased encroachment into protected areas and exacerbate human-wildlife conflict as well as the spread of diseases such as Foot and Mouth which are transmitted between livestock and wildlife.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

Through a visioning process, community members in the Mnisi pilot site (Utah, Dixie, Welverdiend) were involved in developing a joint vision of success for the project and their desired outcomes. Similar visions of success were highlighted in each village with the focus being healthy, productive cattle with sufficient water and managed grazing lands (See Visioning Report in Supporting Documents). These inputs informed the project design. Overall, the project is expected to have the following impacts on the communities:

Community Group	Livestock farmers in the project communities
Impact(s)	Increased market access, income, and livelihoods sustainability
Type of Benefit/Cost/Risk	Livestock farmers will benefit through improved market access and higher prices for their cattle. Project participants are already receiving close to national prices which is unheard of for rural livestock farmers.

	Moreover, through sustainable use of rangeland grazing resources, livestock farmers are ensured adequate forage for their cattle throughout the grazing season. Thus, their livelihoods are less susceptible to the effects of climate change.
Change in Well-being	Improved livestock income estimated at $6,968,553

Community Group	Unemployed youth in communities
Impact(s)	Capacity development and job creation
Type of Benefit/Cost/Risk	Employment opportunities are directly created by the project (eco-rangers, bush thinning, environmental monitors, abattoirs, handlers etc.) as well as indirectly through resulting new/expanding enterprises.
Change in Well-being	Alternative income through job creation estimated at $6,860,096

Community Group	Women in communities
Impact(s)	Skills development, indirect employment opportunities
Type of Benefit/Cost/Risk	Through the enterprise development component of the project, community women are trained in the following skills: - Financial literacy training. - Green retail businesses, which are focused on pro-nature enterprises. In addition, these women are given support on regulatory compliance for their small-scale businesses; and access employment opportunities.
Change in Well-being	Alternative employment and income sources

Community Group	Children and youth in communities
Impact(s)	Education and skills development
Type of Benefit/Cost/Risk	Through boy and girl scout activities, children in the project communities learn the value of wildlife, recycling, veld sanitation/health, and conservation. The project also promotes the establishment of Information, Communication and Technology centers at schools and youth centers in communities who form part of conservation agreements. These centers are focused on providing reliable and fast internet connections and support youth with computer skills, e.g., Assisting youth with drafting their curricula vitae in an electronic format. Where funding is available, the project plans to include bursaries/scholarships to youth in project communities.
Change in Well-being	Increased skills development and access to internet

Community Group	Households near and downstream of project areas

Impact(s)	Restored ecosystem conditions
Type of Benefit/Cost/Risk	Improved ground cover and infiltration in the project area will influence water quality and quantity of rivers and tributaries that flow through the rangelands. The restored rangelands under planned grazing will also increase in biodiversity and act as a corridor between protected areas for many of the smaller fauna. Finally, pruning and brush packing activities reduce the prevalence of invasive plant species which are harmful to livestock and human health.
Change in Well-being	Increased resilience to climate change effects

Community Group	Wildlife guides
Impact(s)	Improved livelihoods through alternative income sources
Type of Benefit/Cost/Risk	Project activities aimed at protecting wildlife on communal land could enable potential job creation from increased ecotourism.
Change in Well-being	Additional ecotourism income

4.2.2 Negative Community Impact Mitigation (CM2.2)

Because the project activities are implemented on communal grazing lands, and are voluntary, there is a risk that livestock farmers, not part of the conservation agreements, may be stigmatized due to the imposition of other community members. CSA works to ensure this doesn't happen by sensitizing the communal livestock farmers about tolerance, voluntary participation rights and conflict management within the project. Increased awareness about resting camps through signs and engagements has been promoted. In addition, monitoring of resting camps including reporting of tracks and dung at the camp gates has been increased.

Moreover, in cooperatives internally there are currently certain non-compliance repercussions in place, such as e.g., a R50.00 fee for not helping with fence fixing. Note this is an internal arrangement within grazing cooperatives and not part of any conservation agreement. Typically, during cooperative or dip tank meetings non-compliant farmers are additionally being called out and must publicly pay the fee. Long-term reliance on incentives is to be mitigated by farmers becoming shareholders of Meat Naturally Program (MNP) (as in other CSA areas), so that profits replace incentives over time. The type and duration of services from MNP should be standardized (vs ad hoc) to increase farmer willingness and secure project sustainability.

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

Overall, the project has a net positive impact on the wellbeing of project communities compared to the without project scenario.

Livelihood & Employment

- Participating producers have already experienced significant increases in household income from improved animal quality and market access. This increase in household income has a cascading effect in the local communities through available income for education, improved nutrition, and food security.
- Selected community members are formally trained as herd monitors (also called Eco-rangers) and 'Eco-trainers' and are directly employed by the project to provide services to the members of Farmers Cooperatives (grazing associations).

- Trained community members support the project through community based monitoring of ecosystem services and impact.
- The project creates further options for ecotourism from increased wildlife, including those IUCN listed species.

Training & Skills development

- Through the project, communities farming livestock receive training that enable sustainable grazing and climate-smart animal husbandry practices.
- Women in the communities are trained in green retail businesses which are potential sources of income.
- Men and women participants alike receive financial literacy training through the project's partners (local banks).
- Children in the project communities learn the value of wildlife, recycling, veld sanitation/health, and conservation. This should lead in the long-term to more informed management of natural resources, livestock and human health.
- Children in the project communities get increased exposure to technology, and internet to enhance learning and development.
- The project also promotes the establishment of Information, Communication and Technology centers at schools and youth centers in communities who form part of conservation agreements. These centers are focused on providing reliable and fast internet connections and support youth with computer skills, e.g., Assisting youth with drafting their curricula vitae in an electronic format.

Climate adaptation

- The project activities lead to reduced methane emissions through climate-smart herd structure, which is sustained by market incentives.
- Rangeland management measures will increase water availability from surface water sources for people, plants, and livestock, providing buffering from drought.
- Restoration of grazing lands and improved forage quality will support climate resilience of livestock and thus the communities of livestock farmers.
- Restoration activities taken to reverse trends of erosion and land degradation.
- Diversified sources of income further increase the resilience of communities to the impacts of climate change.

Governance

- Farmers who are part of Farmers Cooperatives (grazing associations) receive governance training which enhances the understanding of their role as a governing body, builds institutional administrative capabilities, the ability to approach and engage with local government as a valid stakeholder; make ecologically informed decisions about how to manage their rangelands; and share lessons from their experience with other Farmers Cooperatives (grazing associations). Thereby they can build a local community of practice and cultivate pride amongst themselves.

Food security

- As many households in the project area also rear livestock for domestic consumption[29], improved livestock quality should also lead to better nutrition and food security outcomes.

4.2.4 High Conservation Values Protected (CM2.4)

The project will not adversely affect any identified community HCVs. Rather, these will be protected and improved under the project scenario. Rangelands within the K2C region will become more robust following project activities which improve grazing management practices. Buffer zones for protected areas will also be better managed, enabling greater adaptation of the flora, fauna and people depending on protected areas. Finally, improved soil condition in project areas located in major river catchment areas is also expected to have net positive effects on this High conservation value, compared to the without-project scenario.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

Positive Impacts

The project will document and disseminate evidence reports and other communication materials including lessons learnt reports, policy briefs, case studies to support policy makers and other stakeholders interested in research activities in the project area.
This project stands out as a 'demonstration site', where other implementing agents wanting to enhance rangeland restoration with communal livestock owners go to learn, to collaborate, to share.

Negative Impacts

Due to the project, SANParks may have less areas available within the project zone for potential conversion to wildlife reserves for ecotourism. However, this is a marginal negative impact, as the K2C rangeland carbon project will have wide ranging positive impacts whereas conservation area expansion could further marginalize livestock farmers for relatively small gains in ecosystem integrity. This is further minimalized by the encouraged inclusive conservation models that allow for co-existence of herbivorous wildlife animals with herds.

Net impacts are further described in section 4.3.3.

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

A rigorous stakeholder engagement process described in 2.3.7, 2.3.9 was undertaken to ensure that project stakeholders are included in the project design and planning and mitigate any potential negative impacts. Regarding the potential negative impact identified in section 4.3.1; the project mitigates this by increasing awareness among livestock farming communities about wildlife conservation to reduce the occurrences of human-wildlife conflicts. This in addition to increased income from project activities is expected to reduce the likelihood or occurrence of wildlife poaching in the area even below the baseline. Therefore, the stakeholder’s overall goals of wildlife conservation are rather re-enforced and not negatively impacted by the project’s activities.

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

The project has no net negative impacts on any of the identified stakeholders as outlined below:

Stakeholder	Net Impacts
Kruger to Canyons Biosphere Reserve*	Net positive impact through improved resilience, decreased erosion of water catchments feeding protected areas and better protection of wildlife outside protected areas
Traditional Authorities: - Mnisi - AmaShangaan - Jongilanga - Ba pedi Dinkwanyane	Net positive impact through strengthened governance structures within livestock communities via Farmers Cooperatives (grazing associations). Livelihoods of communities are generally improved and there is an increased potential for eco-tourism in the area
Bushbuckridge Local Municipality	Net positive impact through improved livelihoods of constituents

Ehlanzeni District Municipality	Net positive impact through improved livelihoods of constituents
SANParks BSP	Net positive impact through improved rangeland conditions and improved community wildlife conservation
Parastatals (Mpumalanga Tourism and Parks Agency*, SANParks, LEDET)	Net positive impact through improved rangeland conditions and increased potential for eco-tourism
DARDLEA	Net positive impact through improved pasture production
University of Pretoria, Wits Rural Facility, University of Mpumalanga, Southern African Wildlife College	Improved collaboration of socio-economic and natural resource use research in the area generating a positive feedback loop that will help to improve K2C carbon project activities
Department of Agriculture through the Mpumalanga State Veterinary Department	Net positive impact as livestock in the area are better managed and farmers have higher incentives to follow government-recommended practices such as Foot and Mouth Disease and tick control
Thaba Chewu and Maruleng Municipalities	Net positive impact through improved livelihoods of constituents
Department of Forestry, Fisheries and Environment	Net positive impact through reduced erosion and rangeland restoration, rangeland resilience, potential positive biodiversity impacts

4.4 Community Impact Monitoring

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

Monitoring of the project's community benefits is carried out through 2 main processes.

