



**Verified Carbon  
Standard**

## NON-PERMANENCE RISK REPORT



Document Prepared by EcoPlanet Bamboo Group

|                          |   |
|--------------------------|---|
| <b>Project Title</b>     | Bandai Hills Bamboo Reforestation Project, Ghana  |
| <b>Version</b>           | 1.2   |
| <b>Date of Issue</b>     | 01-07-2022  |
| <b>Project ID</b>        | 2929  |
| <b>Monitoring Period</b> | NA  |
| <b>Prepared By</b>       | EcoPlanet Bamboo  |
| <b>Contact</b>           | Camille Rebelo, P.O.Box 44485, Nairobi, 00100, Kenya, +254.721.999.604<br>crebelo@ecoplanetbamboo.com / www.ecoplanetbamboo.com |

# CONTENTS

---

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>INTERNAL RISK.....</b>   | <b>3</b>  |
| <b>2</b> | <b>EXTERNAL RISKS .....</b>   | <b>8</b>  |
| <b>3</b> | <b>NATURAL RISKS .....</b>  | <b>10</b> |
| <b>4</b> | <b>OVERALL NON-PERMANENCE RISK RATING AND BUFFER DETERMINATION ..</b> | <b>14</b> |
| 4.1      | Overall Risk Rating .....   | 14        |
| 4.2      | Calculation of Total VCUs .....                                       | 14        |

# 1 INTERNAL RISK

| Project Management |  |             |
|--------------------|--|-------------|
| Risk Factor        | Risk Factor and/or Mitigation Description  | Risk Rating |
| a)                 | <p>The project is planting 2 species of sympodial bamboo, both of which have been carefully selected to be suited for the project agro-ecological zones. Pilot plantings of the two species covering approximately 60 hectares occurred in 2016 within the vicinity of the project area, allowing for confirmation of their suitability for the specific site conditions.</p> <ul style="list-style-type: none"> <li> <p><i>Dendrocalamus asper</i>: a dense-clumping species also known as giant bamboo, or dragon bamboo, native to Southeast Asia and tropical China. Due to its common occurrence across Asia and its attractive features as well as ease of harvesting, this species has been introduced widely across Latin America and Africa. Culms of this species can have lengths of up to 30 m, and culm diameters of up to 20 cm. The culm walls are generally very thick representing a significant biomass and associated carbon stock. <i>Dendrocalamus asper</i> is suitable for the climate, elevation, topography and soils of the area. This species is one of the most productive and most sought after of all bamboo species for carbon sequestration. Its culms can be easily identified by their greyish hues and the presence of extended hairs around the nodes. It is a tight clumping species with large diameter culms suitable for an array of manufacturing applications. This species is targeted for wetter soil areas within the project area.</p> </li> <li> <p><i>Bambusa textilis spp</i>: a dense-clumping bamboo of southwest China origin. This species is a hardy, drought resistant species that performs well in harsh climates and is suited to the soils, climate and rainfall of the project location. This species has dark green culms with extremely long internode lengths. Culms grow to a maximum known diameter of 12-15 cm but have the unique property of being almost solid at the lower parts making the biomass availability, and thus carbon sequestration is high. This species is targeted for rockier soil areas within the project boundary.</p> </li> </ul> <p>Both species had been introduced into Ghana many years before the project start date, including by the International Network of Bamboo and Rattan (INBAR) as being suitable to the West African location. Both species are approved by the Ghana Forestry Commission.</p> | 0           |

