THE GREEN HOUSE

Tswalu Kalahari Reserve

Baseline audit of a project to generate carbon credits through avoided greenhouse gas emissions due to rewilding of farmland and installation of solar PV panels

Author: Brett Cohen and Matthew Burke

The Green House
Ubunye House
70 Rosmead Avenue
Kenilworth
7708
t: + 27 (0) 21 671 2161
f: + 27 (0) 86 638 3692
e: brett@tgh.co.za

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Table of Contents

1 Introduction

Tswalu Kalahari Reserve (TKR), located in Kalahari region of the Northern Cape, is the largest private game reserve in South Africa. The reserve occupies an area of 113,623 hectares of rewilded cattle farms, with the latest expansion of 18,532 hectares based on cattle farms purchased between 2015 and 2019. Since its official proclamation in 2014, the reserve has worked to restore the degraded farmland, re-establish and preserve biodiversity and improve the Kalahari environment's ecosystem. The reserve employs about 189 people in the Northern Cape province, an area with high levels of unemployment.

Between the time of reserve proclamation in 2014 and 2018, stocking rates, measured as Large Stock Units (LSUs) of cattle or wildlife per hectare grazing area have been above those recommended for the region[1]. High stocking rates increase grazing pressure, with overgrazing linked to irreversible shifts from palatable perennial grass growth to unpalatable woody shrubs dominated by annual species in the Kalahari ecosystem (Skarpe 1990; Rutherford and Powrie 2010). The negative effects of high stocking rates have been observed in the TKR itself, with vegetation productivity, established through remote sensed Enhanced Vegetation Index (EVI), negatively correlated with heavily stocked areas and reports noting a decline in vegetation productivity and habitat condition between 2005 and 2019 (van Rooyen and van Rooyen 2017; Tokura *et al.* 2018). These impacts are seen throughout the Northern Cape, with average stocking rates currently sitting at 0.07 large stocking units per hectare (LSU/ha), more than twice the 0.03 LSU/ha recommended to improve habitat conditions (van Rooyen and van Rooyen 2017; DAFF 2018).

In 2019 stocking rates on the entire property were reduced dramatically due to the drought in the area, through selling off of animals. The opportunity now exists to allow stocking levels to increase but maintain them at lower levels than found between 2014 and 2018, achieving stocking rates of 0.033 LSU/ha within the general reserve areas and 0.03 LSU/ha in the breeding camps[2]. These lowered stocking rates will contribute to reducing grazing pressures on the semi-arid grassland and savannah ecosystems, assisting with ecosystem restoration, improving the soil's microbial activity and, consequently, the sequestration of soil carbon (recognising too, however, that grasslands lose carbon and soil carbon during droughts). Reduced stocking rates will also lower enteric fermentation emissions due to reduced animal numbers.

In addition to the rewilding efforts, TKR installed 119 kW of solar PV panels in a bid to offset grid electricity consumption within the reserve during 2019. This renewable electricity offsets South Africa's coal-intensive grid electricity.

An application has been made for the avoided GHG emissions from both the rewilding process (defined as removing cattle off the land purchased since 2015 and replacing with wildlife at lower stocking rates, and reducing stocking rates of wildlife on the remainder of the land) and the installation of solar PV panels to be registered under the Credible Carbon voluntary-market carbon registry, which trades carbon offsets from Sub-Saharan African projects that also make a direct impact on poverty.

This report documents a baseline audit process, conducted by The Green House, an independent climate change consultancy, contacted by Credible Carbon to confirm the information provided in the Project Identification Note

[1] The exception here is on the farms in the Whynebah area of the property, which were emptied of game when purchased and left fallow until 2019. This is discussed further below.

[2] Note that the PIN only presents data to 2018 and so the reduced stocking rates are not recorded there. This then does not materially affect the baseline assessment.

(PIN) and the eligibility of the project in terms of the Credible Carbon registration requirements. These requirements include answering the following questions:

- Is the project real?
- Does the PIN provide a clear understanding of the project and the mechanisms via which emissions savings can be achieved?
- Are the estimates of projected greenhouse gas emission reductions reasonable in terms of accepted international standards and unbiased towards buyer or seller? Here the question of whether the project is considered "additional" will be explored.
- Is there likely to be a discernible impact on poverty?
- What procedures and baseline data is required for monitoring and verification of emissions savings in future?