1. A socio-economic household survey which is conducted every two years by CSA Eco-trainers with the assistance of the project M&E officer and the Stewardship Coordinator. The survey data is collected from a sample of participating farmers and tracks the following indicators:
    - Level of education of household members
    - Sources of household income (average household Income from livestock, agriculture and tourism related activities that can be attributed to the project interventions will be compared with control data to account for other economic or climate-related distortions).
    - Proportion of household income spent on different categories such as education, food, transport etc.
    - Employment status and types of jobs of people in household
    - Household food production / agricultural practices
    - Household water collection sources
    - Number and types of livestock owned.
    - Household uses of livestock (number sold, number used for consumption etc)
    - Livestock management (how much is spent on feed, challenges to selling livestock, cattle dipping practices)
    - Opinions, preferences, and perceptions of farmers on rangeland conditions

2. Monitoring, Evaluation, Research, and Learning (MERL) reports which are compiled every quarter from data collected by Yes4Youth, herders, Eco-rangers and CSA Eco-trainers via weekly farmers' meetings, key informant interviews and reports from project partners / stakeholders. This data is aggregated from various project communication channels including WhatsApp and Microsoft Teams. The monitoring data is disaggregated into age groups and gender and recorded per indicator theme as per the project monitoring framework.
   - Number of beneficiaries of the project
   - Number of jobs created directly (including eco-rangers, bush thinning, environmental monitors, abattoirs handlers etc.) and indirectly (through employment created by new/expanding enterprises) that can be attributed to the project interventions,
   - Number of livestock sales (data generated from project partners, Meat Naturally)
   - Turnover from livestock sales (data generated from project partners, Meat Naturally)
   - Number of households supported directly by project interventions.
   - Number of people who received a.) formal and b.) informal training by the project (disaggregated by age groups)
   - Number of livestock dipped weekly in community dip tanks.
   - Number of bursaries/scholarships granted to youth in project communities.
   - Total bursaries (in Rands)
   - Number of graduates produced from the bursaries.
   - Number of research papers published which can be directly attributed to the project.

4.4.2 Monitoring Plan Dissemination (CM4.3)

Project description documentation and monitoring reports will be shared as hard copies with the traditional authorities, in the communities and in schools/youth centers where CSA provides internet access. A translated summary is planned to be provided with this documentation. In addition, Eco-rangers and/or CSA staff will present and discuss summaries of the documents in the livestock committees as well as in the events of the Scouts. These presentations will take the form of focused feedback sessions on specific issues of particular interest to stakeholder groups such as soil, grazing quality etc. The project monitoring report will also be published on the Verra website and made available to the wider public for a public commenting period. CI will share this link as well with other project stakeholders for their information and input. A summary of the monitoring report for the recent reporting period will be displayed in the community centers notice-boards.

4.5 Optional Criterion: Exceptional Community Benefits

This project seeks to be validated at the Gold Level for Exceptional Community Benefits.

4.5.1 Exceptional Community Criteria (GL2.1)

The project meets the exceptional community criteria because communities participating in the project have management rights to land in the project area and rights to claim that their activities will cause the project's climate, community, and biodiversity benefits. Although the rangelands are communal (i.e., state owned and without an individual ownership title deed), the rangelands belong to the community through the guidance of the Nduna and Chief from the tribal authorities. This is recognized under the Communal Land Rights Act 11 (2004). Under tribal custodianship, the use of the land is decided through the Tribal Authority and local municipal government through consultation with communities and community structures. The capacity to enforce rights is through the existing governance structures, either livestock committees or dip tank committees as well as traditional authorities. Communities therefore lead the process of dividing grazing areas into rested and grazed zones and own the management and implementation process. CI currently functions as the project proponent but in the future will transfer this role as well to the communities via a suitable governance structure.

With regards to the second criterion, the project zone has slightly less than 50% of households below the national poverty line (45.4% in Bushbuckridge and 42.7% in Maruleng). Nonetheless, the project zone is located within a low human development area of South Africa. In 2011, the poverty rate in Bushbuckridge was at 67.9%. A 2013 socio-economic study ranked the municipality number 15 (out of 18 municipalities) in Mpumalanga province for Human Development metrics; with a HDI score of 0.57. Households' income was ranked number 13 as per department of finance 2011 report with 79% of households earning less than the national minimum wage. Similarly, in Maruleng, about 83% of households earn less than the minimum wage.

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

The project will generate numerous benefits for the participating livestock farmers and communities, discussed at length in previous sections 4.2.1, 4.2.3 and 4.2.4. These benefits are summarized here.

The project will generate the following **short-term** community benefits:

- Direct training & employment of youth
- Empowerment of women with income-generating skills
- Increased income from livestock sales
- Better governing structures among livestock farmers

The project will generate the following **long-term** community benefits:

- Increased household income via employment opportunities for youth and women
- Restoration of perennial grasses for improved livestock forage
- Additional employment opportunities via eco-tourism
- Improved local knowledge about sustainable rangeland management.
- Greater tolerance for wildlife outside protected areas
- Resilience of ecosystems and rangeland resources
- Improved quality and quantity of surface water
- Increased knowledge on health and wellbeing through 'one-health' approach with the veld sanitation guide.

4.5.3 Community Participation Risks (GL2.3)

Risks to community members for participating in project activities are few relative to those under the baseline scenario and are discussed previously in section 4.2.2. Community meetings to discuss options for grazing management allow individual herders to be aware of the benefits and risks of different grazing management options. Community members, through the inclusive decision-making process, will have ample opportunity to express concerns, evaluate options, and choose to participate in grazing plans.

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

Community Group 1	Unemployed youth with no higher-level education
Net positive impacts	The most vulnerable group engaged by the project is unemployed youth, with no higher-level education. Through the Yes 4 Youth program integrated in project, youth within the communities are selected by the farmers to work as herders. 2 to 4 of these can be hired and trained as Eco-rangers (who will mentor the next generation of yes 4 youth herders). The top performers of these can progress to become Eco trainers and go to the herding academy. The top performers of these are envisioned to take over project activities and increase the reach of the project and maybe even take it to rangelands outside of K2C. The salaries are sustained by the carbon project. The project also promotes the establishment of Information, Communication and Technology centers at schools and youth

	centers in communities who form part of conservation agreements. These centers are focused on providing reliable and fast internet connections and support youth with computer skills, e.g., Assisting youth with drafting their curricula vitae in an electronic format. Where funding is available, the project plans to include bursaries/scholarships to youth in project communities.
Benefit access	The youth selected for this program are selected through a participatory approach by the communities of farmers.
Negative impacts	CSA ensures the selection process is democratic and all youth within communities are given the chance to participate in the training activities. Hence, no negative impacts are expected to occur.

Community Group 2	Children in project communities
Net positive impacts	The project conducts boy and girl scout activities within the communities as an after-school activity once a week for 2 hours. Here children in the project communities learn the value of wildlife, recycling, veld sanitation/health, and conservation. This is used as a vector to raise environmental awareness also at home.
Benefit access	Scout centers are established within local communities so that they are easily accessible since long distance transportation could be a barrier. Whenever veld hikes are conducted, transportation arrangements are made for participants who require this. Activities are held after school for convenient participation. Finally, sessions are held in local languages to ensure the understanding is not limited by any of the participants.
Negative impacts	Since this project activity involves school children, it is conducted outside school hours and only once a week so that school activities are not affected, and to allow time for other activities or household tasks. Parental permission is also required for children to participate as scouts

Community Group 3	Women in project communities
Net positive impacts	Through the enterprise development component of the project, community women are trained in the following skills: - Financial literacy training. - Green retail businesses, which are focused on pro-nature enterprises. In addition, these women are given support on regulatory compliance for their small-scale businesses
Benefit access	Women-only workshops are held for selected skill development trainings. In larger sessions involving male and female participants, women are encouraged to speak up and voice their opinions. The project also ensures a fair selection

	process for employment, so that men alone aren't employed in project activities.
Negative impacts	Sessions are held when women are mostly available, this is facilitated by asking women and scheduling sessions at times that suit most women attendees e.g., morning sessions when children are mostly at school

Community Group 4	Elderly not in position of leadership
Net positive impacts	Through the enterprise development component of the project, elderly have improved income through higher market prices. The support in herding provided by the projects also assists elderly community members with livestock safety and support with herd management.
Benefit access	Herders are assigned to support elderly livestock owners through the Yes for Youth programme. Eco-trainers support the herd management of elderly community members' cattle.
Negative impacts	Herd management is focused on supporting the elderly who cannot always tend to their cattle or are not physically able to.

4.5.5 Net Impacts on Women (GL2.5)

The project will have the following direct and indirect impacts on women:

- Women will be directly impacted through skills and business development training and support, including with regulatory compliance for businesses.
- They will also have increased participation in the decision-making processes through stakeholder meetings where women are particularly encouraged to speak up.
- Women benefit from the increased household income and food security through improved cattle production and sales.
- Women are directly employed through the job opportunities created by the project.