|  |  |           |
|--|--|-----------|
|  | <p>However, prior to the proposed project activities, trials of both species were undertaken in the project area, with approximately 60 hectares of planting occurring in 2016. These pilot plantings provided confidence on the suitability of both species to the site-specific conditions, including their ability to withstand fire.</p>   |           |
| b)   | <p>The project is carried out on government tenured lands with boundary markers and full time teams dedicated to maintaining their status as a forest reserve. EcoPlanet maintains a full time team on the ground, but minimal enforcement to prevent encroachment by outside actors is required once the bamboo reforestation activities have occurred.</p>   | 0         |
| c)   | <p>EcoPlanet Bamboo's team covers individuals with extensive (&gt;10 years experience) in all aspects required for the successful implementation of this project, including within the project area, and has all necessary skills to successfully undertake the project activities. This team includes a General Manager with &gt;20 years of experience in managing reforestation activities in Africa, and a team of Ghanaian professionals including Operations Manager, Finance Manager, and other positions required to ensure the successful implementation of the project activities<sup>1</sup>.</p> | 0         |
| d)   | <p>EcoPlanet Bamboo has a full time management team located in the closest town of Agogo, 1-2 hour drive from the furthest point of the project. In addition the project engages with a local contractor that is based on site and visits the project daily during key periods of activity, and weekly otherwise.</p>  | 0         |
| e)   | <p>EcoPlanet Bamboo's Chief Operating Officer, Camille Rebelo has more than a decade of experience in the design, implementation, management and successful deliverable of AFOLU carbon projects, under both the VCS and CDM.</p>  | -2        |
| f)   | <p>EcoPlanet Bamboo employs a company wide policy on adaptive management<sup>2</sup>, which guides the company's methods for learning, continually on-going research, and applying of new management practices based off continuously updated lessons learnt and associated best practice.</p>   | -2        |
| <p><b>Total Project Management (PM) [as applicable, (a + b + c + d + e + f)]</b></p> |  | <b>-4</b> |

<sup>1</sup> EcoPlanet Bamboo West Africa General Manager CV (Christian Potgieter); EcoPlanet Bamboo West Africa Operations Manager CV (Bernard Baani)

<sup>2</sup> EcoPlanet Adaptive Management Plan 2021

Total may be less than zero.

| Financial Viability |  |             |
|---------------------|--|-------------|
| Risk Factor         | Risk Factor and/or Mitigation Description  | Risk Rating |
| a)                  | <p>The project cash flow breakeven point is greater than 10 years from the current risk assessment.</p> <p>The bamboo clumps being planted, under the conditions of degraded land, are expected to achieve maturity between year 7-10. Given that planting is expected to occur over the next 3 year period (2022-2025) it will be upwards of 10 years before the bamboo farm as a whole is able to undergo sustainable thinning of the older culms from individual bamboo clumps.</p> <p>The project is planting bamboo at a scale for which there is no current market for the raw material that might result from such thinning of the older culms. Therefore commercializing this material requires the development of a manufacturing facility in parallel with the bamboo farms. This is not a feasible venture until the bamboo has achieved a state of maturity and for which investors in any onsite manufacturing facility can be confident of the availability of such raw material.</p> <p>As such the project is using a conservative timeframe for achieving cash flow breakeven, of greater than 10 year.</p> | 3           |
| b)                  | Not applicable   |             |
| c)                  | Not applicable   |             |
| d)                  | Not applicable   |             |
| e)                  | Not applicable   |             |
| f)                  | Not applicable   |             |
| g)                  | Not applicable   |             |

|  |   |          |
|--|---|----------|
| h)   | <p>Project has secured 80% or more of funding needed to cover the total cash out before the project reaches breakeven<sup>3</sup>.</p> <p>The project has secured 100% of the funding required to implement the activities as detailed in this PD.</p>  | 0        |
| i)   | <p>Mitigation: Project has available as callable financial resources at least 50% of total cash out before project reaches breakeven.</p> <p>The project funding agreement allows for the project proponent to call on financial resources are required for the implementation of the activities detailed in this PD.</p> | -2       |
| <b>Total Financial Viability (FV) [as applicable, ((a, b, c or d) + (e, f, g or h) + i)]</b><br>Total may not be less than zero. |   | <b>1</b> |

| Opportunity Cost |   |             |
|------------------|---|-------------|
| Risk Factor      | Risk Factor and/or Mitigation Description   | Risk Rating |
| a)               | Not applicable  |             |
| b)               | Not applicable  |             |
| c)               | Not applicable  |             |
| d)               | <p>The baseline scenario is one of continued forest degradation due predominantly to uncontrolled wild fires, and the subsequent conversion of the project area to unutilized grasslands. The only activities that occur within the project boundaries in the baseline scenario are those that are occur illegally, and are limited to subsistence activities.</p> <p>As per the VCS guidance documents “Where the majority of baseline activities over the length of the project crediting period are subsistence-driven, an NPV analysis is not required”. A full analysis of the social and economic impacts of the project have been detailed in Section 2 of the Project Document.</p> | 0           |
| e)               | Not applicable  |             |