The audit report firstly provides some comments on the PIN in Section 2. Section 3 presents observations from the site visit conducted for the purposes of conducting the audit. Section 4 presents a set of conclusions and recommendations for the project's registration with Credible Carbon and future verification of actual emissions savings should it be included in the registry.

2 Comments on the PIN

The PIN clearly presents the proposed project and the mechanisms via which it intends to achieve emissions reductions. As an overriding comment, the PIN is at times slightly confusing between cattle/livestock and wildlife. Some examples here include "Intervention 2 accounts for the impact of reducing of enteric emissions resulting from Management's change in stocking rates to reduce grazing pressure (shown in Table 3). This net reduction of enteric emissions occurs as **livestock** numbers are reduced and/or replaced with wildlife with lower enteric emissions rates", "Historical overgrazing of **livestock** in the four land parcels in the project boundary has resulted in a land area weighted average stocking rate of 0.05 LSUs / ha (19 ha/ LSU) over 2005-2018". Table 6 (and the immediately preceding text) is can be read that all land areas had "**cattle**" during the baseline period, for example the second line talks about a "Cattle stocking density (LSU/ha)" and "Estimated number of cattle". Figure 3 shows only cattle in the illustration of the baseline scenario.

It would be useful if it could be made clearer that it is only the Wynebah area that had cattle during part of the baseline period, and for the rest of the area was populated with wildlife during the baseline period. This does not affect the calculations, which do take this distinction into account, the recommendation is made to make it clearer for the reader.

Some further observations on selected Sections of the PIN are as follows.

2.1 Sequestered soil carbon

Soil carbon sequestration ("Intervention 1") is estimated using Verra's *Methodology for Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing (VM0032, version 1.0)*. This methodology allows for the use of peer-reviewed soil carbon models that have been validated with independent data.

Two separate soil carbon models were investigated for this project, namely the Venter et al. model (2021) , which relies on geospatial mapping of vegetation types which are correlated with soil carbon, and Ritchie's

SNAP/SNAPGRAZE model (2014, 2020), which relies on stocking density and a number of assumptions about location, plant growth and rotation of livestock. The Venter et al. model estimated the potential for soil carbon sequestration to be 14% higher than the SNAPGRAZE model. To be conservative, the SNAPGRAZE model was used for all estimations. The latter model allowed for the estimation of soil organic carbon (tonnes carbon per hectare) at the project start and end (i.e. 21-year period from 2019 to 2039). The annual carbon sequestration rate (measured in tonnes carbon dioxide equivalents per year) was calculated by multiplying the difference between the 2039 and 2018 values by 3.67 (i.e. conversion factor from carbon to carbon dioxide) (IPCC 2003; Echnoserve Consulting 2014).

Findings: The approach to calculating projected emissions reductions through use of methodologies published in the peer-reviewed literature is considered to be in line with Verra methodology. Furthermore, the exploration of two alternative models, and the use of the more conservative option for the baseline and projected emissions calculations is considered appropriate, particularly given the uncertainty in soil carbon measurement and projection.

It is noted that the SNAPGRAZE model ultimately chosen for the baseline calculation and emissions reductions projections, was developed for cattle grazing, however similar relationships between grazing and soil carbon could be expected for other large animals, and the project proponents have indicated that they have discussed this application of the model with the model's developer. In the absence of other modelling approaches this is deemed fit for purpose, although it is recommended that soil carbon increases through rewilding are confirmed through soil sampling, as discussed further in Sections 2.5 and 3.5. This particularly as it is noted that the area covered by the TKR is highly heterogenous, with very localised rainfall patterns across the reserve. The models on the other hand treat the reserve as a homogenous land area.

Is it noted that the PIN is slightly confusing in the way it presents how it uses the two models. It states in Section 3.1 that "Rewild Capital uses the soil carbon map developed by Venter et al. (2021) to estimate the volume of carbon dioxide (tCO_2e) that can be sequestered by the project. SNAPGRAZE is only introduced in Section 3.3 (and alluded to at the end of Section 3.2 – "We then corroborate this remotely sensed model with process-based models.") It would be clearer if the approach of trialling two models, and then choosing the most conservative for the estimates, is presented right upfront when describing the models.