4.5.6 Benefit Sharing Mechanisms (GL2.6)

Benefit sharing mechanisms for the project are agreed upon and concretized in benefit sharing contracts; wherein livestock farmers undertake to perform certain project activities, and CSA to deliver the livestock management benefits to the communities using carbon revenues generated from project activities. The carbon revenue (after deducting carbon transaction costs) will be used to support sustained delivery of the Livestock Management Benefits and incentives such as the provision of fodder, provision of herders and eco trainers to support with project activities, provision of training opportunities (livestock production, health and management, market access, red meat value chain), facilitation of partners who provide services / support e.g. DARDLEA (fencing, water infrastructure etc.), Meat Naturally (improved participation of farmers in red meat value chain). Long term, both parties agree to explore the potential of establishing a Trust for the purposes of more specific sharing of the carbon revenue benefits. Community members are involved in the process as discussed below in the following section. The benefit Sharing Agreement can be made available to the validator.

4.5.7 Benefits, Costs, and Risks Communication (GL2.7)

Community members are involved throughout the project design and planning process as described in sections 2.3.1, 2.3.2, 2.3.3 and 2.3.4. After the engagement team presents the conservation agreement idea (including costs, benefits, and risks, if any) and verifies that the stewards understand the intent, the representatives are given as much time as they need to communicate with their constituency and discuss the desirability of designing an agreement with CSA. CSA confirms that the decision made reflects the sentiment of the wider resource user group, for example through randomly selected focus groups or informal individual interviews (with representatives from a variety of social groups). The objective of this step is to ensure that the resource users understand and consent to the proposition of proceeding to the next step, namely designing a conservation agreement. In addition, a visioning process at the start of the project was undertaken by community members to describe their desired outcomes and expected benefits from the project. These were taken into consideration when proposing project intervention, incentives, and benefit-sharing mechanisms. Concrete project activity plans are clearly decided in farmer meetings through democratic decision-making processes. This includes the formulation of grazing plans, selection of herders and other project roles. Design and negotiation workshops have been successfully facilitated with four Farmers Organizations in Mnisi area (two in Welverdiend and one each in Utah and Dixie) who comprise the first project instance. In these negotiation workshops the costs and benefits are explained to farmers by experienced facilitators. This is evidenced by the conservation agreements and benefits sharing contracts under supporting documents .

4.5.8 Governance and Implementation Structures (GL2.8)

The governance and organizational model (Figure 15) is described in section 2.4.1. Individual livestock farmers are involved through the Farmers Cooperatives (grazing associations). Representatives of the Farmers Cooperatives (grazing associations) sign conservation agreements with CSA when their members agree to partake in the project activities. Organizational development of Farmers Cooperatives (grazing associations) is a strong aspect of this project. Moreover, CSA plans to transfer ownership of the project in the future to the communities through a sustainable community-based structure which will be set up.

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

- Through the project, communities farming livestock receive training that enable sustainable grazing and climate-smart animal husbandry practices.
- Selected community members are formally trained as herd monitors (also called Eco-rangers) and ‘Eco-trainers’, i.e., in herding, kraaling and other critical skills and are directly employed by the project to provide services to the members of Farmers Cooperatives (grazing associations).
- Farmers in Farmers Cooperatives (grazing associations) also receive governance training which enhances the understanding of their role as a governing body, builds administrative capabilities, the ability to approach and engage with local government as a valid stakeholder; make ecologically informed decisions about how to manage their rangelands; and share lessons from their experience with other Farmers Cooperatives (grazing associations).
- Women in the communities are trained in green retail businesses which are potential sources of income.
- Men and women participants alike receive financial literacy training through the project’s partners (local banks).
- Children in the project communities learn the value of wildlife, recycling, veld sanitation/health, and conservation.
- Youth are supported with computer skills through the establishment of ICT centres at schools and youth centres in communities.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

In short: Main threats to biodiversity include degradation of rangelands due to continuous unplanned grazing, increasing density of alien plant species, unpredictable droughts, and increase of human-wildlife conflicts.

The project zone is in the Kruger to Canyons (K2C) Biosphere reserve, a unique biodiversity hotspot. Although this biosphere represents only 1.5% of South Africa's total land surface, it contains nearly 75% of all terrestrial bird species, 80% of all raptor species, 72% of all mammals, 50% of all butterflies and 50% of all frog species found in South Africa[32].

Wildlife

The project area forms part of this biodiversity hotspot, located adjacent to fenced Nature Reserves. Flagship predator species such as African wild dog, spotted hyena, lion, and leopard often enter the rangelands through drainage lines or damaged fences. Elephants occasionally break through to the grazing areas as well, although cases are becoming increasingly rare. In the baseline scenario, wildlife that enter the rangelands are often subject to persecution and retaliatory killings by livestock farmers following predation incidences. Poaching is also a significant threat to wildlife inside the protected areas. These challenges have been identified as providing a major opportunity for this project to change perceptions and educate communities about wildlife conservation both inside and outside protected areas.

Vegetation

The three dominant grass species across the Mnisi pilot sites at the start of the project were *Panicum maximum, Digitaria eriantha* and *Uruchloa mosambicensis*[33]. A healthy population of large marula trees (*Sclerocarya birrea*) provide much needed shade for people and livestock, while also acting as an important food source. Vulnerable and endangered tree species in the project area are *Balanites maughamii, Boscia albitrunca, Combretum imberbe, Diospyros mespiliformis, Philenoptera violacea,* and *Sclerocarya birrea*)[34]. Threats to endangered tree species include wood harvesting and the encroachment of alien species. Recent studies indicate that the communal rangelands adjacent to GKNP have 50% more alien plant species density than inside the protected area (Swemmer & Mmmethi 2016). *Lantana camara, Psidium guajava*, and *Agave sisalana* were the most abundant alien species found in the most recent assessment. *L. camara* outcompetes and inhibits the establishment of indigenous species and is growing abundantly in many camps. With strategic bush thinning and pruning, this effect can be counteracted to keep the high floral and small-fauna diversity intact. Another concern is *Parthenium hysterophorus* (famine weed), which invades grasslands and affects both livestock in the project area and wildlife further downstream in the parks. It can be an irritant for human skin and respiratory systems and thus also poses a health risk. *Parthenium* is entering the central and southern regions of Greater Kruger National Park through water courses that pass through communal rangelands.

Ecosystem Services

The Kruger to Canyons Biosphere encompasses the catchment for critical rivers flowing into the GKNP, and its wildlife is completely reliant on water flow from the upper catchment of Mpumalanga. These rivers flows down the escarpment through degraded rangelands, into the national park, and continue eastwards to Mozambique and the Indian Ocean Figure 33. The initial project implementation site (Mnisi) is located on rangelands within the Sabie (Sand) River catchment. The Sand River is an important tributary of the river Sabie which flows into the central part of the GKNP, forming an important part of the park's

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32 https://en.unesco.org/biosphere/africa/kruger-to-canyon

33 Baseline vegetation assessment (Graeme 2016) in "Supporting documents"→ "Biodiversity"

34 http://redlist.sanbi.org

ecosystem and the K2C biosphere reserve. Previous droughts within the region, as experienced in 2015-2016, have led to significant die-off of the park's wildlife (Malherbe et al 2020) as well as cattle owned by members of downstream communities in the park's buffer zones.

In the baseline scenario, the overutilization of rangelands by unmanaged livestock herds grazing freely results in bare soil, which encourages erosion and runoff, especially during the rainy season, and hardening of soil during the dry season. This effect causes localized flooding events due to lack of infiltration into the soils and creates a siltation that reduces flow levels and affects fauna and flora downstream in the protected areas. Gully erosion is also exacerbated especially along drainage lines and well used cattle paths in the savanna areas.

Historically, conservation activities have been focused within the GKNP and not in the GKNP Buffer Zone, landscapes bordering the extensive protected areas. However, the five perennial rivers that run through GKNP all have their catchments outside of the protected area. Changes to the river systems feeding GKNP have been evident since the 1960s, with records of progressive degradation in quantity and quality (Pienaar, 1970) from silt and other sediment eroding into the river from cultivated lands, as well as reduced river flows through water abstraction, flow regulation via dams, and pollution (Pollard et al 2011).

