

# **Neyarr Dam REDD+**

# **Project Feasibility Report**



Prepared by CO2balance UK Ltd.



# **Executive Summary**

This document outlines a pre-liminary feasibility study to determine the eligibility and viability of a potential REDD+ Carbon Project in Neyarr Dam, Kerala, India. Using the results of this study, we hope to initiate interest from investors and/or grant foundation for conducting further studies into the project area.

The project considers implementation in 5 communities, across 14,180 hectares, representing an estimated 75,000 households. Using remote sensing analysis, existing peer-reviewed research, and local opinion, we have identified 13,124 hectares of Forest Land within the South Western Ghats Moist Deciduous Forest Ecoregion.

The feasibility study includes the estimation of credit generation and budget across the 30-year lifetime of the project. As presented we have attempted to capture all potential associated costs that may be incurred by the project, with benefit sharing considered in the revenue sharing portion of the budget, rather than the initial budget. This study has been formulated on the assumption the project will be submitted under Plan Vivo.

A cost-benefit analysis was conducted for annual emission reduction (ER) scenarios, considering five scenarios based on the adjustments to defined parameters. A Credit generation is expected of 12,700 per year (10,000-18,300) Considering Credit Prices ranging from \$8-\$16, the total project income over 30 years is expected of \$4.57m (\$2.78m-\$8.08m). As per the release of this report, a total budget of \$982,000 has been considered, with a community revenue share of \$2.74m (\$1.65m-\$5.78m). As a result, the project has a high probability of been financially viable and for generating income to local community whilst combatting deforestation.



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### Introduction

This report is the outcome of a Pre-Feasibility assessment for the potential Neyarr Dam Community REDD+ Project. This report has been put together by CO2balance UK Ltd. with input from BGM Social Services and Independent Consultants. All recommendations presented in this report are from CO2balance UK Ltd. alone. The information presented is based on local expert opinion, peer-reviewed literature, and publicly available information. At present, no field studies have been collected for the purpose of this project. The objective of this report was primarily to determine the potential for carbon project generation and provide information for potential investors and grant proposals.

### **Project Overview**

Neyarr Dam, situated within Thiruvananthapuram District, Kerala, India is home to a population of 3,301,427, with the city of Thiruvananthapuram (Trivandrum) itself having a population of 957,730, and the metropolitan area 1,679,754 as per the 2011 census<sup>1</sup>. Trivandrum is the capital city of Kerala.

The region's economy is primarily driven by Information Technology, representing 55% of Kerala's software exports in 2015<sup>2</sup>. In the wider district, industries such as textiles, tea and coffee production, and tourism are widespread<sup>3</sup>. Kerala has experienced significant deforestation, with Forest Cover reducing 27% between 1993 to 2017<sup>4</sup>. This change has primarily been attributed to land encroachment for economic plantations, such as tea, coffee, coconut, and rubber<sup>5</sup>.

The proposed REDD+ project aims to protect the remaining forests by focusing on community engagement and deforestation mitigation activities, including, but not limited to agricultural education and value chain enhancement, tree planting and agroforestry, and livestock programmes. This approach will not only help in the capture of carbon but also lead to a reduction in greenhouse gas (GHG) emissions. The project activities will be designed and implemented in accordance with Plan Vivo to achieve community and biodiversity objectives, ensure compliance with REDD+ safeguards, prevent activity-shifting leakage, and consider project risks.

Within Thiruvananthapuram District, the project is primarily located in six village areas within the Neyyattinkara and Nedumangad Sub-Districts: Mannoorkara, Vazichal, Kalikkad, Veeranakavu, Amboori, and Ottasekharanabgalam, excluding areas within

- <sup>4</sup> Talukdar et al., *Res. Environ. Life Sci.* 11(11). 285-291. P-ISSN: 09744908
- <sup>5</sup> Kerala is fast losing its forest cover: What are we doing about it?, Available online:

<sup>&</sup>lt;sup>1</sup> About Trivandrum District, Available online: <u>https://trivandrum.nic.in/en/about-district/</u>

<sup>&</sup>lt;sup>2</sup> About Trivandrum District, Available online: <u>https://trivandrum.nic.in/en/about-district/</u>

<sup>&</sup>lt;sup>3</sup> Government of Kerala, Economic Review 2021: Volume 1, Available online: <u>https://spb.kerala.gov.in/sites/default/files/2022-03/ECNO %20ENG 21 %20Vol 1.pdf</u>

https://timesofindia.indiatimes.com/city/kochi/kerala-is-fast-losing-its-forest-cover-what-are-we-doing-aboutit/articleshow/58840751.cms



the Neyyar Wildlife Sanctuary and Peppara Wildlife Sanctuary for a total area of 14,181 hectares.