Note an error in the units for SOC_{stock} in the equation near the beginning of Section 3.1, this should be kg C m^{-2}.

2.2 Avoided enteric fermentation emissions

For "Intervention 2", reduction of enteric fermentation emissions, the baseline was calculated using historical stocking numbers. In the case of Whyenbah, the region newly added to TKR, this is based on Northern Cape average values of 0.07 commercial beef livestock per hectare. For the historical TKR regions, this is based on game count data[3]. Projected enteric fermentation emissions were calculated based on target stocking numbers (0.033 LSU/ha and 0.03 LSU/ha for the breeding camps) and current animal split within the TKR (i.e. the current animal split scaled-down to account for lowered stocking density).

[3] Game count data is converted to large stock units (LSU) based on South African specific data (Meissner 1982; Bothma and van Rooyen, N.du Toit 2010)

Enteric fermentation emissions per animal are then calculated based on South African specific data, as utilised in South Africa's National GHG Inventory, (du Toit, Meissner, and van Niekerk 2013a, 2013b) and converted to carbon dioxide equivalents using Fifth Assessment Report (AR5) global warming potentials.

It is noted that the newly added Whyenbah region had extremely low stocking densities at the end of the baseline period, since the livestock were removed as soon as land parcels were purchased, and the land kept fallow until February 2019. It will take time for stock numbers to build-up to the targeted 0.033 LSU/ha. The PIN highlights that the calculations will therefore overestimate project enteric fermentation emissions until such time as the region reaches this target stocking rate.

Projected avoided enteric fermentation emissions were calculated by subtracting project emissions from baseline emissions.

Findings: The approach to calculating enteric fermentation emissions is deemed appropriate, and uses published literature on emissions from different species.

The baseline emissions for Whynebah assumes a constant stocking rate of 0.07 LSU/ha over the baseline period, in line with stocking practices prior to the land being purchased. During the audit it was identified that the farm areas which make up this land were destocked as they were purchased between 2015 and 2018 – i.e. all cattle were moved off the land and the land was allowed to lie fallow until February 2019 when it was opened up. The baseline enteric fermentation emissions will thus be overestimated. However, if it is assumed that intensive cattle farming is the alternative to the rewilding of this land, the assumption could be appropriate. Further comments are offered on this issue in the discussion on additionality below.

Furthermore, the PIN does not account for the lower stocking rates from 2019 to 2022 than were seen in the baseline period on the remainder of the property. Lower stocking rates were introduced due to drought conditions previously. It will also take time to build up stocks on this land, suggesting overestimation of enteric fermentation emissions in the project case in the PIN. Future verifications of emissions savings, which will use actual stocking data, will account for this variability in animal populations.

2.3 Avoided electricity emissions

Avoided electricity emissions were calculated using solar PV electricity generation data and the assumption that all on-site electricity generation will offset the South African grid electricity. The grid electricity emission factor used in the PIN is based on Eskom reported data.

Finding: The grid emission factor used in the calculations of emissions savings from grid electricity generation is based on Eskom data only and thus does not take into account generation by renewable Independent Power Producers (IPPs) which contribute to the grid. This will result in an overestimate of emissions savings from solar PV. Although there is no official grid emission published by government, it is important that a published alternative be utilised which captures the generation from all sources. This value is likely to be 5% to 10% lower than that based on Eskom only, providing a 5 to 10% lower emissions savings estimate.

Furthermore, the projected emissions savings do not take into account reductions in Grid Emission Factor over time as South Africa transitions its grid to inclusion of more renewables, as per the Integrated Resource Plan. This should have been taken into account in the PIN for estimating the future emissions savings (and ultimately revenue generation potential). During the monitoring and verification stage actual grid emissions factors will need to be used to determine the actual emissions savings from not using grid electricity.

2.4 Poverty alleviation benefits

The PIN highlights a selection of high-level opportunities for socio-economic development, including job creation from eco-tourism and the potential for revenue generation to support social welfare projects.