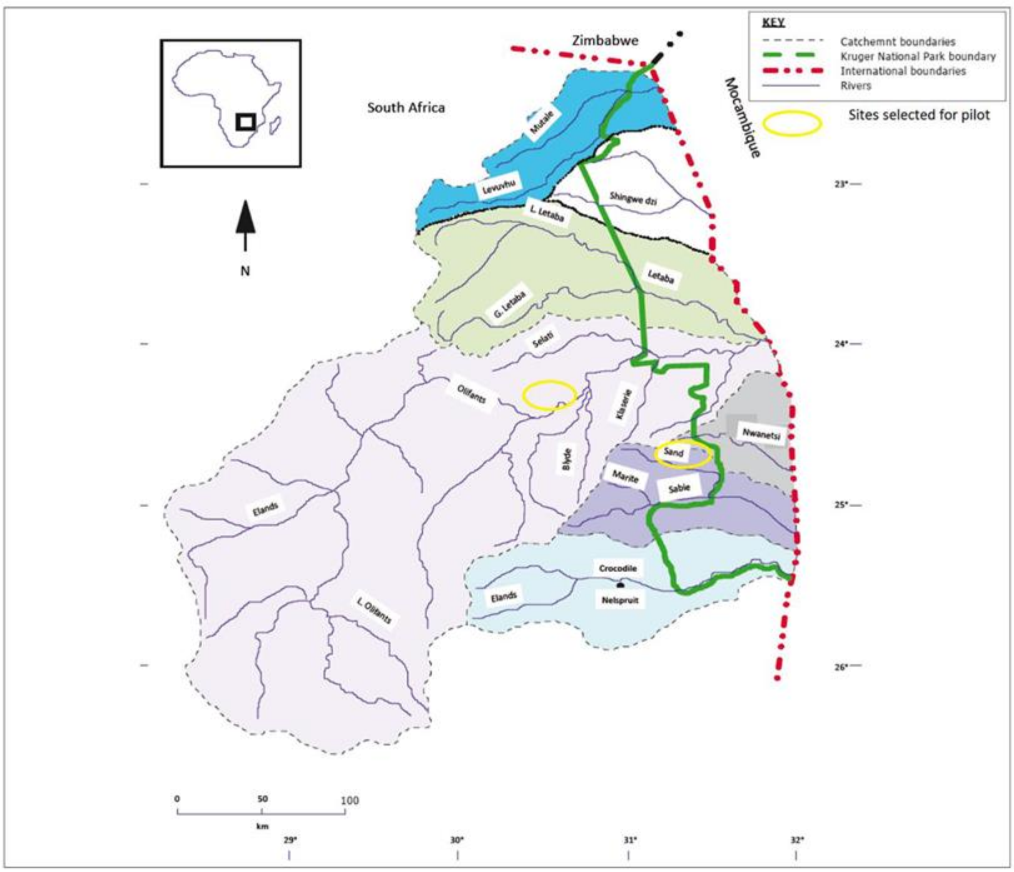

Figure 33: River Catchments of the Greater Kruger National Park (Pollard et al 2011)

5.1.2 High Conservation Values (B1.2)

Threatened or Rare Ecosystems

The project zone forms part of the UNESCO-recognized K2C Biosphere Reserve *Figure 7*. The biosphere comprises 1 million hectares of protected areas, native rangelands, and agricultural lands across three major biomes (savanna, Afromontane forests, and grasslands). These rangelands, in which the project is located, form an important ecological buffer zone for protected areas. The region has high conservation value, being within the Maputaland-Pondoland-Albany Biodiversity Hotspot, which includes 55% of the total terrestrial biodiversity of South Africa despite occupying only 1.5% of the country's land area. This high diversity includes several threatened and endangered species, including the largest remaining wild populations of both black and white rhinos, which are currently experiencing extremely high and increasing poaching rates; some 1,175 rhinos were poached in 2016 alone. The K2C Biosphere Reserve also forms part of the Great Limpopo Transfrontier Conservation Area (GLTFCA), a conservation area linking South Africa, Mozambique, and Zimbabwe, covering approximately 3.5 million ha. It is one of the largest conservation areas in the world.

Furthermore, the project zone includes areas recognized in the South African National Biodiversity Assessment (2011) as priority areas for national biodiversity conservation (*Figure 34*). Additionally, parts of the project zone qualify as potential "other effective area-based conservation measure" (OECM) areas, according to Marnewick *et al.* (2021) (Figure 35). The term OECM (CBD 2018) refers to a, "geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in-situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values."

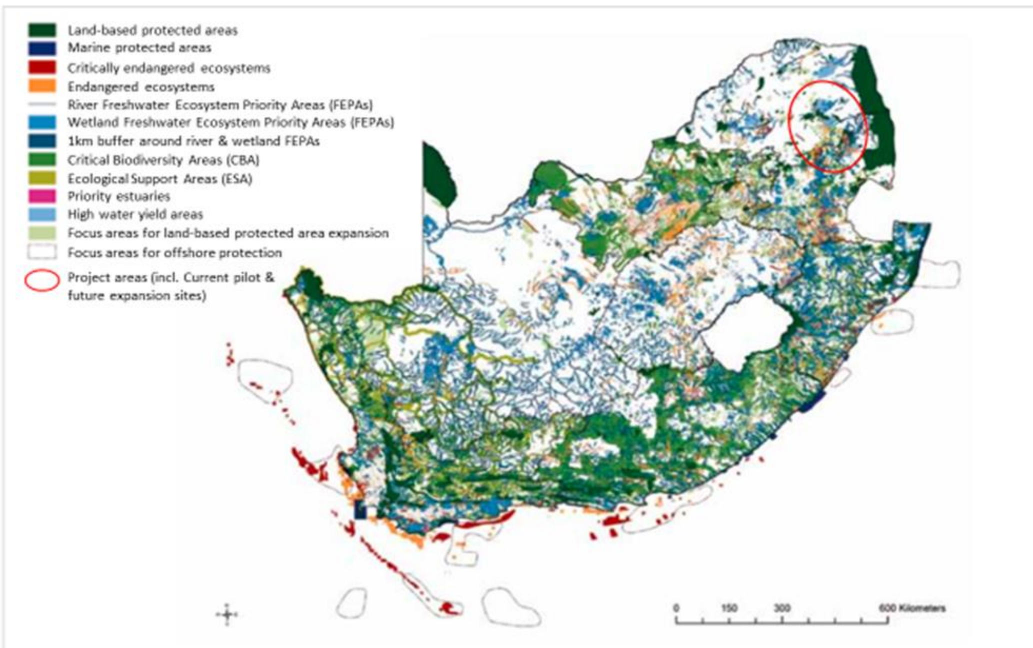

Figure 34: Biodiversity priority areas in South Africa (Driver et al; 2011)

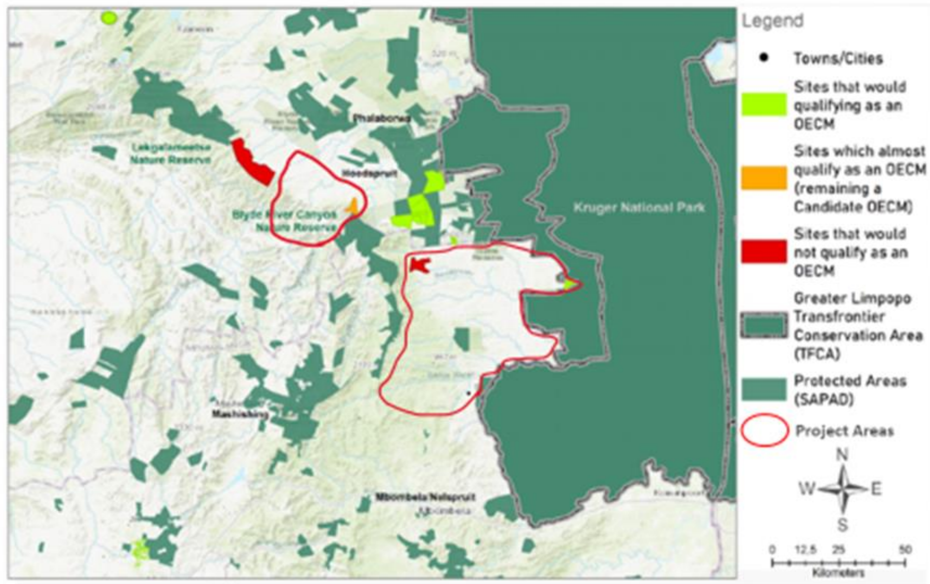

Figure 35: OECM case study assessment sites in the K2C Biosphere (Marnewick et al 2021)

Threatened Species

The Greater Kruger National Park, which is directly adjacent to the project area, contains more than 350 individuals[35] of African wild dog (*Lycaon pictus*), an endangered species[36]; this is the largest connected population in southern Africa. As they roam across their home ranges, wild dogs may leave the park and enter high-risk areas in the communal rangelands, where they can be caught in snares or catch diseases from domestic dogs. The main threats to the species are conflict with humans and human activities, infectious disease, and habitat fragmentation by barriers such as fences or roads, which prevent animals from reaching other populations to breed. Due to their status as endangered species, African wild dog is a trigger species for the project under the vulnerability criterium.

High Conservation Value	Communal Rangelands of K2C Biosphere
Qualifying Attribute	Serving as an important ecological buffer zone for protected areas, the soil and vegetation in these rangelands are under threat from unplanned/unmanaged grazing. This leads to ecological and socioeconomic degradation through the loss of soil cover and productivity favoring less palatable and invasive vegetation.
Focal Area	The grazing camps within the project area can be improved through proper and integrated grazing management and restoration of perennial grasses. This improves soil cover and soil health as well as the health of close-to-nature flora and fauna.

[35] Endangered Wildlife Trust
[36] https://www.iucnredlist.org/species/12436/166502262#assessment-information

High Conservation Value	Catchment areas for Rivers Sand, Blyde, Olifants, and Sabie
Qualifying Attribute	These rivers flow through the GKNP and form an integral part of the K2C biosphere. The region's current drought has caused massive die-off of the Park's wildlife as well as cattle owned by members of downstream communities in the park's buffer zones. Project activities that enhance soil cover and control erosion will lead to increased water infiltration, and availability from surface water sources for people, plants, and livestock helping to raise the adaptive capacity against future drought events.
Focal Area	Though all grazing camps in the project area play a role in conserving the water catchment areas, specific importance goes to grazing camps close to the major rivers or tributaries. Erosion control measures and increased soil cover should have a stronger effect the closer they are to waterbodies.

High Conservation Value	Populations of trigger species, including endangered and threatened endemic large mammals
Qualifying Attribute	The project helps to reduce human-wildlife conflicts through continuous awareness raising. Also, improved management of grazing camps, especially the resting of certain camps, increases landscape permeability for these animals, improving connectivity to other populations of African wild dog. Movement of wild dogs outside protected areas is monitored in collaboration with the Endangered Wildlife Fund Carnivore Monitoring Project.
Focal Area	Especially rangelands near protected areas

High Conservation Value	Populations of endangered tree species
Qualifying Attribute	The project area contains at least 91 individuals[33] from six vulnerable and endangered tree species**Error! Bookmark not defined.**: *Balanites maughamii, Boscia albitrunca, Combretum imberbe, Diospyros mespiliformis, Philenoptera violacea,* and *Sclerocarya birrea*. Through community engagement efforts, the project aims to support the conservation of these tree species in the communal rangelands.
Focal Area	All rangelands in the project area play a role in the conservation of endangered tree species.