Figure 1. Project Boundary considered for their project, and the location within Southern India.



#### **Project Strata**

Using the Terrestrial Ecoregions of the World as guidance, two different ecoregions have been identified in the project area: South Western Ghats Moist Deciduous Forest and Malabar Coast Moist Forest. As the latter cover less than 5% of the project area, under the current study, only the South Western Ghats Moist Deciduous Forest was considered. This is a conservative approach due to lower relative carbon stocks.



Figure 2. Ecoregion Classification of the Project Area



#### **Overview of Standards and Methodologies**

The project aims to obtain validation as a Plan Vivo (PV Climate)<sup>6</sup> project, under the PM001 Agriculture and Forest Carbon Benefit Assessment Methodology<sup>7</sup>.

Plan Vivo has been in operation for over 25 years, and has the longest running Voluntary Carbon Standard, recently renamed as PV Climate. Now in its 5<sup>th</sup> version, Plan Vivo remains focusing on delivering climate and livelihood benefits to communities and smallholders, through participatory approaches.

In addition to Plan Vivo, we have also considered application under the Verified Carbon Standard<sup>8</sup> (and in addition, the Climate, Community and Biodiversity Standard)<sup>9</sup>. Due to the small extent and community focus of the project however, it is our recommendation that Plan Vivo is more suitable for this project.

#### **Project Activity**

The project will primarily be a REDD project (Reducing Emissions from Deforestation and Degradation). Under the Plan Vivo Standard, REDD projects are measured for both avoiding deforestation and degradation simultaneously. In addition, Afforestation, Reforestation, and Revegetation (ARR), and Agricultural Land Management (ALM) will also be considered. For the purpose of this study, we have only considered REDD project activities.

Under the REDD Project Activity, we have assessed Forest Cover Change using the ESA WorldCover 2021 Dataset. Using this data, as well as the 2020 Dataset and data from Global Forest Watch, estimated 2024 Forest Cover and long-term average deforestation rate has been calculated. A summary of the extent of Forest Cover in the Project Area is shown below.

| Year | Area (ha) | Deforestation Rate |
|------|-----------|--------------------|
| 2020 | 13,624    | -                  |
| 2021 | 13,484    | 1.03%              |
| 2022 | 13,363    | 0.90%              |
| 2023 | 13,243    | 0.90%              |
| 2024 | 13,124    | 0.90%              |

| Table 1 | Forest Cover | Change | Analysis   | nroiected | values | in hold |
|---------|--------------|--------|------------|-----------|--------|---------|
|         |              | Change | Allalysis, | projecteu | values |         |

No forest degradation was analysed at this stage due to lack of available information.

<sup>&</sup>lt;sup>6</sup> PV Climate Standard, Available online: <u>https://www.planvivo.org/pv-climate-about</u>

<sup>&</sup>lt;sup>7</sup> PM001 Methodology, Available Online: <u>https://www.planvivo.org/pm001</u>

<sup>&</sup>lt;sup>8</sup> Verified Carbon Standard Available online: <u>https://verra.org/programs/verified-carbon-standard/</u>

<sup>&</sup>lt;sup>9</sup> Climate Community & Biodiversity Standards. Version 3.1. Available online: <u>https://verra.org/wp-content/uploads/CCB-Standards-v3.1\_ENG.pdf</u>





Figure 3. ESA WorldCover 2021 identifying different land use and land cover in the project area based on Sentinel-2 imagery



# **Risk Analysis**

Under PV Climate, an automatic Risk Buffer of 20% is applied. This means that 20% of credits generated are held in a 'buffer pool' and are not eligible for sale. Credit estimates reported have excluded credits that are expected to be assigned to this 'buffer pool'. Beyond this risk buffer calculation, risks have been identified and analysed using guidance from the VCS AFOLU Non-Permanence Risk Tool, v4.2<sup>10</sup>, as a means of analysing risk across project management; financial viability; land tenure; community engagement; political risk; and natural risk. A selection of key risks have been selected in Table 3, with potential mitigation procedures addressed.