Findings: This aspect of the PIN is relatively high-level at this point, and actual value realised directly from the project would need to be monitored as part of the project monitoring and verification (M&V). Further comments on M&V are presented in Section 3.4.

The PIN claims that, "Carbon revenue will be used to help expand these welfare and poverty alleviation expenditures up by an average of 10% per year, generating an additional R42 million in community investment over 2022-30." Over this time period, the PIN indicates a projected emissions savings of 217,851 tonnes of CO_2e. At a nominal selling price of R300 per tonne (being approximately that represented by Treasury's projection that the tax will rise to $20 per tonne by 2026), these credits will be worth around R65 million over this period. If the carbon revenue will go towards socio-economic development. this suggests that almost 65% of the revenues from the sale of credits would go to socio-economic development.

2.5 Monitoring and verification

Section 7 of the report states "Our Rewild Capital geospatial platform will provide standardised monitoring and SOC stock trend analysis on an annual basis. We enable a standard measurement of SOC through remote sensing workflows and customized SOC models. We will monitor the impact and effectiveness of implementing the project interventions." It further states that "There is an existing network of 111 vegetation sampling plots, which are distributed across TKR to enable stratified random sampling of vegetation. Soil carbon samples should be taken from these stations to validate the model predictions and create additional information with which to manage TKR. These empirical data will feed into the SOC model we use to set baselines so that the machine learning workflow can make even more accurate predictions for the region over time."

Finding: The PIN is slightly unclear on the relationship between SNAPGRAZE which was used in the project design, and the use of the Rewild geospatial platform in M&V. This was resolved during the audit as described below. Having said that, substantially more detail would be required in the PIN on M&V plans for the project.

3 Outcomes and observations from the Audit

The Green House conducted a site visit on 28 and 29 May 2022 to meet with the relevant members of the TKR team (Gus van Dyk, Prince Ngomane and Dylan Smith) and to physically inspect the site. Additional information was gathered through telephonic interviews and email exchanges with the Rewild Capital team and Julie Cheetham. The audit allowed for confirmation the project's existence and gathering of further information to complement that provided in the PIN. Findings are presented in this section.

3.1 Utilisation of the carbon credits

It was established that Rewild Capital, the project proponents, would not own any of the credits generated, but rather charge a commission for the design and facilitation of the project. Credible Carbon would act as a registry, facilitating the assurance process and the purchase and selling of the credits in a manner that avoided the risk of "double counting" or contested ownership. It was noted that although the credits would be processed through the Credible Carbon registry to ensure integrity, they would not be offered for sale on the open market, but rather would be retired internally by the company for use for offsetting emissions a proportion of Fireblade Aviation's activities that is associated with flying guests to Tswalu.

3.2 Additionality

One of the critical requirements of a project that is developed for the purposes of selling carbon credits is that the activities are not required by legislation, and are deemed "additional" – that is, would not be considered common practice, and would have been impossible or significantly more difficult in the absence of a carbon revenue stream. The audit ascertained that there is no simple answer to the question of whether this condition holds, as a complex set of questions determine stocking rates and management practices in the reserve. The following observations were made during the audit (which also complements information provided in the PIN):

- It was confirmed that reduced stocking rates are not mandated by legislation and that the targeted stocking level of 0.03 LSU/ha is below the guideline rate of 0.07 LSU/ha.
- Cattle farming is the primary activity in the Northern Cape, although there are some farms that are being converted into wildlife farms. Thus, while cattle farming may become less viable in the surrounding areas over time, as projected climate change impacts are realised, converting cattle farms to wildlife reserve is not common practice.
- The land area required for game drives for a viable, upmarket tourist lodge is to the order of 5,000 ha. The TKR is currently to the order of 110,230 ha, meaning that tourists typically see only a fraction of the property. The primary function of the property is thus conservation rather than tourism, and alternative finance streams are thus required to fund further property expansion and management.
- The additional land which makes up the Whynebah area, which was previously used for livestock farming, was purchased and destocked long before the project was conceived, and any promise of carbon revenues had been discussed.
- Maintaining stocking numbers on the property at a particular level is achieved in two ways, namely the sale of animals and/or the introduction of predator species. Furthermore, population numbers of predators and other wildlife are cyclical: as predator numbers increase, they reduce populations of prey, and vice versa. Although lion have been present on a fenced-off section of the property, maintaining healthy ecosystems in that area, the remainder has largely been predator-free apart from cheetah which have grown in population size, which has affected populations of other species like springboks. The absence of apex predators impacts on herd/grazing patterns of other animals. Recently nine hyena were introduced in this area, which will contribute to keeping stock numbers down, potentially reducing the potential revenue from bulk sale of animals (although this was suggested by one interviewee to be a relatively small income stream).
- Stock numbers are actively reduced under drought conditions to ensure longer term ecosystem protection, through sale of animals. As indicated above, the stocking levels at the time of the audit were