5.1.3 Without-project Scenario: Biodiversity (B1.3)

Without the proposed carbon project, the communal rangelands will likely remain under continuous grazing, resulting in biodiversity losses such as reduced plant diversity (Biggs et al 2008), change of natural plant species composition; reduction in grazing quality; and favoring of annual over perennial species (Rutherford, 2012). Improved changes in vegetation diversity also have proven effects on the abundance of soil fauna and herbivorous arthropods (Prendini et al 1996; Zhang et al 2022). Furthermore, prolonged unmanaged grazing will lead to continued loss of topsoil and spread of invasive alien species (O'Connor et al 2010). As rangeland conditions continue to degrade, further effects may include increasing frequency of human-wildlife conflict as well as land abandonment, land use change (LUC), and loss of biodiversity, especially if current native vegetation is lost through conversion to urban or agricultural land uses.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (B2.1)

The proposed changes in grazing management will increase forage availability and quality, not only for livestock but also for wild ungulates with additional biodiversity benefits associated with ecosystem services, such as improved water infiltration.

Baseline data from the project area that allows for comparison between areas subject to planned vs. continuous grazing (Figures 35-37) suggest that project activities will increase the population sizes and biodiversity of native vegetation. Thus, project activities will improve rangeland habitat for endangered flora and fauna species of the savanna.

By employing Eco-rangers to engage in community sensitization activities, the project also aims to reduce the incidence of conflicts between herders and endangered wildlife species.

Biodiversity Element	Threatened and endangered species
Estimated Change	Reduced threats to endangered species outside of protected areas
Justification of Change	The project employs Eco-rangers who continuously educate communities and herders on managing human-predator conflicts, which is one of the biggest threats to the Wild Dog species. The presence of African wild dogs outside protected areas will be monitored via tracking collars put in place by the Endangered Wildlife Trust (existing data sharing agreement) and reported to the relevant authorities. Conflict incidents will be monitored via reports from Eco-rangers.

Biodiversity Element	Vegetation diversity and composition
Estimated Change	• Higher number and diversity of perennial grasses • Stabilized population of protected tree species
Justification of Change	The project introduces managed rotational grazing to enable recovery time for perennial grass species. Through community engagement efforts, the project also aims to propagate the conservation of protected tree species in the communal rangelands. This change is monitored through a comprehensive vegetation assessment and assessed via the Shannon-Weiner Index and a comprehensive species list every 1-5 yrs.

Biodiversity Element	Invasive Alien Plant species
Estimated Change	Invasive Alien vegetation cleared to maintenance level to promote palatable grass growth and keep the high flora and small fauna diversity intact.

Justification of Change	Strategic bush thinning and pruning activities are promoted by the project. Change will be measured as a proportion of alien vegetation infestation (ha) compared to baseline level.

5.2.2 Mitigation Measures (B2.3)

Improved Rotational Grazing
Through the implementation of rotational grazing, perennial grasses should be restored across the project area. Improved veld condition will have long term benefits, both in terms of enhanced livestock health, and improved ecological functioning. Furthermore, the restored rangelands will act as a corridor between protected areas for many of the smaller fauna. Improved ground cover and water infiltration resulting from these activities also influences water quality and quantity of rivers and tributaries that flow through the rangelands and into the Protected area of the GKNP on which the area relies heavily. Consequently, the project activities build resilience for both the environment itself, and those who depend on it.

Removal of Invasive Species
Alien clearing teams have been formed to engage in bush clearing and removal of invasive alien plants in the rangelands in collaboration with SANParks and K2C Biosphere. The first pilot was successful and will be scaled with special focus on alien species that are harmful to livestock or wildlife health and those which outcompete natural vegetation.

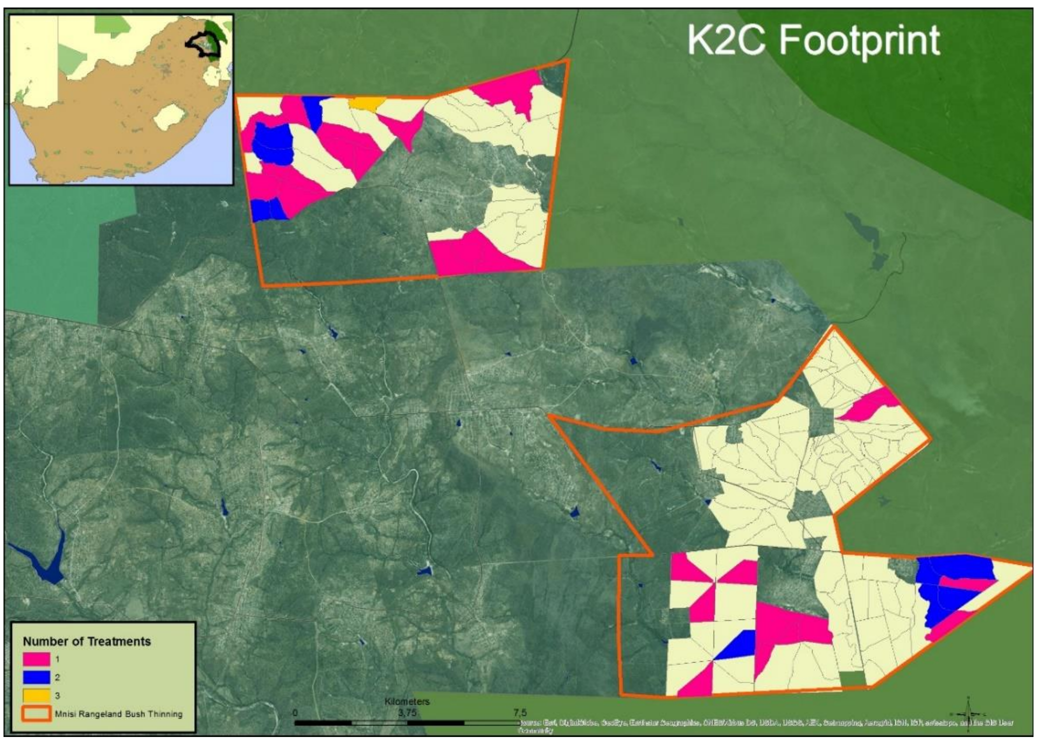

Figure 36: Areas where bush clearing has been implemented.

Detection and Prevention of Human-Wildlife Conflict
Designated Eco-rangers are responsible for patrolling communal rangelands and have received training in identifying tracks of wildlife, specifically predators, to support neighboring nature reserves with wildlife that have crossed the fence. This supports the immediate reporting of wildlife outside protected areas to the applicable authorities and aims to prevent human-wildlife conflicts. The project also uses monitoring

systems from Endangered Wildlife Trust to identify African wild dog packs in danger from snares and human-wildlife conflict.

Community Engagement & Awareness
The Eco-rangers engage continuously with the communities, raising awareness on the importance of wildlife, threats they face, and solutions to reduce conflict between wildlife and people e.g., the practice of kraaling to avoid predation incidents. This is expected to increase tolerance of herders towards predators such as African wild dog (*Lycaon pictus*) and improve the prospects for conserving wildlife in general outside of protected areas. Communities also receive training on conservation, sustainable wood harvesting and use of rangeland resources, e.g., protected trees.

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

The project's core activities involve rehabilitation and restoration in native rangelands that are used as production landscapes. Previous studies show that areas under high utilization (past and present) require intensive management intervention to facilitate recovery (Ebrahim & Negussie, 2020). An effective shift from the baseline livestock management approach of unmanaged, continuous grazing is therefore vital to enhance rangeland resilience, given the heavy utilization pressures. The project intervention of planned rotational-rest grazing by collective herding is expected to have cascading impacts for the landscape. Vegetation surveys were undertaken to establish baseline information on above-ground grass standing crops and biodiversity indices of the four pilot intervention sites (Utah, Dixie and Welverdiend A & B). Results from the pilot project period compared to the baseline indicate that rested areas show larger grass tuft diameter and shorter distance between tufts, indicating the increase in grass cover and reduction of bare ground (Figure 37). The assessment also showed a mean increase in vegetation diversity of herbaceous and woody vegetation in the pilot monitoring sites as measured by the Shannon-Weiner index (Figure 38, Figure 39).

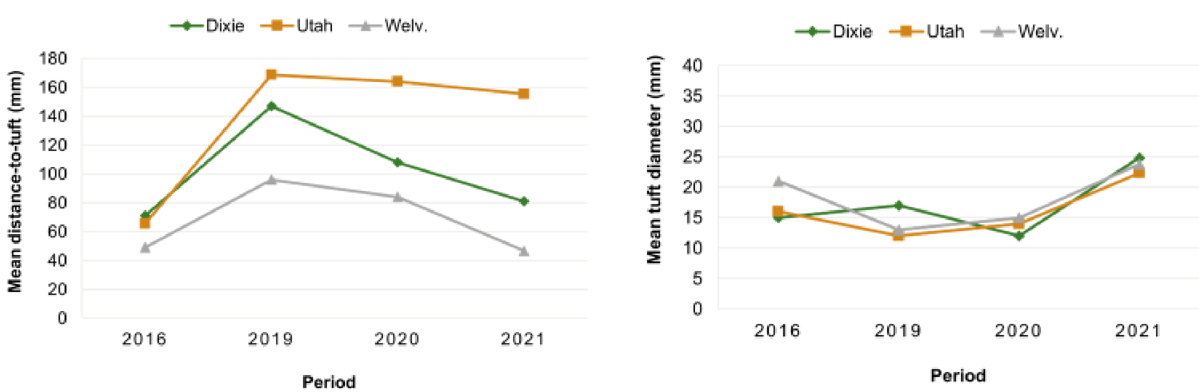

Figure 37: Changes in (a) mean distance to tuft and (b) mean tuft diameter recorded per herbaceous individual from 2016-2021.