<sup>3</sup> Agreement for the Reforestation of 2,500 Hectares of Degraded Lands Within the Bandai Hills Forest Reserve, Ghana; September 6<sup>th</sup> 2021

|   |   |           |
|---|---|-----------|
| f)  | Not applicable  |           |
| g)  | Not applicable  |           |
| h)  | <p>Mitigation: Project is protected by legally binding commitment to continue management practices that protect the credited carbon stocks over the length of the project crediting period.</p> <p>The project proponents hold an executed commitment by the Ghana Forestry Commission to maintain the planted bamboo and the associated carbon stocks for the duration of the project crediting period. This legal document has been provided to auditors as part of the validation audit<sup>4</sup>.</p> | -2        |
| i)  | Not applicable  |           |
| <b>Total Opportunity Cost (OC) [as applicable, (a, b, c, d, e or f) + (g + h or i)]</b> |   | <b>-2</b> |
| Total may be less than 0.   |   |           |

### Project Longevity

|    |  |  |
|----|--|--|
| a) | Not applicable   |  |
| b) | <p>The project is managed under a public private partnership agreement that is 99 years in length. Management plans and financial plans for the length of this period have been approved by the Ghana Forestry Commission.</p> <p>Furthermore longevity of the project can be assessed by the timeframe for which the bamboo clumps will survive. Such bamboo clumps, once established, are extremely hardy, and the complexity of their underground root system makes actively removing them an expensive and labor/machine intensive endeavour. It is therefore extremely unlikely, once these bamboo clumps achieve maturity, and prove to be a useful source of biomass, that they will be removed, until the point they die a natural death or are simply no longer productive.</p> <p><i>Dendrocalamus asper</i> has a productive lifecycle of upwards of 100-120 years<sup>5</sup>.</p> |  |

<sup>4</sup> Addendum to the Benefit Sharing Agreement; November 10<sup>th</sup> 2021

<sup>5</sup> Fernandes De Souza, P., Ribas Dos Santos, C., Ree J., Guerra M. & Pescador, R; 2020. Flowering and morphological characterization of *Dendrocalamus asper* androecium and pollen grains. Grana - International Journal of Palynology and Aerobiology <https://www.tandfonline.com/journals/sgra20>

|  |  |           |
|--|--|-----------|
|  | Bambusa textilis has a productive lifecycle of upwards of 60 years.<br>Assuming the life cycle of the bamboo is a conservative 60 years, project longevity is therefore calculated as $24 - (60/5) = 12$ |           |
| <b>Total Project Longevity (PL)</b><br>May not be less than zero |  | <b>12</b> |

| Internal Risk  |          |
|--|----------|
| <b>Total Internal Risk (PM + FV + OC + PL)</b><br>Total may not be less than zero. | <b>7</b> |

## 2 EXTERNAL RISKS

| Land Tenure and Resource Access/Impacts   |   |             |
|---|---|-------------|
| Risk Factor   | Risk Factor and/or Mitigation Description                                       | Risk Rating |
| a)  | Not applicable  |             |
| b)  | The land is government owned and the project proponent holds a long term lease. | 2           |
| c)  | Not applicable  |             |
| d)  | Not applicable  |             |
| e)  | Not applicable  |             |
| f)  | Not applicable  |             |
| g)  | Not applicable  |             |
| <b>Total Land Tenure (LT) [as applicable, ((a or b) + c + d + e + f + g)]</b><br>Total may not be less than zero. |   | <b>2</b>    |

The plantation areas are government owned and held by the project proponent under a long term private lease with no communities reliant on the areas within these project boundaries.