already lower than the target set in the PIN, driven by drought rather than any carbon related considerations. Stock levels will now be allowed to increase. In this way the current stocking levels are principally determined by drought management strategies and not by carbon considerations. This practice predates the project but has continued, unaltered, since the project commenced.

Thus, while it is very clear that the land is consciously managed with a very strong conservation focus, which requires income streams that do not come from tourism or animal sales alone, the latter three observations indicate that there is not a clear case to be made that generation of carbon credits for sale would be the primary income stream for reducing stocking levels, nor that they were the primary driver for purchasing the further Whynebah land parcels. **As such, there is insufficient information available to demonstrate that Interventions 1 and 2 fulfil the requirement of additionality required for the generation of credits.**

The existing solar PV farm has been constructed in the absence of carbon revenue. Adoption of PV across the country is already widespread, with lifetime electricity costs becoming compatible with grid power costs, and installations providing benefits of managing load shedding. Having said that, the Credible Carbon registry supports the uptake of PV, through the issuance of carbon offsets, in any country where renewable energy represents less than 50% of the electricity mix. **As such, Intervention 3 is considered to meet the requirement of additionality, based on the Credible Carbon priorities**.

3.3 Fires/leakage

The PIN suggests the following with respect to fires: "Fires have been negligible in TKR. Additionally, TKR employs a zero burning management strategy and so there are no baseline emissions from burning biomass or any potential sequestration from reducing fire frequency. Naturally ignited fires are controlled and extinguished, so it can be assumed that there will be negligible SOC losses due to fire. For the extension area, there have been no recorded fires for the baseline assessment period as per the MODIS Burned Area Product, and thus there is no additionality from reducing fire frequency."

Discussions held during the audit suggested that the claim that "Naturally ignited fires are controlled and extinguished, so it can be assumed that there will be negligible SOC losses due to fire" only applies outside of the mountainous areas.

When natural fires occur in the mountains, they are, however, left to burn themselves out. The mountain areas constitute approximately 10,000 ha, or 9% of the land area. It is estimated that the mountain burns once every 10 years.

3.4 Poverty alleviation

As indicated in Section 2.5, the poverty alleviation benefits are described at a relatively high level in the PIN, and the potential value of return to community is considered to be high relative to potential overall revenue generation . However, the audit process did identify that the TKR is a significant employer in an area with few employment opportunities; provides clinic services not only for employees and their families but also surrounding communities; supports local schools; and contributes to upliftment the local community in Van Zyls Rus. A conversation was held during the audit of potentially using a proportion of the revenue from sale of carbon credits if the project goes ahead for extending the local school to provide education until Grade 12, and building a safe space for abused women and children. Finding such a discrete opportunity for supporting a community via a proportion of the carbon revenue is encouraged.

3.5 Monitoring and verification plan

As indicated in Section 2.5, the PIN provides only a high level indication on how monitoring and verification (M&V) is to be undertaken and mentions satellite imaging, soil samples and animal counts. The SNAPGRAZE model which was used in the PIN for baseline and projection soil carbon and enteric fermentation emissions, relies only on counts of individual species (along with a number of assumptions on input parameters). It was confirmed during the audit that stocking data is collected on an annual basis through manual counts using helicopters, so it would be available for future uses.

Further discussions with the Rewild Capital team suggested, however, that the intention was to use their own geospatial monitoring data and approach for M&V. It is suggested that there could be value in ongoing triangulation with calculations using the SNAPGRAZE model, given that the data for use of this model will be available.