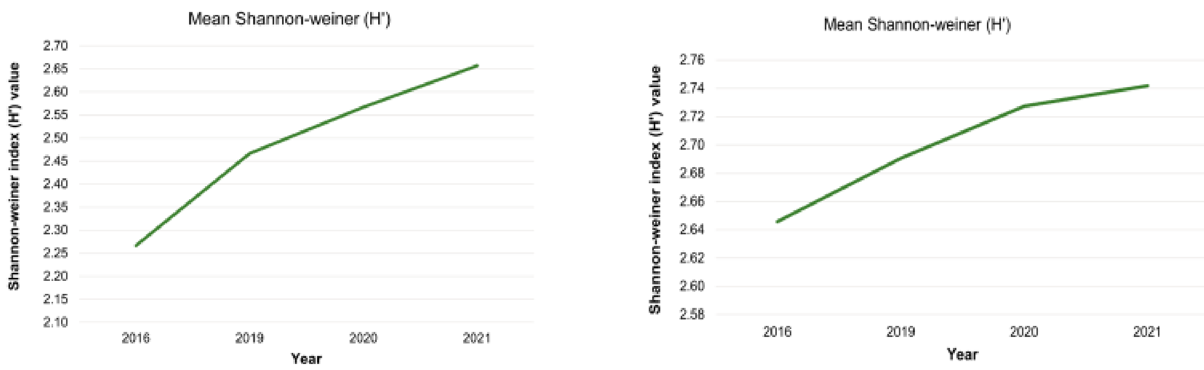

Figure 38: Changes in Mean Shannon-Weiner Index for (a) herbaceous and (b) woody vegetation.

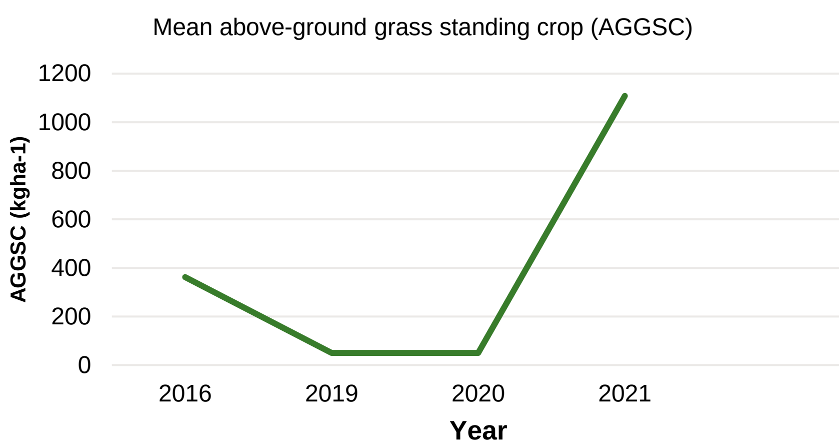

Figure 39: Changes in the mean above-ground grass standing crop (herbaceous vegetation).

Ecological principles indicate that we can expect increased water filtration in rangelands under planned grazing due to increased vegetation cover and resulting decreased erosion (Figure 40). Reduced sheet and gully erosion in rangelands under planned grazing during the pilot phase proved difficult to measure due to theft of monitoring infrastructure. However, consolidated data shows four out of six gullies monitored decreased significantly in size, one remained the same, and one showed soil loss in a higher magnitude than the control (which also showed soil loss) (see report in "Erosion field data" in supporting documents). This aspect will be monitored annually due to its importance in improving biodiversity and climate adaptation in rangelands and adjacent protected areas.

Finally, through the removal of invasive species that outcompete and inhibit the establishment of indigenous species, project activities will impact the restoration of natural habitats and prevent future invasive alien plant outbreaks caused by increased rainfall,, which puts both wildlife and livestock at risk especially areas at the interface of protected areas.

In general, project activities maintain an effective buffer zone for wildlife protection and forage for wildlife, including those with an IUCN endangered status. This is due to high levels of ecological infrastructure present in the area, e.g., being a strategic water source area, the altitudinal gradients and largely intact natural systems that allow for species migration to more suited habitat when needed.

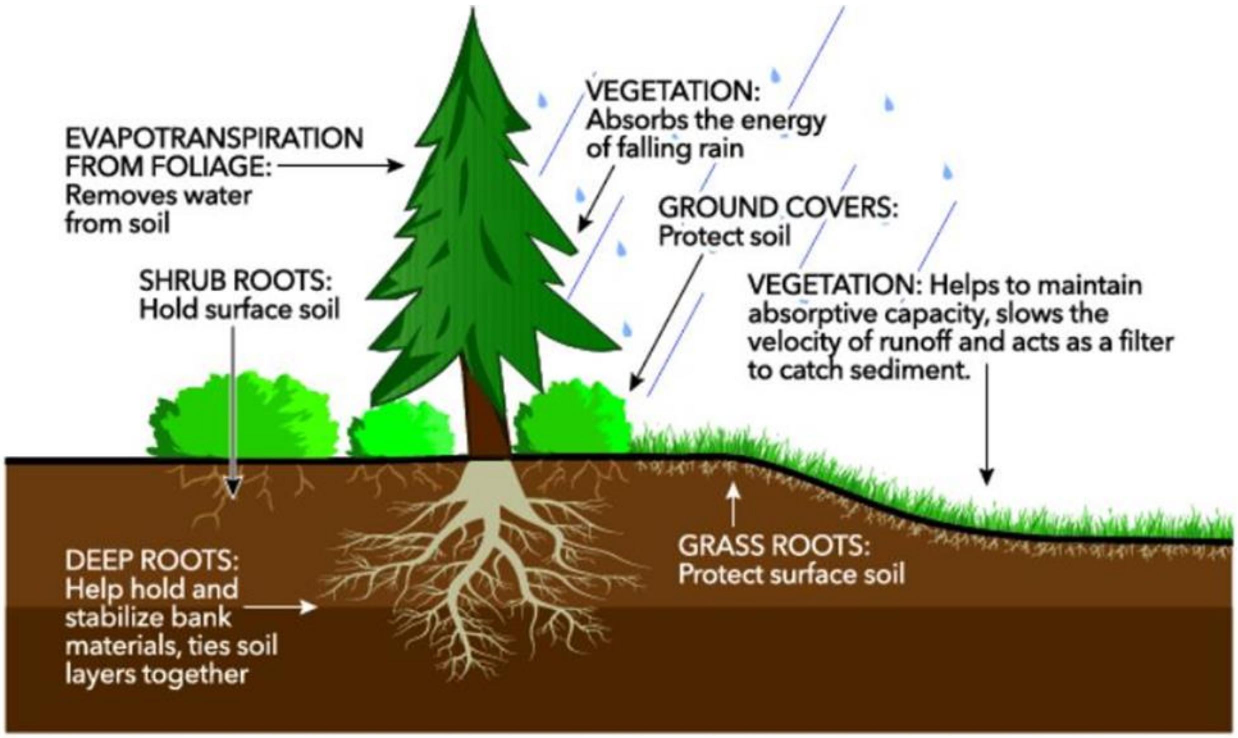

Figure 40: Role of vegetation and soil cover in preventing erosion.

5.2.4 High Conservation Values Protected (B2.4)

The project will not adversely affect biodiversity HCVs because pressure on protected areas will decrease under the project scenario by promoting the ecological functioning of buffer zones. Increased protection from poaching and attacks are expected to benefit endangered or vulnerable endemic local populations of carnivorous lions, cheetahs, and wild dogs.

5.2.5 Species Used (B2.5)

No species are planted by the project.

5.2.6 Invasive Species (B2.5)

Not applicable, no species are planted by the project.

5.2.7 Impacts of Non-Native Species (B2.6)

The project will not introduce any non-native species into the project area, as re-seeding and planting are not project activities; project activities merely adjust rangeland management via the way in which livestock are herded and moved across the landscape.

5.2.8 GMO Exclusion (B2.7)

The project will not introduce any GMOs into the project area, as re-seeding and planting are not project activities; project activities merely adjust rangeland management via the way in which livestock are herded and moved across the landscape.

5.2.9 Inputs Justification (B2.8)

Project activities exclude the use of fertilizers to increase productivity and potential carbon sequestration. Project activities are not applicable to land other than grassland, so no increased use of pesticides or herbicides is anticipated. A small portion of the project area is affected by the invasive species *Lantana camara*, *Psidium guajava*, and *Agave sisalana*, which outcompete and inhibit the establishment of indigenous species. Selective removal of this species is exclusively mechanical, as removal is done by humans using hand tools. There are likely few biological control options for potentially invasive shrub or tree species. If pesticides, herbicides, or biological control are an option, community members largely lack the financial resources to apply them at a scale that would impact diversity.

5.2.10 Waste Products (B2.9)

Project activities do not involve generation of power, conversion of energy sources, or processing of materials and so will not increase or produce waste products.

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

No negative offsite biodiversity impacts are foreseen due to the nature of project activities.