| Risk                                   | Mitigation  |
|--|---|
| Loss of Forest to Anthropogenic Causes | To address the largest risk of<br>anthropogenic deforestation driven by<br>subsistence agriculture and<br>deforestation, the project will actively<br>collaborate with community members<br>and smallholders to ensure a clear link is<br>derived from reducing deforestation, and<br>the benefit sharing associated with th<br>project. This approach aims to mitigate<br>and minimize further degradation caused<br>by these actors |
| Loss of Forest to Natural Causes       | While it is impossible to eliminate natural<br>risks entirely, the project will work with<br>experts and communities to design<br>actionable plans in order to minimise the<br>impact of natural causes on the forest.  |
| Land Disputes                          | Due to the cadastral system developed<br>in Kerala, and based on local opinion,<br>land ownership deeds are highly<br>prevalent and significant land disputes<br>are not anticipated. If encountered, these<br>matters will be dealt with on a case-by-<br>case basis.  |
| Lower than expected issuance           | The values presented in this document<br>have been calculated conservatively,<br>reducing the likelihood of final values<br>falling below the reported estimates.<br>Furthermore, pilot studies will be caried  |

#### Table 2. Risk assessment and mitigation

<sup>&</sup>lt;sup>10</sup> AFOLU Non-Permanence Risk Tool, Available online: <u>https://verra.org/wp-content/uploads/2023/10/AFOLU-Non-Permanence-Risk-Tool-v4.2-FINAL.pdf</u>



|  | out to confirm current assumptions before proceeding with full values.   |
|--|--|
| Higher than expected budget            | The budget used for the Cost-Benefit<br>Analysis is based on preliminary<br>information provided by implementing<br>partner BGM Social Services. Although<br>cost increases are possible, this is a<br>typical aspect of the project design<br>process. To mitigate this risk,<br>conservative calculations have been<br>implemented, minimising the impact of<br>potential budget deviations. Additional<br>budget costs related to project<br>certification have been assessed by<br>CO2balance. |
| Future Deforestation Rate Changes      | Under the chosen methodology, the<br>baseline period is applicable for 5-years,<br>meaning that many parameters are set<br>only for this period. As a result, if the<br>deforestation rate in the region was to<br>change significantly as the project<br>progresses, this could greatly impact the<br>potential credit generation of the project.<br>As this is a regional issue, no mitigation<br>is able to be established, however this is<br>considered a low risk.                           |
| Uncertainty in Remote Sensing Analysis | These projections have used Sentinel-2<br>Imagery and Global Land Use datasets.<br>In the region of interest, it has been<br>noted that there is difficulty in stratifying<br>between Natural Forest, and<br>Agroforestry land with a high-degree of<br>tree cover. This may lead to an over-<br>estimation in Forest land. Based on<br>preliminary assessment, we have<br>applied a 85% discount factor to the<br>expected forest area at the project start.                                      |



# **Cost-Benefit Analysis**

The project's detailed budget and cash flow forecast were provided and analysed to validate the expected costs for the proposed 30-year duration of the project. Based on our recommendation of using the Plan Vivo standard, we conducted an analysis using the information provided within the Plan Vivo documentation regarding program fees. The assessed project expenses include i) Credit levy, ii) Plan Vivo Review Fees, and iii) VVB Costs. The table below summarises this information at the 5-year, 15-year and 30-year mark, as well as to identify the cost in Year 0 of the project (Set-up Costs).

|                      |        | Totals      |             |  |
|----------------------|--------|-------------|-------------|--|
| Budget Item          | Year-0 | 6-year      | 12-year     |  |
| Carbon Standard Fees |        | \$242,338   | \$436,439   |  |
| Project Costs        |        | \$4,293,485 | \$7,724,604 |  |
| Operating Costs      |        | \$59,628    | \$101,628   |  |
| Total                |        | \$4,595,451 | \$8,262,671 |  |

#### Assumptions

In order to calculate the expected performance of the project, a number of assumptions and estimation have been made. In order to investigate multiple potential scenarios, sensitivity analysis has also been performed. Six parameters have been identified for sensitivity analysis, five of which are related to the generation of credits (Deforestation Rate, Forest Area Adjustment, Leakage, Uncertainty, and Project Effectiveness). The sixth parameter, Credit Price is related to the overall income of the project.

#### **Deforestation Rate**

Deforestation Rate has been assessed based on multiple sources, primarily the ESA WorldCover Data, and Global Forest Watch. Using these sources an expected project deforestation rate of 0.90% has been calculated. To investigated uncertainty, an upper value of 1.03% and a lower values o 0.31% has also been investigated.