The PIN also mentions soil sampling potentially being used for confirmation of model results. Given the heterogeneity of the TKR mentioned previously and uncertainty with modelling soil carbon, the idea of using soil samples to support modelled findings that soil carbon is increasing is supported. A selection of soil samples could be taken as soon as possible (to be reflective of the baseline) and at intervals throughout the project period. It is recognised, however, that given the size of the property it would likely be too expensive to take sufficient samples to fully characterise the entire site[4]. As such, the soil samples would provide an indication of soil carbon increases only.

With respect to the solar PV intervention, it was confirmed that electricity generation by the PV farm is recorded on an ongoing basis, and so this data will be available for M&V purposes.

4 Conclusions and Recommendations

The PIN for this project provides a sound analysis to support the case for achieving emissions savings through rewilding, being the reduction of stocking levels of existing land at TWR and through incorporating cattle farms into the existing TWR and stocking them to the same levels as the remainder of the area. These emissions reductions are achieved through increasing soil carbon and reducing enteric fermentation. Although the estimation of soil carbon changes is uncertain, the project proponents have presented two peer-reviewed approaches which align in their calculations within the limits of uncertainty. Sampling could help to confirm that calculated emissions reductions associated with increased soil organic carbon are real.

Having said this, the audit has highlighted that there is not a clear case that carbon credit revenues would be the primary driver for reducing stocking levels nor for the purchase of additional land for incorporation into the reserve, and as such, the additionality of the project could not be confirmed.

[4] To calculate the number of samples required for a full calculation of the soil carbon of the entire area, the GHG Protocol suggests using the Winrock Calculator to estimate number of samples needed.
https://ghgprotocol.org/sites/default/files/standards_supporting/GHG%20Assessment%20Guideline%20Volume%20I%20Soil.pdf The calculator can be found at https://winrock.org/document/winrock-sample-plot-calculator-spreadsheet-tool/.
The IPPC Guidelines suggests calculating the number of samples needed using an RME calculation (https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp4/Chp4_3_Projects.pdf), which is very similar to the Winrock calculator

The intervention linked to PV-based electricity generation may be considered additional given the low penetration rates of these technologies in the country despite availability and reduced costs. As such this intervention could be considered for registration of carbon credits.

Should sufficient detail be provided in future for this or similar projects to demonstrate additionality, critical to the success of the project would be the development of a detailed M&V plan, particularly for the soil carbon intervention (sufficient data is already collected to undertake the M&V of the other two interventions). It is recommended that such a M&V plan be developed as soon as possible, and for soil carbon will include a combination of modelling and a soil sampling protocol that will allow for physical observations of soil carbon increases.

5 Summary: Response to the Credible Carbon Registry questions

The Credible Carbon Registry poses a core set of assessment questions for credit-generating projects. Responses are provided as follows:

Is the project real?

Yes, the project is real and operational.

Is the described technology in place and functioning in accordance with its design specification?

The "technology" in this case is management of stocking levels on the land, and a PV farm to supply electricity. Stocking levels are confirmed to be actively managed and monitored on an ongoing basis, with multiple factors determining the stocking levels in any one year. The rationale for these stocking levels are not, however, linked to carbon sequestration. The PV farm is operational, although was operating sub-optimally at the time of the audit.

Are the estimates of greenhouse gas emissions reduction reasonable in terms of accepted international standards and unbiased towards buyer or seller?

The baseline emissions calculations are considered to be reasonable and unbiased.

As indicated in this baseline audit report, there are some changes (notably stocking rates below the target in 2019-2022 and choice of grid emission factor) which will impact the emissions savings projections from the project.

However, there is no data available at this stage to make a convincing case for additionality of the rewilding interventions included in the PIN, and as such it is very difficult to allocate a carbon saving (either soil carbon increases or enteric fermentation reductions) to modification of LSU stocking rates that has been undertaking for the sole purpose of generating these savings. The solar PV installation may be considered for generation of carbon credits given the Credible Carbon drive to support further uptake of renewable technologies.

Is there a discernible impact on poverty?

The Tswalu reserve is confirmed to be making a materially positive impact on poverty alleviation through the provision of employment, medical care and education not only to their employees but also to the surrounding community. Revenues from carbon credits have the potential to further contribute to these positive impacts.