5.3.2 Net Offsite Biodiversity Benefits (B3.3)

Offsite biodiversity impacts can be predicted for the two adjacent national parks, as the project areas may increase landscape connectivity and serve as “stepping-stones” for migration between them. Moreover, as stated in previous sections, the project area is located on rangelands that serve as a buffer zone for the protected areas. This means that many of the project’s biodiversity benefits will also occur outside of the direct project sites. This includes the improvement of water infiltration in the overall catchment area as well as erosion control from improved soil cover.

5.4 Biodiversity Impact Monitoring

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

Data Collection and Monitoring Design

To monitor the biodiversity effect of interventions in the project area, the project focuses on two major aspects:

(1) Improvement of natural rangeland conditions, including the cover and diversity of vegetation and the presence of invasive grass species as compared to the condition at project start.
(2) Reduced threats to threatened predator species (African wild dogs) outside of protected areas as compared to the baseline scenario.

The former is monitored through annual vegetation assessments, which evaluate species richness and Shannon-Wiener Diversity Index in response to the planned forage and grazing changes. The results of annual assessments are compared against the baseline conditions. Data is collected at 75 sites across the project area (Figure 41) by Sustineri (Pty) Ltd. Assessments are carried out according to the Multiple Indicator Monitoring (MIM) method (Peel et al. 2005), which has been used to monitor rangelands across numerous vegetation types (mainly those associated with savanna and grassland biomes) throughout the Lowveld and surrounding regions of South Africa for the past 28 years (Sutherland and Peel 2011).

Monitoring Sites: Kruger to Canyons

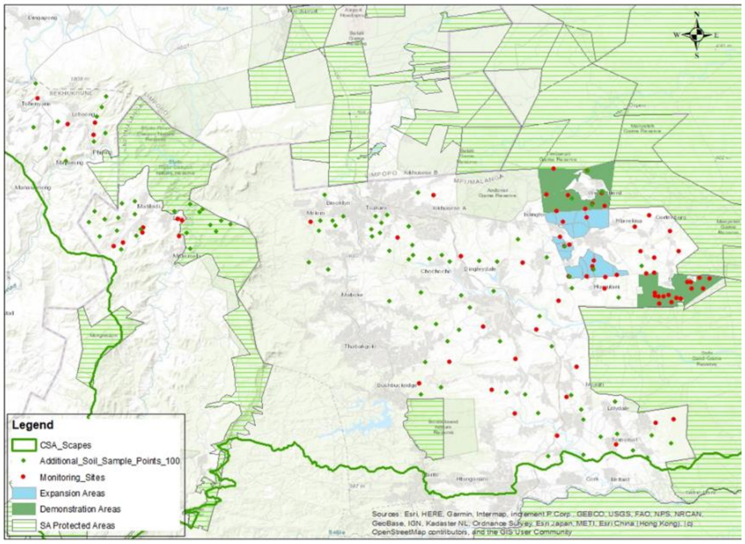

Figure 41: Soil and Biodiversity Monitoring sites within the K2C Biosphere

The occurrence of predators in the project area is monitored using information from near-real-time tracking collars which monitor the movement of wild dogs from the protected areas into communal rangeland. This is facilitated in partnership with the Endangered Wildlife Trust[37] via data sharing agreements using the Earth Ranger platform. Human-wildlife conflicts outside protected areas are recorded via incidence reports from Eco-rangers.

Monitoring Indicators for Biodiversity
The key biodiversity indicators to be monitored are:

Aspect recorded	Procedure
Vegetation biodiversity	
Shannon-Weiner Diversity Index	Evaluated for woody and herbaceous vegetation. The Shannon-Weiner index considers both the richness (number of different species) and the evenness (relative abundance or proportion of each species) within a community. It provides a single numerical value that reflects the diversity of species present.
Percentage IAP cleared to maintenance level	Area of IAP at 5% infestation (ha)/total area infested (ha)
Threats to Wildlife	
Number of predation incidences	Number of human wildlife conflicts reported annually. All incidences to be recorded depending on type e.g., injuries, kills, retaliatory kills. The baseline to be established through Year 1.
Number of human retaliatory killings incidences	

[37] As part of their carnivore conservation program, EWT monitors wild dog populations along the whole of the Western Boundary of the Kruger National Park. Near-real-time monitoring alerts will be shared with CSA via the "Earth rangers" platform whenever a pack of wild dogs move out of the protected areas into Communal rangeland.

Livestock loss to predators with Eco-rangers (% of control treatment)	
Climate adaptation	
Gully profile	(Length (m)/Height (m))
Water security	(table height / mm rainfall (m mm^{-1})
Veld condition score[38]	To be estimated annually as a benchmark for the condition of the vegetation in relation to some functional characteristics, generally sustained forage production and resistance to soil erosion. VCS is calculated using the Ecological Index Method (Vorster 1982).
Above ground grass standing crop	Determined via the Disc Pasture Meter (DPM) method used within plots quarterly (50 drops per plot). Reported annually as average grass Biomass Cover (kg. ha-1)

5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3)

Project description documentation and monitoring reports will be shared as hard copies with the traditional authorities, in the communities and in schools/youth centers where CSA provides internet access. A translated summary is planned to be provided with this documentation. In addition, Eco-rangers and/or CSA staff will continue to present and discuss summaries of the documents in the livestock committees. These presentations take the form of focused feedback sessions on specific issues of particular interest to stakeholder groups. The project monitoring report will also be published on the Verra website and made available to the wider public for a public commenting period. CI will share this link as well with other project stakeholders for their information and input.

5.5 Optional Criterion: Exceptional Biodiversity Benefits

The project qualifies for Gold Level certification, as it would provide globally exceptional biodiversity benefits due to the occurrence of threatened species (African wild dog) in the project zone.

5.5.1 High Biodiversity Conservation Priority Status (GL3.1)

The Greater Kruger National Park, adjacent to the project area, contains at least 350 individuals of the African wild dog (*Lycaon pictus*), an endangered species that qualifies as trigger species. This species is threatened because of ongoing habitat fragmentation, conflict with human activities, and infectious disease.

[38] See guidelines here

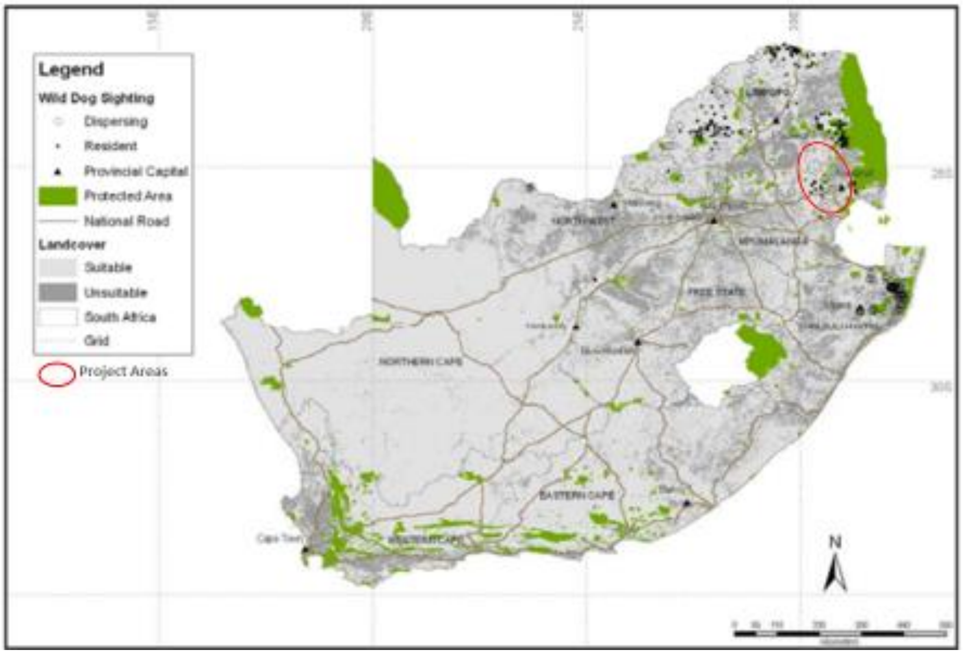

Figure 42: Distribution of African wild dogs outside of protected areas in South Africa (Lindsey & Davies-Mostert 2009)

5.5.2 Trigger Species Population Trends (GL3.2, GL3.3)

In the without project scenario, the population of African wild dogs would be likely to decline in both protected and community-managed areas based on the South Africa-wide survey of wild dogs referenced by Lindsey & Davies-Mostert (2009). The primary threat to wild dogs in South Africa is persecution by landowners. Between 1996 and 2009, at least 81 wild dogs are known to have been killed by landowners in South Africa, comprising as much as 84% of local populations occurring outside of protected areas (Lindsey & Davies-Mostert 2009). Persecution by farmers is probably largely responsible for the failure of wild dogs to expand to fill vacant potentially suitable habitat on game ranches. Within the same period, the number of wild dogs has varied from 42 to 104 individuals in 7 to 21 packs and dispersing groups (Lindsey & Davies-Mostert 2009). The authors reported ~104 individuals in nine resident packs and eight dispersing groups occurring outside of protected areas, comprising ~28.2% of the national population. Wild dogs outside of protected areas occur primarily on game ranches in areas of low human population density and intact natural habitat close to source populations in areas with ≥203 mm of rainfall/year. Primary foci of activity of wild dogs outside of protected areas include: the Central Lowveld (Hoedspruit area); Limpopo Valley; and the Waterberg. The area of occupancy of wild dogs outside of protected areas is ~14,910 km^2, comprising 37.3% of the geographic range of the species in South Africa.

Trigger Species	African wild dog (*Lycaon pictus*)
Population Trend at Start of Project	Occasional sightings of scattered packs and/or dispersing groups, conflict with livestock herders significantly reducing population
Without-project Scenario	Continued population decline due to habitat degradation and clashes with herders without the presence of Eco-rangers
With-project Scenario	Awareness about wildlife conservation, the value of wildlife and measures to avoid human-wildlife conflict will be built among local communities.