“Where local populations are not reliant on the project area, the risk is not relevant to the project and the risk for community engagement shall be zero.”

| Community Engagement   |   |             |
|--|---|-------------|
| Risk Factor  | Risk Factor and/or Mitigation Description | Risk Rating |
| a)   | Not applicable                            |             |
| b)   | Not applicable                            |             |
| c)   | Not applicable                            |             |
| <b>Total Community Engagement (CE) [where applicable, (a + b + c)]</b> |   | <b>0</b>    |
| Total may be less than zero.   |   |             |

| Political Risk  |   |             |
|---|---|-------------|
| Risk Factor   | Risk Factor and/or Mitigation Description   | Risk Rating |
| a)  | Not applicable  |             |
| b)  | Not applicable  |             |
| c)  | Ghana has a governance score of 0.03  | 2           |
| d)  | Not applicable  |             |
| e)  | Not applicable  |             |
| f)  | Ghana is engaged in REDD+ activities and has received REDD+ Readiness funding from UN-REDD amongst other donors. The country has a clear REDD+ policy framework in place. | -2          |
| <b>Total Political (PC) [as applicable ((a, b, c, d or e) + f)]</b> |   | <b>2</b>    |
| Total may not be less than zero.                                    |   |             |

| External Risk                      |   |
|------------------------------------|---|
| Total External Risk (LT + CE + PC) | 2 |
| Total may not be less than zero.   |   |

### 3 NATURAL RISKS

| Natural Risk: Fire |  |
|--------------------|--|
| Significance       | <p>Uncontrolled fires that spread from outside the project boundary represent the most significant natural risk for reforestation projects within this area and requires on-going management.</p> <p>However, given the ecology of bamboo clump, fire does not have a devastating effect on the plant or on the carbon stocks. The fires in the project area are low intensity and move fast, as has been shown on the trial bamboo plantings that occurred outside of the project boundary.</p> <p>Where fire occurs the above ground biomass may be lost, although bamboo is known to be fire resistant due to the higher water content of the biomass, however the below ground biomass in the rhizome system is not affected. New culms will shoot with the first rains after a fire event, and any lost above ground biomass is quickly replaced and a full recovery of the carbon stocks can be expected within 2-3 years.</p> <p>Photos and evidence from pilot trials that have been allowed to suffer from fire as trials and R&amp;D are available to auditors, which shows the rapid recovery of the above ground bamboo biomass.</p> <p>Therefore fire risk to the bamboo clumps can be determined to be:</p> <p><i>Transient (full recovery of lost carbon stocks expected within 10 years of any event).</i></p> |
| Likelihood         | <p>The likelihood of fire occurring either within or adjacent to the project boundary can be conservatively determined to be:</p> <p><i>Less than every 10 years</i></p>   |
| Score (LS)         | 2  |
| Mitigation         | <p>EcoPlanet has in place well developed fire management plans, a qualified forestry manager with expertise in fire management, and a trained fire patrol team on duty throughout the 3-4 month fire season.</p>   |

Mitigation therefore can be determined to be 0.5

### Natural Risk: Pest and Disease

|              |   |
|--------------|---|
| Significance | <p>Bamboo is known to be highly resistant to pests and disease, and to be susceptible to relatively few pests. In the project area, potential pests fall into two categories:</p> <ul style="list-style-type: none"> <li>-Herbivores which will feed on the young shoots of the bamboo as these emerge during the early stages of bamboo clump development. For the particular project area herbivores represent a low risk due to the abundance of other vegetation, particularly during the rains which is when the young shoots emerge. By the time other food sources might become reduced, with the onset of the dry season, the young bamboo shoots have grown to maximum height and are no longer a potential food source.</li> <li>-Carbon accounting takes place on a later stage, when the carbon stock of the bamboo plant cannot be affected by herbivores anymore.</li> <li>-Boring insects which burrow into the culm walls to lay eggs. Such pests do not cause any potential loss of carbon or biomass.</li> </ul> <p>The project is inter planting the bamboo under a framework that maximized biodiversity, and creates a mixed ecosystem, which inherently reduces the already nominal chance of losses due to pests.</p> <p>Therefore the significance of Pest and Disease Risk is determined to be:<br/><i>No Loss</i></p> |
| Likelihood   | <p>There are no records of any devastating pest attack or disease outbreak for the bamboo species being grown by the project.</p> <p>The likelihood of this is determined to be:<br/><i>Risk is not applicable to the project area.</i></p>   |
| Score (LS)   | 0   |
| Mitigation   | Not applicable  |