#### Forest Area Adjustment

Due to uncertainty in the land classification of the project area, the calculated initial area of forest has an adjustment factor applied, reducing the area considered for calculation of carbon credits. The initial value has been generated based on a sample visual analysis of the dataset, providing an adjustment factor of 0.85. To explore any errors in this analysis, a range of 0.75 to 1.00 has also been investigated.

#### Leakage

Leakage is assessed based on the expected emissions that occur during the baseline scenario, that will continue but be shifted to another location. Due to the nature of the project, we anticipate minor impacts from leakage. This is due to large parts of planned deforestation being dependent on landowner considerations. We see the project as a way to change attitudes in the region and develop alternative sources of income. In terms of the unplanned elements of the project, it is anticipated that our community outreach programme will provide the necessary incentives to prevent continued deforestation, inside as well as outside the



project area. Regardless, we have attempted to be conservative with these above considerations and have set leakage at 15%, with sensitivity analysis ranging from 5% to 25%.

#### Uncertainty

Uncertainty represents the potential variation in actual results compared to results reported by the project. The final uncertainty is assessed on the data collected from the baseline and project surveys. As we will be following best practice and incorporating advanced remote sensing monitoring into the final estimates of the project, it is anticipated that the Uncertainty would fall below the 15% range, as such, this value has been chosen as conservative. In addition, a value of 0% has also been explored should the project meet certain requirements that allow for no uncertainty to be discounted.

#### **Project Effectiveness**

An important parameter in determining the Ex-Ante calculation of REDD projects is project effectiveness, the amount by which a project is able to reduce deforestation. It is highly unlikely that a project will be able to prevent all deforestation in a project area, however community-based projects can have significant benefit. As such, an assumed value of 0.7 was used, with a range of 0.5-0.9 also investigated.

#### **Credit Price**

Compared with other standards, such as Gold Standard and the Verified Carbon Standard (VCS), Plan Vivo is able to command a higher price due to a focus on community and smallholder benefits. As such, the standard price for a Plan Vivo REDD credit has been set to \$12 in order to determine project revenue. In addition to this, iteration at \$8 (which more closely reflects VCS prices), and \$16 have been investigated.

| Parameter                  | Value               |
|----------------------------|---------------------|
| Deforestation Rate (DF)    | 0.90% (1.03%-0.31%) |
| Forest Area Adjustment (A) | 0.85 (0.75-1.00)    |
| Leakage (L)                | 0.15 (0.05-0.25)    |
| Uncertainty (U)            | 0.15 (0-0.15)       |
| Project Effectiveness (F)  | 0.7 (0.5-0.9)       |
| Credit Price               | \$12 (\$8-\$16)     |

Table 3. Parameter Values (and Ranges for Sensitivity Analysis)

#### **Credit Potential**

Under the standard analysis scenario, the project is expected to generate  $\sim$ 380,000 credits over a 30-year period. This equates to an annual average credit generation of  $\sim$ 12,700 per annum and  $\sim$ 63,500 per 5-year period.





Figure 4. Annual and Cumulative Credit Generation for the project

#### Sensitivity Analysis

In total, five credit generation scenarios have been summarised for sensitivity analysis. Scenario 1, shown above, represents the median values of each of the parameters selected above. Scenario 2 and 3 represent the most and least conservative assumptions respectively, and Scenario 4 and 5 represent a similar scenario to Scenario 1, with only slight alterations to Leakage, Uncertainty, and Project Effectiveness. These scenarios have been investigated on the assumption that current estimation regarding deforestation and forest extent are representative of the final calculations. The table below summarises each scenario and the parameter values.

| Scenario              | DF    | Α    | L    | U    | F   |
|-----------------------|-------|------|------|------|-----|
| Scenario 1 (Standard) | 0.90% | 0.85 | 0.15 | 0.15 | 0.7 |
| Scenario 2            | 0.31% | 0.75 | 0.25 | 0.15 | 0.5 |
| Scenario 3            | 1.03% | 1.00 | 0.05 | 0.00 | 0.9 |
| Scenario 4            | 0.90% | 0.85 | 0.05 | 0.05 | 0.8 |
| Scenario 5            | 0.90% | 0.85 | 0.20 | 0.15 | 0.6 |

Table 4. Summary of Sensitivity Analysis Scenarios

As would be expected, Scenario 2 has the lowest expectation of the scenarios, generating ~74,000 credits (~2,460 per annum), whilst Scenario 3 generates ~885,000 credits (~29,500 per annum). These scenarios represent the likely absolute ranges of potential of the project, should both existing data and project implementation be unfavourable and favourable respectively. Under Scenario 4, a project generation of ~550,000 credits (~18,300 per annum) can be anticipated. This value is likely very achievable if the projects is properly implemented, and data collection is maintained to a high degree of quality. Finally, Scenario 5 is expected to generate ~300,000 credits (~10,000 per annum) and can be considered an expectation should the project be implemented to a less than satisfactory level, without the entire integrity of the project being jeopardised. Whilst Scenarios 2 and 3 are unlikely, Scenarios 4 and 5 should be considered as achievable, and in reality, year on year, the effectiveness of the project may fluctuate between these scenarios in terms of credit generation.