	The occurrence and movement of species outside protected areas and around the project zone will be closely monitored and degraded rangeland habitat will be restored through which species can migrate. This is expected to reduce the major threats to the species within the project zone.

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APPENDICES

Appendix 1: Project Activities and Theory of Change Table

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (short term)	Outcomes (medium term)	Impacts (long term)	
Rotational grazing with Herding / Kraaling	• Reestablishment of perennial grass cover on grazing camps • Reduction of bare soil on grazing camps • Protection of livestock from predators	• Improved water infiltration in soil • Increased biodiversity & activity of soil fauna • More availability of grazing resources for livestock and less fodder costs • Reduced predation incidents	• Increased sequestration of SOC • Buffer against drought & soil erosion • Sustainable & profitable livelihoods • Reduced human-wildlife conflict.	• Climate change mitigation • Climate change adaptation • Community wellbeing & livelihoods • Biodiversity conservation
Provision of benefits package (Livestock market access, herd health & fodder supplementation)	• Compliance with CAs • Healthier livestock herds • Improved livestock sales in foot-and-mouth red zone (quantity, higher sales price)	• Lower cost of livestock production • Increased income from livestock sales • Improved rangeland conditions	• Sustainable & profitable livelihoods • Improved food security via better quality livestock for local consumption	• Community wellbeing & Livelihoods • Climate change mitigation
Rangeland restoration activities: Bush thinning, brush packing, gully covering with brushes and alien species clearing	• Less area infested by invasive species. • Reduction in size of erosion gullies	• Reduced competition for indigenous vegetation. • Reduced erosion • Habitats of indigenous small fauna are conserved.	• Sustained biodiversity of flora & fauna • Restoration and rehabilitation of degraded lands.	• Biodiversity conservation • Climate change adaptation
Awareness raising on wildlife and natural resource conservation	• Increased awareness on biology and ecology of especially predators • Increased environmental awareness	• Informed decision making on rangeland and livestock management.	• Stable populations of endangered species (flora & fauna)	• Biodiversity conservation

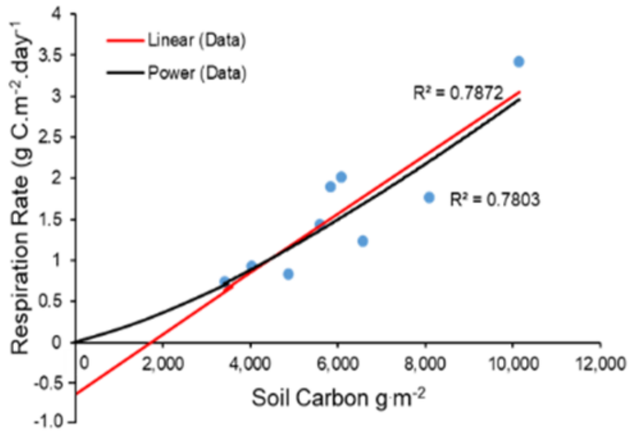
		• Reduced wildlife conflicts. • Sustainable wood / plant harvesting		
Weekly Boy/Girls Scout meetings	• Increased awareness on restoration, veld sanitation, WASH	• Improved conservation, veld sanitation and health habits in children / households	• Better livestock and human health • Improved integration of livelihoods and natural environment	• Biodiversity conservation • Community wellbeing & Livelihoods
Establishment of ICT & youth centers	• ICT training & Skills development	• Improved job perspectives and modern employability • Access to information	• Increased income & livelihoods	• Community wellbeing & Livelihoods • Climate change adaptation
Yes4Youth programme	• Local employment & capacity building	• Work experience, skill development & future employment prospects • Income generation	• Poverty reduction	• Community wellbeing & Livelihoods
Promotion of various gender development and income generating activities for women (e.g. business development / Financial Literacy trainings with local partner-banks)	• Involvement of women, youth, and disadvantaged community groups in community decision making • Increased business development and administration skills of women • Increase in green businesses • Better money management skills of community members	• Improved financial habits • Green / climate friendly businesses • Granting more voice to women, youth, and disadvantaged community groups	• Financial empowerment of women • Sustainable livelihoods	• Community wellbeing & Livelihoods • Climate change adaptation

Appendix 2: SNAPGRAZE model version

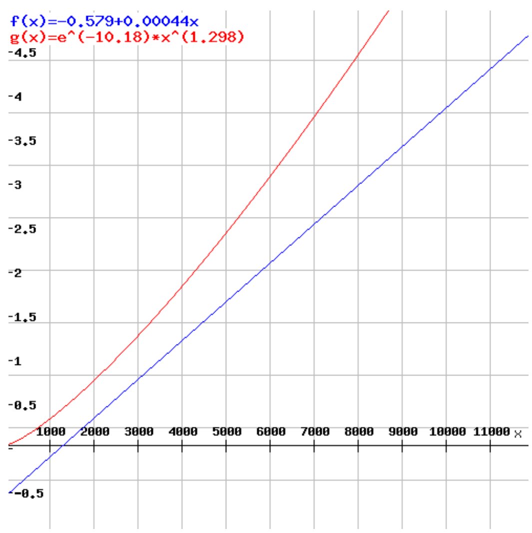
The SNAPGRAZE model as defined by (Ritchie 2020) was used with the following modifications. Figure 5 in the paper depicts equations (20) and (22) from the paper:

$$DMRESP = -0.579 + 0.00044 * SOC_y \quad (20)$$

$$DMRESP = e^{(-10.18)} * SOC_t^{1.298} \quad (22)$$



However when we replot these functions they do not intersect and neither of them follows the graph of the figure:



We renamed (20) so that we make sure we see that it applies to SOC values > 4600 gC/m². When plotted we see it does not follow the linear graph depicted in figure 5. Therefore, we adjusted the constant (gradient) in front of SOC_Y:

$$DMRESP_H = -0.579 + 0.00044 * SOC_Y \quad (20)$$

Modification: $DMRESP_H = -0.579 + 0.00036 * SOC_Y$ *(20')*

We renamed equations (21) and (22) to make sure we see that they apply for SOC values <4600gC/m² and when we compare them we see that the decimal digits change:

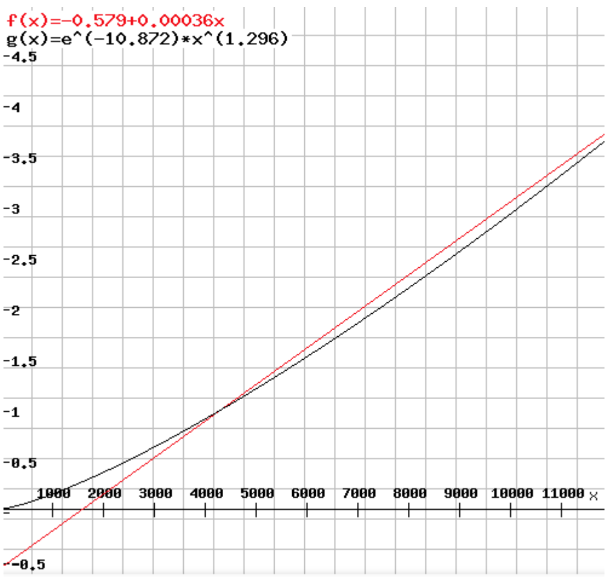
$$LN(DMRESP_L) = -10.872 + 1.296 * LN(SOC_Y) \quad (21)$$

$$DMRESP_L = e^{-10.18} * SOC_Y^{1.298} \quad (22)$$

The paper does not explain the change of these values and therefore we suspect that this happened by mistake. So, we changed the values in (22) to the original values from (21).

Modification: $DMRESP_L = e^{-10.872} * SOC_Y^{1.296}$ (22')

This is what plotting (20') and (22') looks like:



DMRESP$_H$ and DMRESP$_L$ are required to calculate the SOCeq, as described in (23). It is valid:

$$MRESP = WETDAYS * \left(0.7 + 0.3 * \left(\frac{SAND}{100}\right)\right) * DMRESP$$

With MRESP the ΔSOC can be calculated as depicted in (24):

$$\Delta SOC = PDSOC + DDSOC - MRESP$$

By setting ΔSOC = 0, the above equation can be solved for the SOC$_Y$ term in MRESP. We insert (20') and rearrange (24) for SOC$_Y$:

$$WETDAYS * \left(0.7 + 0.3 * \left(\frac{SAND}{100}\right)\right) * (-0.579 + 0.00036 * SOCeq_H) = PDSOC + DDSOC$$

$$SOCeq_H = \frac{PDSOC + DDSOC}{WETDAYS * \left(0.7 + 0.3 * \left(\frac{SAND}{100}\right)\right) * 0.00036} + 0.579$$

Doing the same for (22') results in:

$$WETDAYS * \left(0.7 + 0.3 * \left(\frac{SAND}{100}\right)\right) * e^{-10.872} * SOCeq_L^{1.296} = PDSOC + DDSOC$$

$$SOCeq_L^{1.296} = \frac{PDSOC + DDSOC}{WETDAYS * \left(0.7 + 0.3 * \left(\frac{SAND}{100}\right)\right) * e^{-10.872}}$$

$$SOCeq_L = \left(\frac{PDSOC + DDSOC}{WETDAYS * \left(0.7 + 0.3 * \left(\frac{SAND}{100}\right)\right) * e^{-10.872}}\right)^{\frac{1}{1.296}}$$

The modelled value of SOC, using the linear equation determines which of the two equations is applied (if(SOCeqH<4600; SOCeqL; SOCeqH))