### Natural Risk: Extreme Weather

|              |   |
|--------------|---|
| Significance | <p>The extreme weather events that potentially have significance to the project's carbon removals are limited to drought.</p> <p>Bamboo is susceptible to drought in its early stages of development, in particular in the time between transplanting into the field, and the</p> |
|--------------|---|

|            |   |
|------------|---|
|            | <p>establishment of a healthy underground rhizome system. Water stress represents the highest cause of mortality for the planted bamboo seedlings, with such mortality occurring within the first 6 months after planting. To mitigate this the project proponent carries out a replanting event 12 months after initial planting, to maximize stocking densities.</p> <p>The final stocking density and actual number of planted clumps is only finalized after this replanting event.</p> <p>Subsequent to this initial period, bamboo is relatively tolerant to drought, and the underground rhizome system means that unless extremely extended periods of drought were to occur (more than 1-2 annual growing seasons) like other grasses the clumps would simply become dormant, with no additional culms emerging until the drought was over. This means that should such an extreme drought occur, there would be no loss of existing biomass and related carbon removals, but there would be no additional removals during the relevant period. This would be reflected within the project's monitoring plan.</p> <p>Therefore the significance of this natural risk has been estimated to be:</p> <p>Insignificant (less than 5% of carbon stocks) if extreme weather events were to occur during the first 12 months post planting, and transient (full recovery of lost carbon stocks expected to occur within 10 years of any event). Therefore the significance of Extreme Weather Risk is conservatively determined to be:</p> <p><i>Transient (full recovery of lost carbon stocks expected within 10 years of any event)</i></p> |
| Likelihood | <p>Extreme weather events such as rain, drought, floods or storms are historically unlikely for the project areas.</p> <p>The likelihood of extreme weather events can be determined to be:</p> <p><i>Once every 100 years or more, or risk is not applicable to the project area.</i></p>  |
| Score (LS) | 0   |
| Mitigation | <p>The project has mitigated the risk of drought by carrying out pilot plantings over a five year period prior to the start of project activities, to ensure that both species are adapted to the project conditions. Furthermore, the project proponent carried out a replanting event to mitigate any effects and maximize stocking density in the project area.</p>  |

**Natural Risk: Geological Risks**

|              |  |
|--------------|--|
| Significance | <i>Transient – all carbon stocks would be expected to fully recover within 10 years of any event.</i>  |
| Likelihood   | Catastrophic geological risks are classified as volcanoes, earthquakes, tsunamis, avalanches and landslides. None of these occur within the vicinity of the project areas. Therefore the likelihood of geological risks to the project is determined to be:<br><br><i>Not applicable to the project areas.</i> |
| Score (LS)   | 0  |
| Mitigation   | Not applicable   |

#### Natural Risk: Other Risks

|              |  |
|--------------|--|
| Significance | No other natural risks to the project activities and associated carbon removals are anticipated. |
| Likelihood   | Not applicable   |
| Score (LS)   | 0  |
| Mitigation   | Not applicable   |

#### Score for each natural risk applicable to the project (Determined by $LS \times M$ )

|   |          |
|---|----------|
| Fire (F)  | 1        |
| Pest and Disease Outbreaks (PD)   | 0        |
| Extreme Weather (W)   | 0        |
| Geological Risk (G)   | 0        |
| Other natural risk (ON)   | 0        |
| <b>Total Natural Risk (as applicable, <math>F + PD + W + G + ON</math>)</b> | <b>1</b> |

## 4 OVERALL NON-PERMANENCE RISK RATING AND BUFFER DETERMINATION

### 4.1 Overall Risk Rating

| Risk Category                          | Rating    |
|--|-----------|
| Internal Risk                          | 7         |
| External Risk                          | 2         |
| Natural Risk                           | 1         |
| <b>Overall Risk Rating (a + b + c)</b> | <b>10</b> |

Therefore a 10% buffer allocation will occur.

### 4.2 Calculation of Total VCUs

Estimated Net GHG emission removals: **3,778,510**

Estimated Buffer credits (10% of Net GHG Benefits): **377,851**

Estimated Total GHG credits / VCUs: **3,400,659**