Figure 5. Annual Credit Generation Sensitivity Analysis



Figure 6. Cumulative Credit Generation Sensitivity Analysis

#### Budget

The budget has been developed alongside BGM Social Services, who have provided typical values for a number of activities, including Stakeholder Consultations, and Monitoring costs. Costs related to the Plan Vivo standard and Validating and Verifying Bodies have been determined by CO2balance. In addition to these costs, we have also considered administrative costs to run the project from CO2balance, which was considered when determining the share of credits. It is assumed that the project will be verified every 5-years.



#### Table 5. Summary of Costs including intial (Year 0) costs

|             |      |          | Totals    |           |           |  |
|-------------|------|----------|-----------|-----------|-----------|--|
| PV/VVB      | Unit |          |           |           |           |  |
| Fees        | Cost | 0        | 5-year    | 15-year   | 30-year   |  |
| Subtotal    |      | \$31,000 | \$79,278  | \$174,772 | \$315,426 |  |
| Project     |      |          |           |           |           |  |
| Costs       |      |          |           |           |           |  |
| Subtotal    |      | \$35,000 | \$90,000  | \$200,000 | \$365,000 |  |
| Admin Costs |      |          |           |           |           |  |
| Subtotal    |      | \$17,000 | \$64,500  | \$159,500 | \$302,000 |  |
|             |      |          |           |           |           |  |
| Total       |      | \$83,000 | \$233,778 | \$534,272 | \$982,426 |  |

#### Return

Using the above budget, revenue from the standard scenario was calculated based on a credit price of \$12. In this report, 60% of credit revenue is giving back to the community, either via cash or through community benefit programmes as per Plan Vivo requirements, 25% to CO2balance to cover administrative costs for the project, and a further 15% to additional investors. This division has been chosen due to a total budget of \$982,000 across the lifetime of the project, of which \$617,000 expected to be covered by CO2balance. Benefit sharing is not included in these values.

Under this scenario, a total revenue to the community of \$2,743,000 is anticipated, with \$685,000 generated for additional investors. The project return period is expected at 5.22 years, a return of 337% after 30-years.

|                   |     | 5-year    | 15-year     | 30-year     |  |
|-------------------|-----|-----------|-------------|-------------|--|
|                   |     | 65,695    | 194,430     | 381,065     |  |
| Expected Issuance |     | VERs      | VERs        | VERs        |  |
| Community         |     |           |             |             |  |
| Income            | 60% | \$473,004 | \$1,399,896 | \$2,743,668 |  |
| Additional        |     |           |             |             |  |
| Income            | 15% | \$118,251 | \$349,974   | \$685,917   |  |

#### Table 6. Estimated Income to Community and Additional Investors

#### Sensitivity Analysis

Additional Sensitivity Analysis was conducted on project revenue, with credit Scenario 4 with a credit price of \$16, and credit Scenario 5 with a credit price of \$12 being investigated. Both scenarios have a return period of 5-6 years and are shown to be profitable. This suggests that there is significant financial leeway to these estimations. The results of all three Scenarios are shown below.

| Soonario   | Credit | Return | 30-year | Community   | Additional  |
|------------|--------|--------|---------|-------------|-------------|
| Scenario   | Price  | Period | Return  | Revenue     | Income      |
| Scenario 1 | \$12   | 5.22   | 337%    | \$2,743,668 | \$685,917   |
| Scenario 4 | \$16   | 5.11   | 735%    | \$1,657,056 | \$1,320,456 |
| Scenario 5 | \$8    | 5.46   | 134%    | \$5,281,824 | \$414,264   |



#### **Next Steps**

Using the information presented in this report, we would like to initiate preliminary studies into the project. If the information contained in this report is of interest, we would like to discuss further possibilities of grants and/or investments regarding participatory workshops in the project area.

Please contact <u>george.syder@co2balance.com</u> for further details.